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INTERNATIONAL ATOMIC ENERGY AGENCY

OPERATIONAL SAFETY REVIEW TEAM

FRANCE

CATTENOM NUCLEAR POWER PLANT

OSART MISSION

14 TO 31 MARCH 1994

AND

OSART FOLLOW-UP VISIT

12 to 16 June 1995

IAEA-NENS/OSART/95/70/F Rev. 1

OPERATIONAL SAFETY OF NUCLEAR INSTALLATIONS

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REPORT TO THE GOVERNMENT OF FRANCE

PREAMBLE

This report presents the results of the IAEA Operational Safety Review Team (OSART) review of Cattenom nuclear power plant in 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. The findings of the IAEA's OSART Follow-up Visit, which took place from 12 to 16 June 1994, have been incorporated into the report. The purpose of the Follow-up Visit was to determine the status of all proposals for improvement, to comment on the appropriateness of the actions taken and make judgements on the degree of progress. The original report of the March 1994 mission has revised to include the results of June 1995 Follow-up Visit.

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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 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 experts 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, good performances and proposals for enhanced operational safety, for consideration by the Member State and its competent authorities and the results of the Follow-up Visit, which was requested by the competent French authority to check the status of implementation of the OSART's recommendations and suggestions. The text in normal type relates to the OSART mission of March and the text in italics relates to the Follow-up Visit of June 1995.

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INTRODUCTION

At the request of the government of France, an international IAEA Operational Safety Review Team (OSART) of experts visited the Cattenom nuclear power plant (NPP) near Metz, France, from 14 to 31 March 1994 to review operating practices and to exchange technical experience and knowledge between the experts and power station counterparts on how the goal of excellence in operational safety could be further pursued. The Cattenom OSART was the sixth mission to France.

The team (Annex I) was composed of experts from Belgium, Canada, Germany, South Africa, Spain, Switzerland, the United Kingdom and IAEA staff members with scientific visitors from Brazil, the Czech Republic and Ukraine.

Before the OSART review of the power station, the team studied relevant information made available to them to familiarize themselves with the power station's main features, important programmes and procedures, and the operating record of recent years. At Cattenom, the team of experts, using techniques derived from their collective nuclear experience of 220 years, reviewed the power station's operational safety indicators and other documentation, examined procedures and instructions, observed work being carried out and held extensive discussions with power station personnel Throughout the period of review, there was an open exchange of experience and opinions between the power station personnel and the OSART experts.

At the request of the Government of France, the IAEA carried out a follow-up to the Cattenom 0SART mission from 12 to 16 June 1995. The team comprised an expert from the United States of America and two IAEA staff members. The external expert was the team leader of the OSART mission. The purpose of the visit was to discuss the actions taken in response to the findings of the OSART mission that had been conducted from 14 to 31 March 1994.

During the four day visit, team members met with senior managers of Cattenom nuclear power plant and their staff to assess the effectiveness of the power plant's response to each recommendation and suggestion given in official report of the Cattenom 0SART mission (IAEA –NENS/OSART/94/70). The team made technical comments supplemented by a broad categorization indicating whether an issue could be regarded as 'resolved', whether 'satisfactory progress' or 'little or no progress' had been made in resolving an issue or whether a proposal should be withdrawn.

The results of the Follow-up Visit are summarized in the sections below. The results are presented in a quantitative manner in Table 1 and detailed comments can be found for each finding in the pages that follow thereafter.

Plant description

Cattenom NPP consists of four nearly identical pressurized water reactor unites rated at 1335 MW net electrical output. The units, designed by Electricit6 de France with

Framatome nuclear steam supply system islands, entered commercial operation between April 1987 and January 1992. At the time of the OSART mission, 20 of this series of NPPs were in operation in France.

Each reactor core consists of 193 fuel assemblies, each having 264 fuel rods in a 17 x 17 square array. The reload fuel is 3. 1 % enriched UO_2 with a total UO_2 weight of 117.8 tonnes and a thermal output of 4117 MW. Reactor power control is performed by grey control rod banks that minimize axial power distortion and permit operation in the load following mode. The primary coolant system consists of four cooling loops, each having a steam generator and a circulation pump.

Safety systems to cope with design basis accidents include the protection systems, emergency power supply, emergency core cooling systems and containment systems. The protection systems initiate a reactor trip or actuate other safety functions whenever the limits of the safe operating range are approached. The emergency power supply system comprises two diesel generators per unit and a mobile gas turbine that can be manually connected to replace one of the diesel generators. The emergency core cooling system consists of four hydro-accumulators and two separate subsystems for safety injection and coolant recirculation. The subsystems are physically separated, in different zones of the plant, and with separate electric power supplies, ventilation and cooling systems.

The reactor containment is composed of an inner prestressed concrete shell meeting high leaktightness requirements, and an outer reinforced concrete shell to resist external impacts. The space between the shells is maintained slightly below ambient pressure. The containment could be cooled during accidents with a two-train spray system, and is fitted with a filtered venting system to enable mitigation of severe accident consequences.

Steam is supplied from the steam generators to the 1500 rpm turbines. Steam from the turbines is condensed in the main condenser. The condenser is cooled by a closed circuit which comprises a cooling tower for each unit with two circulation pumps and an artificial lake. Makeup water is obtained from the Moselle river.

Main conclusions

During the Cattenom NPP OSART mission Unit 1, 2 and 3 were operating at 100% power and Unit 4 was in a refuelling shutdown. As a result the team had opportunities to observe the plant and staff during the conduct of both normal operating and shutdown maintenance activities.

The team's overall impression is that the Cattenom NPP is well maintained and safely operated. The Electricité de France designed plant is performing well as reflected by improving WANO performance indicators. The team identified a number of commendable features in the programmes of the utility and the power plant, for example:

- Strong corporate and plant policies and programmes.
- Corporate and plant emphasis on improved quality, safety, safety culture and performance through appropriate policy, training, analyses and risk assessment techniques.
- A highly experienced and motivated staff.
- A well structured and effective contractor and staff training programme, as reflected by establishing seven operating shifts to enhance training.
- The control and availability of high quality normal and emergency procedures.
- Effective use of internal and external operating experience
- An effective computerized maintenance work control programme
- A high standard of housekeeping and material condition
- A strong management commitment to reductions in personnel radiation exposure and radioactive effluent releases.

The team made a number of proposals for management's consideration to improve plant activities. These proposals are primarily intended to stimulate the plant management and staff to consider ways and means for enhancing existing programmes and to make good performance more effective, and include the need to:

- make some improvements in the administrative control of temporary modifications.
- further strengthen training in aspects such as waivers of initial training requirements, radiation waste operator training and the co-ordination of department training engineers.
- make improvements in chemistry laboratory quality controls and in the containment post accident sampling capability.

The team also noted that in a number of areas, Cattenom had taken actions based on recommendations and suggestions from OSART missions to other EDF NPPs, that many programmes and procedures have been recently revised, and that immediate corrective actions were taken on some of the specific items the team identified during the review. These initiatives reflect the good use of operating experience, as well as responsive and proactive management.

The team also reviewed safety culture, as described in IAEA Safety Series 75-INSAG-4, as an integral part of the OSART mission. Recommendations, suggestions, good practices and good performances having possible safety culture implications were included in each expert's review area and were the basis of each experts perception of safety culture in their review area. The perceptions of the experts formed the basis of the team's impression of safety culture at the Cattenom Nuclear Power Plant. The team's impression based on the review is that there is a good safety culture that is continuing to improve in most areas.

Several upper level management policy documents address the importance of quality and safety. Managers and staff demonstrate by their attitudes and performance that safety is a high priority, and plant operators are able to give specific examples of safety culture in their area. Safety culture training has been conducted, a safety culture assessment questionnaire is completed by most employees and a weekly bulletin advises the staff on safety culture related matters. In addition, related performance indicators have been established, events are analyzed for human factors considerations, recruitment and promotions include safety considerations, safety system unavailability is analyzed and reported by computer, and risk assessments are conducted before the start of selected work activities. However, these achievements should not lead to complacency or for plant personnel to accept the few non-conforming conditions that do exist.

The team's conclusion from the review of safety culture is that opportunities should continue to be sought to further improve the existing good safety culture in order to prevent complacency and to promote the best possible safety performance from assigned personnel.

The general view of the team having completed the Cattenom OSART mission is that the Cattenom staff and programmes are good, and that the items identified for improvement are generally minor in nature. It is recognized that some of the recommendations and suggestions may be in progress or planned. All proposals should be given appropriate priority and integrated with other management programmes and initiatives to further improve overall performance at the Cattenom Nuclear Power Plant.

The Follow-up Visit team found that excellent progress has been made in addressing and resolving the findings of the 1994 Cattenom OSART mission. This is the encouraging outcome of the significant efforts of the staff at Cattenom and in EDF. The resulting improvements should contribute to the enhancement of operational safety at the nuclear power plant. All the issues have been fully resolved or are progressing satisfactorily to completion. This is the first time in the history of the OSART follow-up programme that no issues have been categorized as having little or no progress.

A new feature of the OSART follow-up programme that has been introduced with this visit is the intention to identify issues whose satisfactory resolution could be of interest to other utilities. Four such topics have been identified during this follow-up visit.

- *The initiatives taken by Cattenom to address the question of fitness for duty and drug dependence is an interesting approach to the issue. Cattenom's approach can* *be seen to caring in nature whilst still aiming to achieve the objective of ensuring plant safety from anyone whose behaviour might be affected by a dependence on drugs.*

- *The creation of a central training department has made it easier for workers and supervisors from specific disciplines to meet monthly with a training department special advisor. At these meetings, it has been possible to exchange views on training programmes, determine needed skills and training and to suggest appropriate approaches to training. This has resulted in open and effective communication leading to a number of visible and beneficial training changes.*

- *Following the completion of a fundamental study of how temporary installations are controlled and carried out, EDF has overhauled the process and set up a clearer, more rigorous system. All staff involved have received initial training in the new system. Further training will be carried out for specific outages and formalized training is Part of the initial and continuing training programmes. The new system appears to be well understood as exemplified by a field operator who was questioned at random.*

- *The new instructions provided for shift safety staff and the on-call senior manager Provides sufficient guidance for responding to non-radiological unusual events. The guidance aims at ensuring that appropriate actions are taken in the short term to protect staff and plant and that specialist staff are called in when coping with events such as a chemical release from on-or off-site sources.*

A characteristic of the response of Cattenom to the findings of the OSART mission has been willingness not only to look at the specific issues identified, but also look at the wider implications. In a number of cases, improvements have been introduced that have exceeded the expectations of the OSART team.

The attainment and maintenance of high standards demands that all staff dedicate themselves each day to strive to do better. There must not be any relaxation in the drive for excellence even though the OSART mission and in follow-up was successful. Indeed, greater efforts are required to overcome the occasional lapses in safety culture thinking that were expressed in discussions with plant and corporate staff.

However, no one can deny that considerable improvements of a lasting nature have been introduced as a result of the OSART mission. Nevertheless, effort is required to complete the actions that have not yet been completed. Many of the changes have been introduced only recently and their effectiveness will need to be monitored, assessed and further changes made as necessary. The implementation of the outstanding actions and the continued monitoring for effectiveness, if pursued with the son e motivation and determination that has been applied thus far, should result in Cattenom achieving high standards in operational safety performance.

1. MANAGEMENT, ORGANIZATION AND ADMINISTRATION

Nuclear power plant operation in Electricité de France (EDF) are the responsibility of the Generation and Transmission Group and specifically this responsibility is delegated to the Executive Vice-President of the Nuclear Power Plant Operations Division (EPN).

The high degree of standardization in the EDF Nuclear Power Plants and strong support from the corporate level are considered a strength for the nuclear plant sites.

A strategic plan covers a three-year period and involves managers at every level in the organization. Annual objectives are pursued via the application of management contracts that are effectively utilized to improve safety and quality performance.

A new corporate Quality Policy and an excellent new Quality Manual have been developed and implemented. The intent of these documents is to improve performance and quality and include the conduct of risk analysis before conducting designated work. The QA programme is well structured and NPP Quality Manual has been completely reviewed since February 1993.

There is a policy on alcohol consumption at nuclear power plant sites. Although there is no known drug problem, the team suggests the implementation of a drug policy

The plant management organization is well defined and effectively directed towards achievement of safety and quality objectives. The performance indicators that have been developed and implemented at all levels of management are considered a good performance.

Good liaison exists between regulatory authorities and the Cattenom Plant Management, and interactions appear to be frank, open and professional.

Industrial safety is part of the strategic plan and is included in all management contracts. A new accident prevention policy was issued by EDF in February 1994. The plant areas inspected were maintained to a high standard of housekeeping. However, there are many minor industrial accidents, and consideration should be given to the extensions of the regular management safety tours. Regular team briefings by supervisors and management should emphasize items relating to industrial safety. Staff members should participate in accident prevention actions.

Colour coding was suggested to identify important piping at the plant. In the demineralized water plant a full height transparent plexiglass screen is used to protect the general area from acid and caustic products, and this was considered to be a good practice. Also protection from noise is installed in different areas in the turbine building.

The documentation control process is well structured and effectively controlled and implemented.

The concept of safety culture is receiving good attention at the corporate level and the plant management is fully committed to achieving a strong safety culture with all staff members.

The OSART mission made suggestions regarding a corporate policy with respect to drug dependence and fitness for duty and to extend the regular management safety tours as a means of improving industrial safety performance. Although a corporate policy with respect drug dependence is still awaited, the matter has been taken up by a national management committee that is actively pursuing the issue. The plant, in the meantime, has extended its alcohol dependence/fitness for duty programme to include drug dependence. The programme is paternalistic in character, seeks to avoid dismissal from service in the first instance but includes measures to ensure plant safety. The eventual corporate policy may be similar in character. The regular programme of management safety tours has been extended to cover all parts of the plant, as requested by the OSA R T team, together with a scheme industrial safety tours and housekeeping tours. These are recent initiatives and adjustments to the programme are to be expected as resources are optimized to achieve maximum safety benefits.

1.1 Corporate Organization and Management

EDF is a national utility that employs a large staff in its Paris headquarters. Nuclear power plant operations constitutes one of the operational parts of the EDF Generation and Transmission Divisions and is placed under the authority of the Executive Vice-President in charge of Nuclear Power Plant Operations (EPN).

At the corporate level, management is organized either around the Restricted Management Committee or through an expanded committee that includes Unit Managers. The Restricted Management Committee is comprised of the Executive Vice-President, the Senior Vice-Presidents for nuclear matters, three other Senior Vice-Presidents, two of whom are responsible for the two unit or four-unit sites, and four other vice-presidents. These committees are assisted by seven committees: four in the technical area (technical operations, nuclear safety in operations, corporate information systems, ALARA) and three in the resources area (careers, resources, communications).

The strategic plan covers a three-year period, and specifies the fundamental orientation adopted and the actions to be taken, while indicating in general terms the objectives to be attained. The objectives are developed by the departments and units and approved by the Generation and Transmission Division management. The strategic plan for the nuclear power plants includes overall common objectives for the sites, which form the basis for establishing site plans. The site plan for Cattenom is then implemented by formal management contracts with managers and these constitute the short-term management tool for detailing the annual commitment.

(a) **Good performance:** The strategic plan and management contracts address both national objectives (which contribute to the achievement of Corporate Strategic Plan objectives), and site objectives, specific to departments. These objectives are used with suitable indicators for each management level. Thus, each plant unit department and section has a monthly control tool/system. The unit control system is used to measure plant performance and clearly indicate deviations, malfunctions or slow parameter drift over a period of time. The control system is a decision aid tool used by the management team, covering all the objectives of the Strategic Plan. Performance in the areas of nuclear safety, industrial safety, environment, availability, management and cost control is assessed. As a part of the management contract monitoring, each department defines its contribution to national indicators and commits itself to results assessment indicators enabling progress in the various action plans to be assessed and monitored. To reinforce staff commitment to the plant's main objectives and priorities, the results for the five most significant indicators are individually notified monthly, to each employee. The results are also communicated to contractors working on the site, either on the notice boards or through the internal video network. The objective is that all the EDF and contractor employees should be fully aware of the plant's strong points and weak points.

At the Cattenom nuclear plant site, at the end of 1993, the director issued a clear statement on nuclear safety policy to all staff. Within EPN, there is a policy on alcohol consumption at nuclear power plant sites. This takes the form of a limited tolerance approach which allows a small consumption when taken with a meal.

Currently there is no policy of maintaining a drug free environment as part of the fitness for duty programme.

(1) **Suggestion:** Consideration should be given to establishing a corporate policy relating to drug use. Some approaches that might be considered are to formalize existing practices, to train managers in the recognition and handling of drug issues and to develop a new formal programme. The result of such actions would be an improved assurance in the quality of work.

Plant response: *(June 1995) A corporate level working group has addressed "Uncontrolled Individual Behaviour". The conclusions and recommendations of this work group were finalized in April 1995 and are in the process of being validated by the Management of the EDF Nuclear Power Plant Operations Division. Part of these conclusions and recommendations have already been implemented by the site. In parallel and as part of the continuing actions launched by the Cattenom Nuclear Power Plant in its fight against alcohol abuse (compliance with IN 29 and on-site standing orders), the following have been confirmed or adopted:*

- *The current conditions for hiring new staff members include systematic early detection of drug addiction through additional medical investigation carried out under the responsibility of an occupational physician. According to labour laws and to the recommendations stated in the Medical Bulletin No. 93-10 dated July 1993, this physician is responsible for deciding on a candidate's medical ability to hold his (her) future position.*

- *Regulatory medical monitoring of plant workers organized on a regular basis, (i.e. once or twice a year depending on the position held), and any biological testing to which any given individual may be subject, provide the plant physician with a thorough knowledge of workers' health. These investigations may lead the physician to decide a plant worker's unfitness (temporary or permanent) for a given position.*

- *Additional training for managers called "Generation of Moderation" Part 2 on Attitude and Responsibility " helps early detection of human problems when analyzing behaviour. This provides a staff manager, in close cooperation with the plant physician, with all necessary elements for managing the workers concerned (such as reacting in the proper manner in any given situation). This action also concerns the attitude to adopt when facing any type of addiction (alcohol, drugs, medication, etc.).*

- *A whole set of informative meetings for the staff on the subject of drug abuse are scheduled by the site occupational physician and the Communication Team. An officer from the Office for Immigration Control takes part in these meetings (the first conference was held on December 15, 1994 and followed a series of actions to promote awareness, launched by the Plant Management Committee in March of the same year).*

These actions are all the more efficient in that they include the following additional elements:

- *A listening and counseling role for physicians. This role was strengthened by their systematic participation in the weekly Plant Management Committee meetings.*

- *Close cooperation has improved communication between EDF occupational physicians and their regional counterparts that are responsible for contractor personnel. Together, they seek to achieve a harmony between the different practices to adopt when facing various risks (eg. alcohol).*

IAEA comment on status: *(June 1995) At the time of the OSART mission the plant had a number of measures in place to address the question of fitness for duty with respect to alcohol. Since the mission, the programme has been extended to* *cover drug abuse. The approach is paternalistic in character in that it seeks to educate staff and their families in the problems of drug dependence and to help individuals with a problem to overcome their addiction rather than, in the first instance, to dismiss them from service. The programme includes a system of work place counsellors who can be contacted at any time with the guarantee of absolute confidence. Managers and supervisors are being trained in being better able to watch out for signs of personality and behaviour anomalies that might give early warning of alcohol or drug dependence in the workforce in their charge.*

Medical and nursing staff are also involved as described in the plant's response. The co-operation of company doctors of contractors in the Moselle region is a noteworthy extension of the programme.

The initiatives were taken by the plant were in advance of the initiative now being taken by the corporate organization. The report of a national working group that discusses the issues surrounding uncontrolled individual behaviour and how best such individuals can be identified and restored to acceptable behavioural norms is yet to be published. It is expected that measures similar to those adopted by Cattenom nuclear power plant will result. The programme in force at Cattenom and that being developed at the national level could be of wider interest to other utilities especially to those not willing to introduce measures as far reaching as those adopted in the USA.

Conclusion: *Satisfactory progress to date.*

As a result of designers and operators from the Engineering and Construction Division and the Generation Transmission Division considering and rethinking the results of recent years, a new quality policy was implemented. This policy was developed to address some weaknesses in the earlier existing programme. For example too many errors continued to be made and there was a tendency for managers and workers to not assume responsibility if existing quality requirements had been satisfied.

(b) **Good performance:** A new corporate Quality Policy and an excellent new Quality Manual have been developed and implemented. The Quality Policy includes seven major principles and 15 fundamental rules and the Quality Manual addresses 33 relevant topics. Collectively, these principles, rules and topics define the new approach to quality, and the areas that have been designated for specific management attention. The intent of these documents is to improve performance and quality. Direct changes as a result of this effort include commitment by the management and staff members to the quality system, the conducting of risk analysis before designated work, different levels of quality for different tasks, depending on their impact on safety and a motivation for error free performance. For example, in 1993 there was a reduction in the number of incidents classed as 'significant' and the achievement of some objectives related to the environment.

The nuclear safety policy for all nuclear power plants is formulated by the corporate Nuclear Safety Department and approved by the EPN management committee. This department, together with the Nuclear Plant Co-ordination Group, fulfills strong co-ordination and monitoring roles to identify any area for improvement. At the nuclear power plant, the plant manager is responsible for compliance with safety and quality policy.

A corporate nuclear safety policy was issued in 1993. This policy describes fundamental principles to ensure the safety of nuclear power plants and includes the concept of safety culture from the IAEA Safety Series No. 75-INSAG-4.

Operating functions are defined by the corporate departments and by services units. These functions include programme formulation, operations history and performance indicators, operational experience feedback, accident management, human resources, and line/staff communications. More specifically, for example, the Operations Department manages experience feedback by analyzing the technical and human aspects of operating incidents; the Maintenance Department establishes basic programmes; the Technical Support Unit handles scheduling and supervision of generic maintenance operations.

As a result of a high degree of standardization, the organization of EPN includes extensive central support functions. The Corporate Technical Departments (Nuclear Operation; Nuclear Maintenance; Nuclear Safety; Industrial Safety Radiological Protection and Environment; Nuclear Plant Co-ordination Group; Training) and Units (chemical and metallurgical laboratories, technical support, engineering support for operations) assist the nuclear sites with analyses and expert evaluations.

The corporate reviewing functions are performed by the EPN management committee, assisted by the supporting functional departments and corporate services units, to check results and correct deviations in relation to specific objectives and indicators in strategic plans, and annual management contracts. They are assisted in this task in a number of ways:

- The Plant Safety Review Committee (CSNE) meets monthly to analyze matters relating to plant operating safety and quality, particularly on the basis of inspection reports by the Nuclear Inspectorate Department of EPN.

- The Plant Operating Review Committee (CTE) is the decision making body for all technical matters of a corporate nature, in particular concerning proposals for modifications.

- Management contracts are clearly stated and periodically monitored to enable progress to be monitored using key indicators relating to safety and general management.

Internal checking of company performance is organized at a number of levels, Such as:

- At general management level by the General Inspectorate and the General Inspector for Nuclear Safety.

- At the Generation and Transmission Group level, by the Internal Audit Inspectorate.

- At nuclear power plant level by the Nuclear Inspectorate. Reports of plant audits conducted by inspectors independent of the plant checked are submitted to the management involved and to the official audited.

1.2 Plant Organization and Management

Cattenom NPP has four nuclear units each of 1300 MW capacity that are directed by the Plant Director. The Plant Director is entirely responsible for nuclear safety on site, as the nuclear operator within the meaning of the law. The site organization is clearly described in site management documentation. Job descriptions for senior management positions are available together with a clear delegation of authority from the Plant Director to the senior management team in the areas of finance, human resources, safety related issues, operation of the plant and environment related activities.

The structure of the organization is composed of five groups for operation of the units and of three teams, responsible for activities across the whole site. The five groups are the two Generating Twin Unit Groups, the Site Technical Support Group (SUT), the Site Administration Support Group (SUG), and the Site Joint Modifications and Works Organizations Group (SCORE). The three teams are the Quality and Safety Team (MSQ), the Engineering Team and the Communication Team.

The site management philosophy is one of assigning full responsibility for operation to each sub-group manager. Therefore, each sub-group manager has the greatest possible degree of autonomy consistent with his delegated authority, and this includes delegation for the interface with corresponding external contacts.

The Twin Unit Managers assume responsibility for the operation, safety and management of their two units, the 'Owner' for maintenance and the 'Contractor' for I & C and Technical Inspections. With regard to the SUT, the manager assumes responsibility as 'Contractor' for maintenance work and fuel handling, and 'Owner' and 'Contractor' for site instrumentation and control, telecommunications, industrial data-processing, environmental control, solid wastes and effluents processing.

The SUG has an advisory and supporting role with respect to the other units and unit management in the fields of human resources, finances, data processing and compliance with regulations (salaries, purchasing, personnel). The SCORE assumes responsibility as the 'Owner' of new work and modifications at the NPP, and as 'Contractor' for civil engineering. The MSQ carries out conformity checks and analyses of eventual discrepancies and gives advice and assistance in the nuclear safety, quality and industrial safety fields.

The organization of the twin unit groups is clearly defined in organization charts and management procedures. The structure is composed of three departments (Operations, Technical Inspection, Maintenance) and two attached sections (Industrial Safety and Radiological Protection, and Administration).

The selection and promotion of senior management staff are based upon a career development process using an overall staff appraisal system. Individual management contracts form the basis of the personnel performance appraisal systems down to department and section head and team leader level. These contracts include safety and quality targets.

Plant objectives are defined in three year strategic plans, proposed in line with a strategic framework at both plant and subgroup level. Management contracts are used at each level of management to set clear annual goals in the areas of plant performance, safety and resources. Regular monitoring throughout the year results in trending and analysis of performance indicators specific to each contract.

(a) **Good performance:** Performance indicators are developed and implemented at all levels of management. These indicators are developed in the areas of nuclear safety, plant production, environment, industrial safety, radiation protection, resources and management. They are implemented at section level in the organization structure and with natural work teams of employees. Performance indicators, established using the quantitative and qualitative objectives of the unit strategic plan and included in management contracts, allow deviations to be detected and analyzed. They are an effective means of achieving improvements in quality and safety.

The Plant Director, together with the Deputy Site Director and managers of the groups and the leaders of the teams, form the Site Management Committee. The committee meets regularly to monitor and discuss matters relevant to the site as a whole and to formulate and agree on matters of policy. The site Management Committee is assisted by seven specialized committees (Maintenance, Process, Conventional Safety and Radiation protection, Cattenom Data Processing, Nuclear Safety and Quality, Effluents, Training). The Plant Director ensures that decisions are correctly applied across the site, by independent checks performed by the MSQ in the field of nuclear safety, quality and industrial safety, and in other areas by the internal audits.

(b) **Good performance:** The site volunteered to receive a full evaluation assessment by the IAEA (OSART). The Nuclear Installation Safety Directorate (DSIN) requested the mission. In 1993 the site conducted a self-assessment against the

OSART Guidelines and identified areas in need of improvement and items from earlier OSART missions to other EDF NPPs which it would be prudent to implement. The managers then set priority objectives to resolve issues to achieve the improvements deemed important.

The concept of safety culture is receiving good attention at corporate level. The plant management is fully committed to achieving a strong safety culture throughout all staff. The document *Cattenom NPP - Nuclear Safety Culture Situation on 23 March 1994, questions and answers*, is an indication of good performance in this area.

(c) **Good practice:** The dissemination of safety culture in Cattenom is well structured from upper corporate management down to lower tiers of the plant. The strong commitment to the implementation of safety culture is clearly communicated in corporate policy. This policy has been implemented using several mechanisms such as:

- Letter mailed to each staff member by the Site Director.
- Safety and quality team weekly bulletin, highlighting good practices and safety issues.
- Recruitment, using specialized screening techniques.
- Incorporation of nuclear safety doctrine in the Quality Assurance Manual.
- Incorporation of nuclear safety goals in management contracts at all levels.
- A one day training workshop set up in 1993 on Safety Quality attended by every staff member.
- A safety culture questionnaire completed by all employees, followed by corrections and discussions with management.

The coherence of activities in fields common to all group departments is ensured by the management committee, either in the form of routine meetings or in the form of special meetings. Site policy documents and procedures are clearly identified. Administrative and control procedures are reviewed periodically.

1.3 Quality Assurance Programme

The policy concerning quality assurance (QA) and the resulting stipulations are defined in the Nuclear Power Plant Operations Quality Manual. This manual contains the basic rules establishing the fundamental principles of quality assurance, the resources to be utilized in application of the principles, and topics covering activities which may directly affect safety and quality control.

Each NPP or organization has its own Quality Manual which sets out the special local management systems for applying the provisions of the Nuclear Power Plant Operations Quality Manual. The Cattenom site documents are developed from these rules and form the basis by which quality assurance is achieved in all activities relating to nuclear safety.

(a) **Good performance:** The Cattenom NPP Quality Manual has been completely reviewed since February 1993. The manual comprises fields as: Management Declaration; site policies; 15 basic rules; set of application notes, classified into 16 sections (91 management and/or organization notes). This manual has been distributed to all department managers and its clear presentation has made it a very practical tool. All site policies, all management and organization notes and the management declaration have been rewritten, validated by the NPP management through the safety technical review committee and widely distributed. Also, 91 application notes develop the principles of self-assessment, monitoring, supervision and checking, and generally result in procedures, instructions or guides. The Quality Manual is supplemented by some 300 notes, that is directives, covering management, organization and application, which together with the application notes, constitute the Organization Manual. These documents and notes help management and staff members achieve good performance, good quality of work and nuclear safety.

MSQ carries out independent audit and analysis and provides advice and support. QA training is a feature in the training programme. The Plant Safety Technical Committees (GTS) are involved in any question related to installation safety or quality assurance and check that safety and quality assurance rules are applied.

The basic quality rules impose the setting up of a system of inspections. In each plant, this role is entrusted to the Safety and Quality Team (MSQ), which is independent of the operational departments. The Safety and Quality Manager reports directly to the Plant Director and is the co-ordinator of internal checking.

All nuclear power plants are inspected by EDF's Nuclear Inspectorate which reports to the Executive Vice-President in charge of Nuclear Power Plant Operation (EPN). The Plant Director's informed of the results of inspections related to his/her plant.

The technical content of each EDF and contractor job procedure is technically assessed by a person competent to carry out a critical review. For all job procedure, the plant has developed the principle of individual assessment and technical assessment by another person able to formulate a critical review of EDF In addition, MSQ carries out checks and audits; the results are analyzed in the Safety Technical Committee. Significant incidents are examined at the site for root causes, and subsequently by specialist groups at corporate level. The plant also has developed operational experience feedback based upon the SAPHIR computerized system (safety related occurrences).

1.4 Regulatory and other Statutory Requirements

The utility-regulatory interface is characterized by a strong EDF organization which administers a programme of self-regulation. Various regulatory authorities monitor compliance with national prescribed requirements to ensure operational and environmental safety.

The Ministries of Industry and the Environment are responsible for regulating the safety of nuclear installations in France. In discharging this responsibility they may consult the High Council for Nuclear Safety and Information (CSSIN) who provide advice on policy matters related to nuclear safety and public information. The ministries are required to consult the Interministerial Commission for Basic Nuclear Installations (CIINB) in matters related to licensing decrees for the creation and amendment of regulations. They rely on the Nuclear Installations Safety Directorate (DSIN) which plays the fundamental role of developing and monitoring the application of the technical rules, examination of licensing procedures with regard to the Basic Nuclear Installation monitoring, emergency accident response and public information.

The Institute for Nuclear Protection and Safety (IPSN) and the expert groups (the Standing Expert Groups and the Standing Nuclear Section) are the technical support of the DSIN and supply it with suggestions and recommendations. They play an essential part in assessing the safety of the installations. By their physical proximity to the nuclear installations, the Regional Directorate for Industry, Research and the Environment (DRIRE) is the obvious interlocutor for the sites. The DSIN has entrusted DRIRE with some of the surveillance tasks. The annual programmes of site inspections by DSIN or/and DRIRE are drawn up in advance and approved by DSIN. The site managements are informed approximately 15 days before an intended inspection, except for some unexpected inspections; generally, the inspector verbally provides general information on the topic to be inspected.

The Site Director is responsible for nuclear safety at the Cattenom site, but the day to day interface between NPP and Safety Authorities is ensured by MSQ. The corporate function of the Nuclear Safety Department (DSN), within EDF, is also involved directly with DSIN on matters of a generic nature. References to regulatory requests are required to be made within a certain time-scale. These are monitored by the Twin Unit Group and MSQ.

Following inspections, a copy of the site inspection report is given to the Twin Unit Manager who has an opportunity to make an immediate documented response. These inspections are reviewed by the NPP Safety Technical Committee. The regulatory body does not have a formal role in the appointment of EDF key staff with safety related duties, but they do inspect training records as part of their inspections duties.

Good liaison exists between regulatory authorities and the Cattenom Plant Management, and interactions appear to be frank, open and professional.

1.5 Industrial Safety Programme

Industrial safety in EDF is organized to comply with the requirements of French legislation, and is also part of a general organizational framework determined by the general management of EDF. Compliance with national regulations issued by the ministry in charge of labour is checked by the regional safety authority, DRIRE. A new Accident Prevention Policy was issued by the EDF Corporate Department in February 1994.

Industrial safety is part of the strategic plan and is included in all management contracts. For the Cattenom site, a Local Committee for Health and Safety (CHSCT) is established for each subgroup and chaired by the Deputy Subgroup Manager. An assessment is made at least once a month, by the NPP management team, of safety actions and results.

Safety notes on all aspects of safety are issued on site. Surveillance of industrial safety on the site is carried out by the Industrial Safety and Radiological Protection Section of each subgroup. A safety meeting is held each Friday with these persons and chaired by the Industrial Safety Engineer. Inspections are scheduled at regular intervals with formal worker questionnaires during visits in the field.

Safety staff performing their duties have the authority to check any individual at work for compliance with personnel safety protection policy. Management inspections are ad hoc, and are not co-ordinated in a systematic way to ensure total inspection of the plant. They are not directed specifically to the identification of industrial safety hazards, but there is increased presence of management staff in the plant. A number of minor accidents have been noted, that involve time off work, particularly in the Technical Support Group (SUT). More than 15 occurred in 1993. The Plant Manager gave a high priority to this subject in 1994, and several improvement actions were seen to be in progress.

(1) **Suggestion:** Consideration should be given to the extension of the regular management safety tours, to ensure that all parts of the plant are inspected by a management representative at a specified frequency (eg. monthly). Regular team briefings by supervisors and management should emphasize items relating to industrial safety performance. Staff members should participate in the actions of accident prevention. Other actions should be considered, as necessary, to reduce these minor accidents.

Plant response: *(June 1995) The Cattenom Nuclear Power Plant is well aware of what is at stake in personnel industrial safety: this is why an action involving supervisors' and managers' field presence was launched as early as 1992. This presence has recently been consolidated by using the conclusions formulated during an industrial safety seminar. This seminar took place after the so-called "Talks on Industrial Safety " led by a company called TESE Consultants, and was* *based on an audit performed by the Industrial Safety Department at the end of 1994. The programme is divided into three categories:*

1. Management safety tours

On a weekly basis, teams made up of two representatives of the Plant Management Committee go on a safety tour. Their main objectives are to discuss with the plant staff, to remind the employees of site rules on housekeeping, industrial safety and fire protection, and to directly identify possible short-comings. The Management Committee is kept informed on a weekly basis.

2. Industrial safety tours

Together with a staff member involved in industrial safety, a representative of the Plant Management Committee performs a weekly tour of outage work sites in order to analyze risks, observe good practices, detect possible weaknesses and remind the staff involved of our industrial safety requirements. During normal operation, this type of tour occurs every other week. These tours are scheduled every six months and Performed in accordance with a 7our Guide" They are subsequently reported on, managed and followed up. This principle applies to the managers of each twin unit group (TUG).

3. Housekeeping tours

Since the OSART mission, the requirements on cleanliness have increased. In order to cover the whole site, the plant has been divided into "housekeeping areas". Several criteria on cleanliness have been defined and "owners" in charge appointed. For satisfactory cleanliness of all premises, a housekeeping contract applies. A systematic housekeeping review is done using a specific procedure which allows results to be quantified. A representative of the Plant Management Committee takes part in periodic housekeeping reviews. There are five such visits performed every third week, covering all equipment buildings on site.

Note: During one such visit, a defect was detected on one unit (boric acid traces on a pipe). After investigation by technicians, a check was performed on the three other units. This allowed for early detection and correction of a defect common to all four units.

In addition, the subject of industrial safety is systematically tackled at the beginning of each meeting of the Plant Management Committee and the group managers. The Industrial Safety Department performs a weekly safety review which is then presented to and discussed by the Plant Management Committee. Each accident leads to a thorough root-cause analysis and experience feedback.

New Organization Implemented since the OSART Mission

TYPE OF VISIT	LEVEL	FREQUENCY
Management	Plant Management Committee	2 persons - 3 hours/week
Industrial Safety	Plant Management Committee	2 persons - 3 hours/week during outage 2 persons - 3 hours/fortnight during normal operation
	Twin-Unit Group Management Committee	2 persons - 3 hours/week during outage 2 persons - 3 hours/fortnight during normal operation
Housekeeping	Twin-Unit Group Management Committee	2 persons - 4 hours/fortnight

Industrial Safety Results

	1993	1994	1995 (5 months)
Minor injuries	180	130	20
Injuries involving absence from work (more than two days)	15	7	6

Main Lines of Communication on Industrial Safety

METHODS	SUPPORTS	COMMENTS
Media (site video network and written documents)	Site TV monitors Newsletter sent to each employee	Daily information On a weekly and two-monthly basis
Meetings Work site meetings Outage work meetings General plant staff meetings Department meetings Plant and TUG Management Committee Meetings	 Implementation of Industrial Safety Rules Booklet and of Accident Prevention Programme dated February 1992 Before each outage Yearly seasons' greetings and before summer vacation Three times a year Weekly status of minor affairs	 Every month, a progress report on current affairs is compiled by industrial safety specialists

IAEA comment on status: *(June 1995) The plant has responded appropriately to the suggestion of OSART team through a system of tours directed towards safety and cleanliness and through regular meetings and newsletters that include reference to safety issues. This system has only recently been instituted and it might be too early to identify improvement. However, in industrial safety, the results show a welcome decline in minor injuries but greater efforts are required to reduce more serious injuries that result in absences of more than two days. The cleanliness tours have not yet completed one cycle but already improvements to optimize their routes and duration are being discussed. The measures, if continued with the same motivation and determination as has been applied in their inception, should ultimately bearfruit in creating a safer, cleaner work place.*

Conclusion: *Issue resolved.*

2. TRAINING AND QUALIFICATION

The training and qualification of staff at Cattenom NPP is taken very seriously not only by training personnel but by the line management organization. Training is viewed as an important part of an employee's job with future training requirements being formulated with a view to the continual development of staff. Both initial and continuing training programmes are well structured and comprehensive.

The most important strengths are the strong corporate support to training with a comprehensive National Training Plan Guide, supported by well-equipped national training centres; the qualified and well trained on site training personnel supported by good on site facilities; and a strong contractor training programme carried out in partnership with the state education system.

Cattenom has in several areas considerably improved on the national training plan via the local professional adaptation programme (PLAP) and incorporated experience feedback into all areas of the programme. There are several noticeable areas where improvements in training have been made in line with previous OSART recommendations.

Station management demonstrate commitment to training by routinely taking part in safety courses, supporting the system of annual evaluation of staff and by attending the same obligatory continuing training courses as all staff at Cattenom.

In some areas, however, there is room for improvement or further development. Training is structured on a department basis, each with its own staff responsible for training. Since these members of staff do not seem to be communicating well, it is suggested that trainers hold regular briefing meetings. Another area requiring development is a system for logging some of the shadow training of the control room staff. Finally the system of course waivers could be improved by implementing a system of waiver by assessment to ensure that all students completely understand all the course objectives.

There is a strong underlying safety culture in training at Cattenom, with safety issues covered in several of the initial training courses, particularly in the area of risk assessment. Safety culture is also evident in the contractor training programme, and in the process of applying experience feedback to the Cattenom training programmes.

The commitment of the plant managers to training continues to be demonstrated through their support of existing programmes and through initiatives to further improve training effectiveness. Most of the areas identified for improvement have been resolved, and all are progressing satisfactorily.

For example, a training department has been established that promotes communication, idea exchange and problem resolution through regular trades work group and management work group meetings. A 'follow-up record for trainee shadow-training' has been implemented to document control room trainee shadow training. In addition, a decision was made to limit the number of waivers of training requirements and waivers, when approved, require that a line manager or a supervisor makes an assessment against specific criteria.

These and the other improvements that have been initiated demonstrate a high level of responsiveness and a desire for further improvements in the area of training and qualifications. However, it should be noted that these initiatives are relatively new and require continued support and emphasis to achieve the maximum benefit from these efforts.

2.1 Organization and Functions

The training of staff at the Cattenom NPP is directed from the corporate level, via two corporate training groups, the Professional Training Division and the Nuclear Generation Division. The Professional Training Services group controls the centralized training centres which give support to Cattenom. The corporate resources department under the Nuclear Generation division issues the training guidelines policy and training QA manual to all EDF sites. This leads to a National Training Plan Guide which is obligatory to all sites, and covers all jobs. This is consistent with best international practice.

Changes to the National Training Plan Guide are carried out in the following way:

- A plant reports a problem (eg. an event, new job or modification).
- The problem is analyzed at the national level to determine its nature and applicability to the rest of EDF.
- If required, in collaboration with the sites, a training project specification is drawn up.
- The training is designed
- The training is produced, and
- The training is evaluated using feedback from sites (is the problem solved) and the trainees.

(a) **Good performance:** Problems raised by a site which may have implications for training are sent to the corporate training group and, if applicable, a training programme is developed and put on the National Training Plan Guide. Thus, an issue raised by one site that may have an implication for training is fed via the corporate level to all sites. This leads to a speedy implementation of an improved training programme for all sites.

The site training organization receives the National Training Plan Guide which is updated annually by corporate staff. The site staff add to this plan by producing a Site Professional Adaptation Programme which is developed per department or group of counterpart departments and includes training in QA; plant knowledge; job (technical, organizational and socio-professional) aspects and Nuclear Safety and Safety Culture. This leads to the production of a Standard Training Plan and, when linked to a formal review of the trainee, leads to a trainee's individual training plan.

The site training organization is led by a training committee chaired by the Site Technical Support Group Manager. It controls the training budget, defines site training Policy, defines the guidelines for the training plan, manages training experience feedback and collects training statistics. All departments on site are represented on this committee.

All training carried out whether by EDF or outside contractor training is controlled by the site training team under the control of the manager of the Human Resources Section. Each department head is responsible for the training of his staff and has control of the Standard Training Plan and Individual Training Plans.

A head of department may waive the need for a member of staff to take an initial training course if the person was deemed to have sufficient knowledge. The head of department could exercise this waiver without a demonstration that the member of staff could completely meet the objective of the course.

2.1 Organization and Functions

(1) **Suggestion:** Consideration should be given to instigating a system of 'waiver by assessment' whereby a trainee demonstrates that he can meet the objectives of a course by satisfactorily passing the assessment. This would give an improved confidence in trainees' ability.

Plant response: *(June 1995) Professional experience and former training may lead to a waiver of certain training sessions which are part of a staff member's individual training programme (PIF in French). The staff member concerned is thus granted a waiver of these courses. This waiver is justified by the acquisition of skills corresponding to the objectives of the training. A stricter waiver granting procedure has been implemented. After an objective analysis based on the following elements, the skills acquired are evaluated by the individual's managers:*

- *objectives of the skills sought during a training session for which a waiver is solicited.*

- *possession of the said skills demonstrated by the staff member when performing the activities with which he (she) is entrusted, and confirmation of the said skills by his (her) manager.*

This waiver system implemented through observation of skills and performed in accordance with training objectives, is based on a list of skills criteria prepared locally for each position. However, if acquisition of skills cannot be confirmed by the staff member when performing his (her) activities, his (her) manager undertakes a formal individual evaluation with a questionnaire corresponding to the training objectives. If there is a discrepancy between the evaluated and the expected level, the person's manager will instigate the necessary corrective action. The waiver statement which formalizes the granting of a waiver is kept in the employee's individual training record. The waiver is also mentioned in his (her) individual training programme.

IAEA comment on status: *(June 1995) A decision was made to limit the number of waivers and a procedure has been implemented that incorporates specific requirements for granting a waiver. These requirements are as described in the plant response. Subsequent to the implementation of this system on January 1, 1995, fifteen waivers have been approved, mostly in maintenance. Waivers of training requirements are not granted in operations. Waivers can be approved by a line manager or supervisor after conducting an assessment of experience and performance against specified requirements. Such waivers are normally granted only when the requirements are clearly satisfied. When there is any doubt whether the training received by an individual is equivalent to that given by the plant, the individual would undertake the plant training*

Conclusion: *Issue resolved.*

It is quite clear that all EDF training staff whether at Cattenom or nationally have taken notice of the OSART findings at Gravelines in 1993, and incorporated many improvements into training.

Instructors at Gurcy-le-Chatel training centre are selected from the best technicians from NPPs, and then spend a year in training to become instructors. During this year they work on a training project (e.g. development of a new course or improving an existing course) and are progressively used as trainers as they become more fully trained. During the year's training there are five periods of evaluation, each evaluation must be successfully completed before progressing. On completion of this training the instructors spend three years at the training centre before returning to a NPP.

A similar detailed training programme exists at Paluel for instructors that takes 2 years for a non-operator to become an instructor, and six months for an experienced operator to become an instructor. All on-site instructors have pedagogical skills training.

Everyone on site has an individual training plan. The training plan and training records are kept together in the site training centre as a paper copy in the administration office. They are also stored on a computer. The records are controlled by the training team manager. An individual transferring to another site takes his/her training records. These records are not fire protected.

2.1 Organization and Functions

(2) **Suggestion:** Consideration should be given to protecting individual training records from fire. This would prevent the loss of these important records in the event of a fire.

Plant response: *(June 1995) Individual training records (CIF in French) are stored inside specific fire-proof cabinets of the Training Division building (fire resistance: one hour at 1090°C). This ensures their protection against any kind of destruction from fire. The main information elements making up the individual training record are also stored in a computer data base for Routine Training Management (GCF in French). This safeguarding of data applies to all structured training programmes taken by EDF staff members, namely the programmes involving acquisition and maintaining of various authorizations (Nuclear Safety, Technical and Radioprotection Safety authorizations). At corporate level, this data base (GCF) has also been transferred to another computer data base called GPSO (Computer Staff Management).*

IAEA comment on status: *(June 1995) Individual training records are promptly stored in afire-proof cabinet as described in the response.*

Conclusion: *Issue resolved.*

2.2 Training facilities, Equipment and Material

The personnel at Cattenom are trained at on- and off-site facilities. The on-site facilities are located just outside the site main entrance. This modern training facility consists of three general classrooms. Two computer classrooms are equipped with several computers and designed for tutor-led sessions. There is also one classroom for industrial safety and radiological protection training and one for first-aid training. The classrooms are well laid out and equipped for training.

The centre also houses two software based steam generator tube rupture simulators, which are effective training tools with excellent graphics. The centre also has several models (eg. reactor vessel and steam generator), and a video library. Site training facilities are consistent with international practices.

Off-site maintenance facilities are located at Gurcy, La Perollière and Cetic. Gurcy provides training in the fields of valves, diesel generators, basic electronics, basic electricity, power electronics, electrical protection, voltage regulation, automatic control systems, data processing, chemistry, radiochemistry and radiological protection equipment. La Perollière provides training in welding, non-destructive testing, rotating machinery and vibration analysis, pipework and pipework supports. Cetic is essentially EDF's refuelling training centre, containing a full-scale refuelling pool and refuelling equipment enabling refuelling teams to be trained in realistic conditions. It also contains steam generator mock-ups allowing training of personnel for conducting eddy current inspections of steam generator tubes.

Off-site Operations training is carried out at Paluel Training Centre. This is a modern well-equipped training centre housing three full scope replica simulators, six laboratories, three function simulators, a complete mini-plant simulator and several well-equipped classrooms. Great pride and professionalism was shown by all staff at Paluel.

The simulator facility at Paluel houses one 900 MW and two 1300 MW P4 simulators. Remote Emergency Shutdown Panel simulators are available for both 900 MW and 1300 MW simulators, and there is a simulated emergency technical centre. The simulator used for training Cattenom staff is based on Paluel Unit 1. Any differences between Paluel and Cattenom are covered by a special training session at the beginning of each course.

Plans are underway for a simulator to be installed at Cattenom in April 1995 and be available for training in July 1995. This will be the same as the simulator at Paluel and will be modified at a later date to fully replicate Cattenom. Discussion with the staff indicate that the differences have very little impact on training.

Three function simulators are used at Paluel, for training on the chemical and volume control system, turbo generator control and reactor control. Paluel also houses a full mini plant simulator used for training in the operating principles of PWR operation and integrated plant response.

The simulators are maintained in a high degree of readiness, and are shut down twice a year for a total of six weeks for maintenance and modification. There is a good system in place for receiving details of plant modifications. All the necessary quality assurance procedures have been included in the process. There is a similar system in place for feedback to the plants of information derived from the use of procedures in simulator sessions.

All training course and reference material is held in a controlled central store. All the necessary QA procedures are in place for the control of this material. Operational experience feedback is factored into all training material using a database system. The training material used for the training of operators is based on a hierarchical task analysis. Great care has been taken in the preparation of training material, especially simulator material, to ensure that it is a close replication of plant conditions. This is done to the extent that a sheet has been prepared detailing the time an operator takes to move from place to place and the time he takes to perform certain key actions.

(a) **Good practice:** In the simulator training modules requiring simulation of operation in the field, the time taken for the field operator to move from area to area is included in the training file. The timings of the duties are presented as a matrix in a similar way that mileage tables for distances between cities are presented. The times taken to perform the tasks are obtained by actual observation at Paluel NPP and included in the instructor's session file. As a result of this enhancement the training has added realism and effectiveness.

2.3 Control Room Operators and Shift Supervisors

All control room operators at Cattenom have been promoted through the field operator route and so have completed the field operators' training programme.

Over the past two years Cattenom has moved to a seven shift system and each twin-unit has operations shift managers in charge of two shifts.

The initial training programme was revised in 1993 and has been significantly improved and is now an eighteen-month programme. All the courses are followed by assessment, successful completion of which is required for continuation through the programme. There are four three-week classroom training modules at Paluel. These are interspersed with periods on site, followed by one month of site designed training from the site professional adaptation programme (PLAP). This is followed by a two-week simulator course at Paluel covering normal operations, a month of PLAP training on site and the first of two one-week safety courses given by Paluel staff either at Paluel or on site and covering general operating rules and procedures. Prior to returning to Paluel for the next two-week course on simulator training on incidents and accidents the trainee must complete a comprehensive self-assessment package to ensure he has a thorough basic understanding of reactor operation and operating conditions.

The second simulator two-week course at Paluel is followed by a trainee evaluation sheet, detailing his/her performance over the two weeks and indicating any areas for improvement. The trainee then has four weeks on site before returning to Paluel for a one-day objective-based assessment. Another month's PLAP training follows, followed by the second one-week safety course, involving the study of several types of accident. Paluel intends to use this evaluation technique on all simulator courses in the future.

The next segment of training is another two weeks on the simulator, consisting of a mix of corporate training requirements, Paluel training staff decisions and trainee requests. This course is continually assessed.

This training is followed by a structured site PLAP course essentially covering the loss of power supplies, followed by a two-week simulator course on the same subject.

This is the last formal course in the training programme. The results of all simulator assessments are fed to site in a comprehensive report.

(a) **Good performance:** There are four two-week simulator training modules at Paluel. The objective-based assessments for the simulator training both before and after the training are very thorough and comprehensive. The assessment of the second module is delayed to allow a period of personal improvement, and this considerably enhances trainee performance.

Throughout the initial training programme, the trainee shadows an operator in the control room on site when not in formal training courses. However, the period of shadow training is not documented. At the end of the programme, the trainee is authorized as an operator via a formal interview. This extensive and improved training programme is considered to be consistent with international practices.

(1) **Suggestion:** Consideration should be given to instituting a formal system of logging or documenting control room trainee shadow-training. This would give confidence that each trainee received sufficient training to ensure an adequate level of knowledge and experience, thus enhancing the training programme.

Plant response: *(June 1995) Follow-up and documentation of training sessions taken and of experience gained during "on-the-job " training for control room operator trainees are recorded in a "Follow-u record for trainee shadow-training " (for all new control room trainees, this system started as of January 1, 1995).*

This record, given to any employee appointed to be a control room operator trainee, has three objectives:

- *Enable the control room operator trainee to acquire the skills necessary for his (her) qualification;*
- *Guide his (her) tutor (who is a qualified operator) in his (her) shadow-training assignment;*
- *Enable a trainee's manager to follow his (her) progress (follow-up of internal and local training experience) in view of his (her) qualification.*

After the shadow-training period is over, the follow-up record is filed in the employee's individual training record (CIF in French). The use of this shadow-training follow-up record is being extended to the other site departments.

IAEA comment on status: *(June 1995) A 'Follow-up record for trainee shadow-training' was implemented on 1 January, 1995. It is a formal system that requires new control room trainees to log the activities they have performed under close supervision. The system provides a guide for the trainees use in completing the* *shadow-training assignment, provides the means to record the actual training completed and can be used by the responsible manager to assess the trainee's readiness for qualification. Several control room operator trainees have begun but none have completed the process to date. Several other departin ents are now studying how they can adopt the process.*

Conclusion: *Issue resolved.*

The programme for continuing training, based on task analysis, is to spend two weeks on the simulator and a refresher course on the basic knowledge of control. Some of the simulator training sessions are conducted by two trainers, one looking at the technical competence, the other at areas such as interpersonal skills and communication. Feedback is heavily factored into this training. The on-site training at Cattenom is based on maintaining skills and proficiency and addresses such areas as general operational/technical skills, nuclear safety, quality, industrial safety, management skills and general knowledge. It also addresses areas of obligatory training, such as authorizations, fire fighting and first aid.

Engineers who have a role to play in emergencies, such as the shift operations managers, safety engineers, technical supervisors and crisis team engineers, are sent on a one-week training course on the SIPA simulator at SEPTEN in Lyon. The concept of the software is similar to the steam generator tube rupture (RTGV) simulators on site. it is designed to demonstrate primary and secondary side conditions in the event of severe accidents. Cattenom uses this period to train for events such as major steam generator tube ruptures, major LOCAs and total loss of secondary coolant without a trip on the re-actor. The scenario is first conducted without intervention with the students only observing. It is then conducted again with the students using Cattenom procedures to help control the situation. In this way the student is shown the value of following the procedures.

(b) **Good performance:** The SIPA simulator is used to demonstrate a severe accident scenario and then to train operators and engineers with emergency responsibilities in severe accident situations and in the use of procedures to help control these situations. This training enhances the operators understanding of the scenarios, the use of emergency procedures, and their ability to safety control the plant if similar situations should occur.

2.4 Field Operators

Cattenom has made the decision to only. appoint field operators who have a Baccalaureate plus two years of further educational experience. The intention is to eventually promoting field operators to control room operators.

The initial training programme for field operators lasts for a year and is supervised by the shift operations manager. The aim of the programme is to obtain Nuclear Safety

Authorization level 1. The training is in four week periods. The first week is usually a classroom course at Cattenom, Fessenheim or a national training centre followed by an assessment. This is followed by three weeks on site shadow training. That is assessed by the technical supervisor, shadow trainer and training supervisor. The programme then repeats itself.

On a plant tour, it was noticed that field operators responsible for controlling site effluent discharges were not receiving initial or continuing structured training in that plant area. Site staff explained that training for this work was under consideration.

(1) **Suggestion:** Consideration should be given to supplying structured initial and continuing training to operators involved in the operation of the waste treatment plant and control of effluent discharges as soon as possible. This would enhance the performance of operators in this area and reduce the potential for operator error.

Plant response: *(June 1995) Prior to the commissioning of Unit 1, which operates and manages the waste treatment plant, a Unit 1 specific initial training was given to all field operators. Since then, new field operators have received generic initial training at a national training center. In addition, plant specific shadow training has taken place at Cattenom. Since February 1995, this shadow training has been structured, as suggested, in a shadow-training file. Furthermore, in order to improve the skills, a local training session called 'Release of effluents" is part of the operators' training programme. This structured training (number 4539 E 011) is defined in a reference specification and implemented based on a training file. Its objective is to improve the safety culture of staff members in the area of effluent releases.*

It is designed for Operations Department staff and also for those in the Maintenance Department who are involved in effluent management. When this course is completed, trainees are able to explain:

- *the different types of liquid and gaseous effluents;*
- *the origin of these effluents and the procedures used to manage them,*
- *what a planned release is;*
- *what a unplanned release is;*
- *the site organization for releases, and distribution of responsibilities, especially those of the operators.*

The 1995 Training Programme states that all site operators have to take this training. Recording of training sessions attended appears on the individual training programme and the individual training record.

How to maintain skills in this field is currently being analyzed and will be included in an objectives document. This action is part of the power plant three~ year training Programme currently being developed.

Note : As of 31 May 1995, results show that
- *107 employees from the Operation, Department*
- *57 employees from the Maintenance Department*

had participated in this training course.

***IAEA comment on status:** (June 1995) New operators now receive generic initial training at a national training centre on the operation of the waste treatment plant. This training is augmented at Cattenom by Plant specific shadow training, which has been structured since February 1995. In addition, a local training session, 'Release of effluents', is required for all operators. Although it would be desirable to have a structured site specific initial training Programme for the operation of the waste treatment plant, such a programme is not reasonable due to the small number of new operators. Also, it is reported that the error rate in operating the waste treatment plant is extremely small.*

***Conclusion:** Issue resolved.*

Cattenom's aim is to promote the field operators to control room operators. This approach is by continuing training which has two elements. The first is a periodic refresher of such skills as fire fighting, first aid and emergency plan training. In addition, OEF is factored into this training and the views of the field operators are included through a Monthly meeting with a field representative from each shift. The second part of the training is aimed at improving the qualifications of the field operator, and contains several one-week courses such as chemistry, I & C and regulation. One week is spent at Paluel training on the mini-plant and there are several courses on the function simulators. Overall this is a very comprehensive programme and leads to an interview for promotion to technician, and then via further training and assessment to control room operator.

2.5 Maintenance Personnel

The initial training programmes for maintenance personnel are very strong and are aimed at giving personnel sufficient training to enable them to be promoted. The initial training Programme therefore covers all grades.

Skilled workers can be appointed with only a basic educational qualification. EDF and Cattenom in particular have very strong links with the State Education system, and between them have produced courses that can lead to a qualification of Baccalaureate plus 2 years. To get these qualifications, the trainee is selected by management and on the company's time trains for various certificates that lead to a diploma at a local school (Malgrange) in Thionville.

Another aspect of a skilled worker's training is the shadow training concept, where the trainee usually trains with a technician. Clear objectives are set and are reviewed between the trainer and trainee every two weeks. Every quarter a progress meeting is held between the trainer, trainee and deputy department head. At the end of a year this training leads to an interview and, if successful, the skilled worker is authorized to nuclear safety level 1. All the shadow training is well documented and full records kept.

The training programme at all levels is very thorough. It is based on the national training plan in addition to the input from Cattenom via the PLAP and a personal input via an annual interview with the employee.

Maintenance training at Cattenom is formalized and well structured. In addition to the obligatory refresher training, employees are trained to improve their personal qualifications. This training is agreed to at an annual interview. However, it appears that the various departmental training groups are not communicating well. It was observed that the maintenance sections do not hold regular meetings with their field staff, to obtain feedback on training programmes. (This practice is carried out for field operators). Good training initiatives in use in one work area at Cattenom are often not seen in other work areas.

(1) **Suggestion:** Consideration should be given to implementing regular meetings between field staff and trainers to exchange views on training programmes. This would lead to an enhanced training programme for field staff.

Plant response: *(June 1995) Cross-discipline site work groups have gradually been implemented since the summer 1994. These groups are made up of field staff and led by a special Training Department advisor. Depending on the subjects tackled, specialists or trainers of the Department take part in the meetings.*

The assignments of these groups are as follows:

- *detect and examine additional skills to acquire within their assigned functions;*
- *determine training needs;*
- *suggest training sessions to managers;*
- *perform experience feedback of actions developed.*

Managers in the area chosen make the appropriate choices and define priorities. These work groups meet once a month.

IAEA comment on status: *(June 1995) Trades work groups consisting of workers and supervisors from specific trades'(disciplines) and a training department special advisor meet monthly to exchange views on training programmes, to determine needed skills and training and to suggest appropriate training sessions. A meeting report is prepared that is distributed to line managers and the management work group. The management work group is chaired by the training department special* *advisor. This group develops specifications that lead to the provision of appropriate local, corporate or subcontractor training. The training department special advisor appears to be an essential element of this process. Trades work groups are active in operator, maintenance and administrative disciplines, and are being expanded to other plant areas. In addition, it is planned to involve other disciplines in the current trade work groups on an as needed/requested basis. This approach ha, promoted open and effective communication, has resulted in a number of visible and beneficial training changes, is well received, and would be appropriate for sharing with other utilities.*

Conclusion: *Issue resolved.*

(2) **Suggestion:** Consideration should be given to holding regular departmental training engineers' meetings at Cattenom to exchange ideas and help one another solve problems. This could probably be achieved by giving the central training team of the plant more authority. Improving communications between training engineers would benefit the training group as a whole.

Plant response: *(June 1995) After the OSART, the creation of a Training Department made it possible to reinforce the role and authority of the local training structure. At least twice a year, meetings of the Training Committee are held for the major site professions, which are attended by those responsible for training in the departments concerned. In addition, line management work groups, chaired by the Training Department advisor, meet monthly. Their role is to:*

- *take corporate and local training guidance into account;*
- *analyze the changes in Professions and the consequence for training programmes;*
- *examine the proposals made by work groups;*
- *validate objectives of the training courses considered;*
- *define priorities In training actions;*
- *follow up on the quality of the training actions carried out.*

Currently, for the professions in the operations and administrative fields, local training programmes are prepared by managers' and supervisors' work groups. For Maintenance Department professions, the exchange process takes place between the training managers concerned and the Training Department.

IAEA comment on status: *(June 1995) A training department has been established that has acted to reinforce the local training structure and to promote communication, idea exchange and problem resolution by department engineers. For example, a management work group meets at least twice a year. This group consists of department training managers and appropriate department and training staff, and the training department special advisor. This group has a number of training related assignments, including the review of the trades work group* *reports, and the development of related specifications to resolve specific training issues. The activities of the training department and the management work group, as identified in the response, appear to be appropriate to achieve the intent of this suggestion. However, they are relatively new and should continued to be strongly supported and enhanced to achieve their full potential.*

Conclusion: *Satisfactory progress to date.*

EDF and Cattenom in particular are heavily involved in contractor training, the aim being to harmonize the training of EDF staff and contractors. The training is shared between EDF and the State Education System.

(a) **Good practice:** The harmonization of EDF staff and contractor training in the areas of quality and safety, risk prevention and ALARA ensures that contractors are trained to a common level, gives greater confidence in the work carried out by contractors at EDF sites and results in a better working relationship between the contractors and the plant staff.

Contractors are trained in quality and safety (plant operating principles and nuclear safety), risk prevention'(a course used by EDF staff) and ALARA principles and practice. This training is either carried out in state-run work-site schools or in EDF training centres (Gurcy Le Chatel, for example). All training centres are periodically audited by staff from the corporate Professional Training section. The names of contractors' staff passing these courses are recorded in the Cattenom Access Book and the qualification is valid for three years. After this time the individual has to return for a 2-day refresher. Successful completion of these courses has been obligatory for entry to EDF sites since July 1993.

(b) **Good practice:** Contractors staff requiring access to EDF sites require an access passbook which contains details of the individual, photograph, company, dose record and training record in the areas of quality, safety, prevention of risk and ALARA. Using the access passbook in this way, EDF is able to determine immediately if the contractor is qualified and hence EDF has an improved level of confidence in the contractor's ability to perform work on the site.

2.6 Technical support Personnel

The technical support positions at Cattenom include engineers, planners and technicians in the Technical Support (SUT) Group, the testing sections in the Twin-Unit Groups and the Safety and Quality Team (MSQ).

All sections have similar training programmes. Training leads to authorization and people are not allowed to work in certain areas until they have obtained the necessary authorization. All section heads prepare formal training plans for their engineers during an annual interview and initial training makes good use of the shadow training approach.

All support personnel receive general employee training (GET) training and the risk prevention courses.

The Planning group has training courses relating to their particular specialties. They also attend three national safety courses, the first being the basic safety quality training course (FBSQ), a one-week course. The next is the one-week works co-ordinator and checker course (FAC), followed by the Planning quality safety methods (PQSM) three-week course.

The testing engineers' specific training programme is designed around employees' authorizations and has been structured based on reference skills for the foremen and technicians. The PLAP part of the training covers areas such as technical training for testing and reactor start-up tests. The specific departmental training adds twelve groups of half day technical courses concerned with Plant testing. The programme is very comprehensive.

The MSQ department is comprised of engineers and ex-operations personnel and has perhaps the strongest training programme. The seven nuclear safety engineers follow the safety part of the shift operations managers training plan. Other engineers in the group who have specific duties during an outage (eg. refuelling team leader) have specific training programmes to cover these duties. Training for auditors in the group was equally well structured, covering safety and technical issues, as well as auditing skills.

Other technical support groups all have good training programmes. However, as noticed in the maintenance training field, the various departmental training engineers do not communicate well with one another. Many of the technical support staff have pedagogical skills training.

All the technical support groups carry out annual interviews to help define individuals' future training needs. This, together with the obligatory refresher training, leads to a continuing training programme with personnel spending approximately three weeks per year in training.

2.7 Radiation Protection Personnel

The radiation protection group consists of three sections comprising the Technical Support Group (SUT), Twin-Unit Group (TUG) 1/2 and TUG 314.

The initial training programme is formalized and well structured using the shadow training technique for on-site training. Site training includes specific assignments, equipment, shipping of radioactive materials and training in radioactive source management. Obligatory national courses include such topics as safety, quality, risk prevention, maintenance and operating principles, with a total of three weeks at Gurcy Le Chatel training centre on radiation protection and a one day ALARA course at site. More senior staff are sent to the Atomic Energy Commission (AEC) at Saclay for their three day ALARA course. Several approved manufacturers' courses in radiation protection are also included in initial training. This training leads to specific nuclear safety authorizations.

Obligatory refresher training is itemized in the standard training plan and consists of fifteen hours every three years. Other site-based continuing training covers such areas as fire zone, fire-fighting and emergency drills and training for personal advancement. The three radiation protection sections exchange information. A good example is the formation of an industrial safety team for Outage 4. The team is led by a section head and foreman from TUG 3/4, but the six technicians were from both twin units and SUT. Proposals are currently under consideration to instigate a programme of rotating technicians.

2.8 Chemistry Personnel

Chemistry training follows the same systematic approach of the other departments. Each individual must be authorized to perform work unsupervised in the chemistry section. There are five areas of authorization, nuclear safety, emergency plan, radiation protection, test supervisor and authorization for activities involving electrical and mechanical equipment.

The training starts with general employee training (GET), followed by laboratory work with a shadow trainer. When a trainee is appointed, he is on one year's probation. If he fails to complete this period successfully, he can be relocated. Over a period of approximately two to three years, the trainee will complete his technical training programme, which includes specific courses on safety and fifteen weeks of chemistry specific training off-site. A trainee's work is monitored monthly with a formal review every three months.

There are eight work areas within the laboratories and it usually takes two years to achieve proficiency in all areas. This is followed by three months of training for work in the demineralization plant. If a trainee is carrying out shadow training in an area for which he is not authorized, his results must be validated by an authorized worker and checked by an other employee. All shadow trainers are fully trained in pedagogical skills and are authorized at level 1 Nuclear Safety.

Other chemistry specific training is given in regard to the emergency plan. There are four areas of training for the plan, Health Physics control centre, sampling of gases and liquids, Post Accident Sampling System and Emergency Plan Software training.

The chemistry section policy is to continuously train their staff so that they are trained and ready for promotion. An annual interview establishes their continuing training programme which will be a mixture of obligatory refresher training, emergency plan drills, training in new equipment or procedures and training to enhance personnel qualifications. It is a well structured and well documented process.

2.9 Management Personnel

Promotion to senior management positions at nuclear power plants in EDIZ is closely controlled. Plant managers send a list of potential managers to a career path Committee in Paris. In return, each plant manager receives a list of potential candidates for their NPP. If a vacancy occurs, the committee proposes two people for the position and the site makes the final decision.

A standard training plan corresponds to each senior management function and is established according to site organization documents. The plan includes obligatory training actions which contribute to becoming nuclear safety authorized. It also includes training actions which are desirable or recommended to acquire, maintain or perfect knowledge related to the function, as well as management skills.

Training and evaluation of managers centres around nuclear safety and senior management skills. Nuclear safety is described in Nuclear Safety Cattenom policy guidelines. Senior management skills are assessed annually at an interview. The results are formalized on a development sheet that details future training requirements.

All the departments in the same specialization meet regularly in Paris for several days. The purpose of these meetings is for information exchange and continuing training.

Another key element of continuing training is the emergency plan training, and last year, Cattenom's senior managers were involved in four training exercises. Senior managers at Cattenom attend all the site obligatory refresher training (fire-fighting, risk prevention), as any other worker on the site. On average, managers will spend three weeks a year in continuing training, as well as being given special assignments such as periods of attachment to INPO.

2.10 General Employee Training

Cattenom has a strong GET programme. It is centred around the three areas of risk prevention (which includes radiation protection), first aid and fire fighting.

The programme includes a half-day session covering site safety, a half-day course in first aid , a three-month period when staff are given a structured training pack to study risks on site, and a ten-day course on risk evaluation and prevention. All staff are given training in emergency muster procedures. Training records are maintained by the training section.

(a) **Good performance:** A three-month'general employee shadow training period is provided in which employees use a structured training pack to study and discuss all risks in different plant locations. This is followed by a two-week risk prevention course for all staff. This programme makes the staff very aware of plant nuclear and industrial safety issues and better prepares them for their plant responsibilities.

Risk prevention is refreshed every three years with a two-day programme, fire-fighting for half a day per year, and an unannounced annual emergency drill is carried out.

3. OPERATIONS

The Operations Departments, one for each twin unit group, comprise seven shift teams, thus improving individual and team training, and operator coverage during busy periods such as outages. Strong support is given by the corporate level, strengthening areas such as site engineering and human factors considerations. The control room is well equipped, and operations are conducted in a professional manner to high standards.

The operating procedures for normal operation and emergency, including beyond design basis conditions, are developed with the support of the corporate organization, and are consistent with international practices. Nevertheless, it is recommended that in the surveillance test procedures the difference between technical and safety acceptance criteria be analyzed and defined.

The administrative tagging of safety related components in Cattenom is very well organized and reliable. However, in the work control tagging system a deficiency was observed regarding the ability to securely attach tags on vertical panels.

The experience feedback programme at EDF/Cattenom on significant incidents led to improvements in training, design and procedures. The plant personnel are committed to this programme, which has contributed to improved NPP performance.

The administrative procedure regarding temporary modifications should be revised to correct the deficiencies in the approval, control and installation processes noted during the review.

The fire protection programme is well organized, responsibilities are properly defined, and training is correctly planned and carried out.

Actions taken by the corporate level and plant clearly demonstrate safety culture in operations. During the review, managers, supervisors and field operators demonstrated their commitment to safety as a main objective.

Good progress has been made by Cattenom in the resolution of the identified operations issues. In all cases progress is either satisfactory or the issue is resolved. The redesign of the tags used on control panels to indicate that equipment is isolated has resolved the issue concerning tags either falling off or obscuring other indicating lights.

The clarification of closing times for containment isolating valves both during shutdown testing and during on power testing was eventually resolved satisfactorily, but it took a long time to establish the rationale for the differences between the required operating time in the shutdown mode as compared to on power. This suggests some further training in safety culture should be considered.

Significant progress has been made in the area of field control of housekeeping, identification of deficiencies and temporary documentation. This has included the identification of housekeeping standards setting up routine joint management and operator tours of all units on a scheduled basis using comprehensive checklists and the creation of a new foreman's post with resources to rapidly respond to routine housekeeping issues.

Field checks on the effectiveness of these programmes indicated that housekeeping and defect identification were satisfactory. Operator knowledge of plant conditions was also found to be good during this field check.

There were three issues in the operations area concerning improving control over temporary installations. As a consequence, EDF carried out a fundamental study of how temporary installations are controlled and carried out in the plant. This lead to a complete overhaul of the process and has resulted in a clearer more rigorous system which exceeds the requirements of the issues identified in the OSART review.

3.1 Organization and Functions

The Operations Departments consist of shift teams, assignment advisors, an operating engineering section and a process engineering centre (common for the site).

There are seven shift teams in each unit. Each shift is composed of a Shift Supervisor, a Tagging Supervisor, two Control Room Operators and a minimum of four technicians and Field Operators. The teams are headed by an Operations Manager (common to two units) who is responsible for safety, power generation, team management and who is also a member of the Department Management Team. The Shift Supervisor leads the operations activities, he is responsible for the detection and analysis of the anomalies and for a detailed unit management. The functioning of seven teams increases the availability of staff to assist during outages and for conducting scheduled training.

(a) **Good practice:** The functioning of seven shift teams makes more operators available for training, and makes additional resources available during outages. In particular, this permits adapting shift staff numbers to the work load, improves the preparation of specific activities having an effect on safety, such as tagging alignment operations, enables the operating staff to enhance performance and increases the department efficiency by updating operations documents, participation in important meetings, improving the interface with other departments, working in close collaboration with operations engineering staff, developing and participating in specific experience feedback activities, and facilitating the scheduling of team training. The overall benefit of this initiative is an improvement in individual and team training, improved operator coverage during busy periods such as outages as well as improved performance in a number of other operator activities.

A very strong interface was observed between Operations and Maintenance to schedule and prepare work orders.

Assignment advisors assist the operations Department and Shift Managers in decisions in safety, human resource management, training and technology. One of the assignment advisors acts as the Department Deputy Manager.

A corporate structure supports the plant, proposing policy and rules, and providing expert assistance in examinations and analysis. Several initiatives of the Corporate Resources were implemented at Cattenom NPP. Some examples are implementation of the post of the Operations Manager, a computerized monitoring system for approach to criticality and computerized field inspections. These initiatives have led to improving the organization and performance of Cattenom NPP. The Corporate Operations Department establishes the operating doctrine and manages the experience feedback by analyzing technical and human aspects of operating incidents.

(b) **Good performance:** The Corporate Operations Department has transferred part of Site Engineering to the plant to support maintenance and operations. As a consequence, in operation, the problems that emerge and require a medium or long term study are addressed by this engineering team. Goals are established and follow-up meetings update the status of the studies. The site engineering team is mainly composed of experienced tagging supervisors and shift supervisors, and safety and operation engineers. As a result of this support, the shift teams are able to concentrate most of their efforts on plant operation.

A Human Factor Consultant post was established upon the recommendation of the Corporate Operations Department in order to conduct human factor analysis in events report analysis. The corporate organization, as a consequence of a decentralization process, has established a site engineering group to support Operations and Maintenance

(c) **Good practice:** A Human Factor Department was created at corporate level several years ago. Its responsibility was to analyze the human factors in incidents, in order to determine corrective actions, such as: improvements in control room ergonomics, training actions (eg., start-up of the primary pumps in special conditions), and modifications in the presentation of the procedures (eg. emergency procedures presented in form of a flowchart). Although this corporate department has sufficient resources, its study is limited to incidents with important consequences having generic characteristics. In 1993, only one of the 24 significant incidents in Cattenom was studied by this group. To reduce the amount of incidents, it was considered necessary to have a specialized human factors person on site.

The main task of the Site Human Factor Consultant is to study all incidents and near misses with human factor root causes. This permits the implementation of corrective actions in short term (about 10 actions in 1993) and to monitor their effectiveness in the field. The consultant is known by the operating personnel, given that he was a Safety Engineer and simulator instructor. He also completed special training course on human factors performed at corporate level.

Some examples of actions taken include:

- Following a reactor trip while, at 106% of nominal power, the rate of load change was modified, a local training programme on operation methods was developed and an open discussion was held on ways to improve the shift turnover process.

- Following drainage of the reactor pool below the set value, a clarification was made of connections between relevant procedures and training was improved concerning middle loop operations with the residual heat removal system in operation.

- Following two cases of exceeding surveillance test intervals, a double control was established that included a computerized system and a manual follow-up of test planning methods.

The implementation of these actions is monitored by the Site Safety Technical Committee. During the last fifteen months, no recurrence of similar incidents was noticed and the employees proposed new and better solutions. As a result of discussions with the consultant, the employees now think more deeply about the potential consequences of incidents, The most immediate result, however, is the improvement in the transparency of the incident reports thus leading to a significant emphasis on safety culture.

The Safety Engineer, who is required to complete the same training programme as the control room staff, reports to the Safety and Quality Team Head who is common to the four units. The Safety Engineer is on call to support the shift in case of emergency.

A operating engineering section assures an interface with the non-shift department, (primarily the Maintenance Department) gives technical support to the shift teams (in activities schedules and experience feedback analysis), manages training and assures the logistics of the department.

For outages, an operation team supports the shift teams. Its purposes are: preparation (activities planning and general schedule setting-up); follow-up of the outage schedule and management of unscheduled events; and ensuring experience feedback including an outage assessment. These special structures for outage provide support to the shift staff including a better understanding of outage activities and planning.

The Operations Department managers visit the control room at least once a day. The new management contracts require that all plant managers periodically perform walkdowns of the plant. The Operations Department heads and deputies carry out refresher training on a simulator, in the role of Safety Engineer and/or Shift Supervisor, as part of their supervisory responsibilities.

3.2 Operations Facilities and Operator Aids

A computerized operating aid programme is implemented in control room. The process computer (KIT 1300) provides real time aid in assisting the shift team in decision making and diagnostics. This is accomplished by acquisition of control process monitoring data that is processed and displayed on the screen. The computer stores the information and performs specific calculations. This computer enables the analysis of transient and scram data. It also provides assistance in criticality calculations and can transmit data and results to the National Emergency Response Center.

The unavailability of each safety related equipment is visually displayed on a special board in the control room. The operator also displays each unavailability on a computer system that analyses the unavailabilities and classifies them by equipment. The unavailabilities are reported and discussed with the Maintenance Department.

(a) **Good practice:** A computer is used to analyse unavailabilities. It provides the basic data for nuclear safety assessment by three independent and complementary groups:

- Safety and Quality Team: Engineers prepare a weekly Nuclear Safety Report that provides staff of the various departments and site management, with general comments concerning site nuclear safety level; indicators related to the management of equipment unavailability; and a list of event reports that are issued or will be issued.

- Maintenance: A computerized file is used by technical management staff members to develop statistical unavailability analyses, which are shown in graphic reports.

- Operations: Operations managers provide an overview of unit nuclear safety through the weekly Operations Report. The elements developed in these reports are discussed in the weekly department meeting.

These processes have resulted in improved co-operation between the Safety Quality Team, Operations and Maintenance, and have reduced the incidence of unavailabilities.

The waste station control room for the four units is operated by the field operators from the twin-unit group 1/2. The same is true to the water treatment station control room. It was observed that the tagging process in the water treatment vertical panels has some deficiencies. The tags used on panels in Cattenom are correctly sized for the main control room panels, but in the water treatment station where the hand switches are closer to the indicating lights, the tags frequently cover the indicating lamps. Since this panel is vertical, the tags are not securely attached and could easily fall to the floor. In some cases, tape was applied to fasten the tags but the tags could still fall down.

(1) **Recommendation:** The tags used on panels in Cattenom NPI` should be designed to fit the panels, avoid hiding indicating lights, and be securely fixed to the vertical section of the panels to prevent the tags from falling down. In providing the proper tag for operational tagging, it should be assured that the isolated equipment and the boundary components will be properly indicated to provide safe work conditions without affecting other panel indications.

IAEA comment on status: *(June 1995) The purpose of the panel tags is to indicate to the operator that a piece of equipment which is controlled from a control panel is isolated. They are not the primary means of ensuring equipment remains isolated while work is in progress. This is the function of the tags placed on breakers and valves, etc. The problem with the original panel tags was that they were designed to fit the switches for the EDF 950 MW units. The switches on these units are larger than on the 1300 MW units at Cattenom.*

The new tags were inspected and found to be of satisfactory design. They have a press out cross in the centre which enables them to be easily and firmly placed on the switches. The design of the switches and the tags prevents the tags from rotating or falling off once they are placed on the switches. An inspection of field installation of these tags on vertical panels confirm ed that they work well and do not obscure indicating lights. They can be printed with the appropriate isolation information by a computer prior to installation.

Conclusion: *Issue resolved.*

3.3 Operating Rules and Procedures

Cattenom has a well established procedure structure, supported by comprehensive administrative procedures. The only procedures required to be reviewed every two years are the procedures related to abnormal and accident conditions. All the other procedures are to be updated during their frequent use. EDF operates 56 NPPs of which 20 are very similar to Cattenom NPP units. There are standardized general procedures and a strong operational experience feedback system, that makes this procedure review criteria acceptable.

EDF assumes the technical responsibility for safety and safety authorities check how this responsibility is assumed relative to regulatory requirements.

The technical specifications are being reviewed and may be published in two separate volumes. One will include statutory requirements and the other the technical bases. The statutory volume will be structured for the operations area. This review will take into account experience feedback so that the document is improved and that the number of waivers normally requested from the Regulatory Body will be reduced.

A list of surveillance tests to be carried out is established by the Safety and Quality Team, taking as a basis Chapter IX of the General Operating Rules and the Safety Instructions Number IV for system tests not approved by the Nuclear Installation Safety Inspectorate. Each department produces its own test performance procedures that contain the criteria to be checked.

The surveillance test procedure to confirm the availability of a group of containment isolation valves does not include stroke time measurements. There are two limits: 'technical', which is the manufacturer's recommended closing time (10 seconds) which is checked only after maintenance has been carried out, and 'alarm limit' set at 15 seconds, which is a common alarm for this group of valves. Thus, if during a test, the stroke time of the valve is less than 15 seconds, the result is considered to be satisfactory. A valve taking longer than the 'technical' limit, say 13 seconds, could indicate problems with the valve and the potential exists that the valve would not operate properly on the next use. It also was observed that the setpoints established for these alarms are not in the rules of Safety Instructions. The stroke time is measured, however, during outages, but it is not used for trend analyses.

(1) **Recommendation:** With respect to the surveillance tests of the availability of containment isolation valves, the stroking time limits should be analyzed and consideration given to establishing one limit as the acceptance criteria to avoid inconsistencies and misinterpretation of the technical and safety acceptance criteria. The stroke time should also be used to trend performance and identify potential failures.

Plant response: *(June 1995) The stroke time of each containment isolation valve is measured during each outage. A single stroke time criterion has been defined for each actuator. This test is performed in cold and depressurized conditions. Starting with the outages performed in 1995, the engineering test coordinator systematically does a trend analysis of the test report stroke time results. During power operation, proper valve operation is checked every 2 months by ensuring that the alarm ``Operating time too long'' is not actuated. This type of alarm is adjusted at 20% above the criterion determined for the surveillance test performed during an outage. This 20% margin takes the differences in test conditions into account - namely cold and depressurized conditions during an outage and hot and pressurized under power conditions. Because of the behaviour of certain actuators during these various surveillance tests, margins higher than 20% had to be taken into account. This anomaly is currently being investigated at the corporate level.*

IAEA comment on status: (June 1995) Investigation by the plant indicated that, for testing during outages, different closing time criteria existed in maintenance *and technical section documents, however the stroke time which was acceptable to the operations department was always that which was required by the safety analysis. These times have now been resolved into a single criterion and recorded in plant documentation which was examined and found to be satisfactory. Since the rending of valve closure times during outages has only started this year, there are as yet no trends available for review, but the process for developing trends is in place. The remaining issue Concerns the on line testing of these containment isolating valves at power. The setting of the alarm "operating time too long" is normally set at 20% higher than the shutdown allowable operating time due to differences in the operating environment. In some cases it is set higher, due to the fact that some valves are unable to meet this 20% figure. This problem has been analyzed and it has been determined to be satisfactory. New settings have been established which are not progressively changed if valve closure time deteriorates. Some of the initial answers received from plant personnel to explain this situation included: a desire to prevent the alarm coming in too frequently, and the official test was the shutdown test and the on power test only tested the logic train. It is suggested that these ways of thinking about an issue be reviewed to fine tune the safety culture of the plant personnel concerned.*

Conclusion: *Issue resolved.*

Temporary procedures can be requested by any department, but the request has to be endorsed by the Tagging Supervisor, Control Room Operator or Shift Supervisor and should be approved by the Operations Manager. A procedure in the periodic test programme requires that the Control Room Operator confirm every two months that these procedures are still needed.

Cattenom NPP, as well as some other EDF NPPs has implemented the 'control by state approach' emergency procedures. These procedures use the same basic concept as the symptom-based procedures applied in many NPPs in the world. The aspects that make these procedures outstanding are:

- The use of a reduced number of procedures. The Reactor Operator and the Shift Supervisor use a total of seven procedures, the secondary plant control room operator uses two procedures, and the Safety Engineer (the Operation Manager, upon his arrival) uses one procedure. The procedures are in a flow chart format, that permits the inclusion of several loops of verification.

- A colour code is used in the flow chart to indicate, for example, when there is a need to confirm or to have confirmed an action or status. The sequence of actions that are made to confirm a certain status (e.g. subcriticality, subcooling) is always presented in a coloured rectangle with a legend indicating the status to be confirmed.

- Each shift post has its own procedure (each post has a related procedure Colour). With this criteria the secondary plant control room operator had his procedures reduced to two procedures. This helps him to have clearer objectives during emergencies.

- The Safety Engineer makes an overall check of the reactor status. These procedure are the result of a great effort from the corporate to take human factors into consideration and give to the operators a sophisticated and improved user-friendly guide during an emergency.

(a) **Good performance:** In Cattenom, the control room alarms are prioritized based on their relationship with a safety state, and highlighted by using a special sign in the alarm windows. The way they are linked with the alarm sheets, abnormal and emergency procedures (through two procedures: Logic Initial Orientation and Status Validation Diagnosis) causes an analysis to be performed of all the related safety functions, as well as actions needed to preserve this function. The procedure structure is user-friendly, with the same codes as the emergency procedures.

Control room alarms related to a safety state are highlighted by a red border. For each alarm there is an alarm sheet and a procedure which must be followed. A well established sequence of evaluations and diagnosis ensures that all safety related functions are checked and that the correct abnormal or emergency procedure to be followed is validated.

3.4 Operating History

Cattenom NPP Unit 1 was commissioned in 1986, Unit 2 in 1987, Unit 3 in 1990 and Unit 4 in 1991. The average plant availability during the last year is 75.6% in spite of an alternator failure which immobilized Unit 1 for nearly six months.

The number of scrams per year and per unit has averaged 2.3 since the commissioning of the units. It was observed that in the last two years these values decreased to 1.5.

Beginning in April 1994, the abnormal events occurring at Cattenom have been classified on the International Nuclear Event Scale (INES). Prior to that date they were classified according to a national event scale. France has 56 nuclear power plant units: Ranking the abnormal events of these plants according to INES adds significant data, provides a better international indication of the plant performance and allows the establishment of improved indicators of plant performance.

In a letter to EDF dated 1982, the regulatory safety authority required reporting and in depth analysis of significant incidents defined according to ten criteria. EDF/Cattenom has developed a strong experience feedback programme, in which each event is analyzed on site and reported to the Corporate Resources Department and to the regulatory safety authority. If an event is considered to be a significant incident according to one of the criteria set by the regulatory safety authority and detailed in Directive 019, *Equipment and Operations Significant Events*, a deeper analysis is carried out by the Corporate Operations Department together with the site. This analysis considers human factors, determines root causes and proposes possible improvements in safety thus providing experience feedback to the sites.

(a) **Good performance:** The experience feedback programme at Electricité de France/Cattenom identifies the significant incidents, develops a comprehensive analysis process supported by administrative procedures, and as a result a final report is issued with recommendations to enhance training, design changes and procedure modifications. The plant personnel are committed to this experience feedback programme, which has contributed to improved NPP performance.

The primary and secondary heat exchangers performance is monitored by the Technical Inspection Department; monthly reports are sent to the Operations Department. The Technical Inspection Department, with the support of the corporate organization is developing a computerized performance monitoring system, mainly for the secondary heat exchangers, that was tested last year in Unit 1.

3.5 Conduct of Operation

The control room is well equipped, including furniture and panels that establishes a professional atmosphere. The alarms are displayed in windows and screens in four different colours: 'red' for defects requiring immediate action; 'yellow' for defects that do not require immediate action; 'green' indicating an automatic protection in progress; 'blue' for information during surveillance tests, and 'white' indicating a change of status of the equipment. These colours of alarms assist the operators in analysis.

Shift turnovers are carried out in a professional manner. Following this turnover, an incoming shift team meeting is held in the control room by the Shift Supervisor to verify and complete the information exchange and to validate the shift objectives.

The shift log books, planning and alignment files are filled out correctly. The operator's and the shift supervisor's logbooks include daily updates of technical specification related unavailabilities.

During outages, the operators of each shift verify availability of equipment required for safety by applying the surveillance procedure relating to the reactor conditions. The Operations Manager also ensures availabilities of this equipment by a second verification using a status board that lists the required equipment for the existing reactor conditions.

Before going into other reactor conditions, the availability of equipment that will be required is verified. The Outage Safety Committee verifies that the plant is ready to be taken over by the Operations Department by ensuring that all tasks performed by each participant are completed.

(a) **Good performance:** During the outage the operators and the Operations Manager verify the availability of equipment required for safety on each shift. The frequency and redundancy of the verifications of availability of safety required equipments ensure an adequate margin of safety is maintained.

The general plant material condition and cleanness is at of a high standard. Unit 4, which has been in outage for refuelling since last February, has maintained an impressive housekeeping condition, highlighting the commitment of management and field workers in this area. As a consequence, the working environment in all areas is highly professional and the work can be performed in a controlled manner. However, few deficiencies were noticed as listed later.

Field inspections are organized in such a way that all zones and buildings are visited once a day. The unit is divided in different zones. Each zone is divided into different field inspections for different shifts so that complete coverage of the unit is provided. The field activity is supported by a computerized system (SERVIR), which incorporates minimum and maximum values and is very effective for trending of data. The SERVIR is not connected with the plant network, but this connection is planned in the near future.

(b) **Good performance:** The computerized system (SERVIR) is an effective tool to record data, support field operator activity and trend data when analyzing equipment performance and equipment failures (eg. running time of equipment for preventive maintenance Purposes). Each time an operator inputs a value for a parameter that has changed since the last reading, the computer asks the new value to be confirmed, and an explanation for this change can be added by the operator. At the end of a round, when the operator loads all of the collected information into the main computer, a report is issued with the seven last readings of each parameter, and a list of all parameters that were out of predetermined limits.

During the field operator walkdown in the turbine hall of Unit 2, several deficiencies were noticed that were exceptions to the normal standards. They included.

- A significant number of unauthorized handwritten labels on pipes and equipment
- Turbine oil leaks on cable trays and the floor
- Lighting deficiencies in some areas

- Cleanness improvements needed in some areas

- Some small steam/water leaks were not identified or directed to drains and some rain leakage

- Two temporary modifications were not properly documented.

During the field operator walkdown in the controlled area of Unit 3 and 4, a high level of housekeeping and material conditions was observed, nevertheless on Unit 3, some deficiencies were noted in areas such as lighting, cleanness, defect identification and temporary modifications.

(1) **Suggestion:** Consideration should be given to instructing the field operators to enforce existing instructions regarding housekeeping, identification of deficiencies, and documentation of temporary modifications, and so conduct a more effective field inspection. This initiative should enhance the timely identification and correction of deficiencies.

Plant response: *(June 1995) We have reminded our operators of the importance of using the existing means which aim to improve their questioning attitude as owners of plant equipment, through identification of deficiencies in the areas of housekeeping, malfunctions and temporary modifications. Furthermore, there is a periodic check of site material condition to ensure that this is satisfactory. The following aspects are checked:*

- *state of cleanliness*
- *temporary labels and the correctness of permanent labels*
- *implementation of leak-off recovery devices*
- *signaling local deficiencies which require work*
- *labeling of temporary modifications.*

These checks are carried out by operating teams with the participation of management to remind field operators of the need to comply with existing instructions.

IAEA comment on status: *The required standards of housekeeping are specified in cleaning contracts. Regular checks of site material conditions have been implemented since April 1995. The system has been set up as part of the surveillance system and is therefore formalized in plant documentation. The teams that carries out the verification includes a manager and a field operator. The results of the checks are recorded on the record sheets of each procedure. The work required to correct the observed deficiencies are either written into one of four log books (cleaning, lighting, door fittings and general) or a work order is raised if safety in carrying out the work is an issue. A new position of rapid response housekeeping foreman has been created who has the staff and resources* *necessary to promptly deal with routine housekeeping issues. Through this and other systematic plant tours it is intended to progressively increase the standards with respect to housekeeping , deficiency identification and documentation of temporary modifications. [Control of temporary modifications is also discussed in 3.6 (1), 3.6 (2) and 3.6 (3)]. Identification of deficiencies was also checked by identifying three defects at random and tracing them through the SYGMA system to ensure they were correctly identified. It was also noted that all of these defects were labelled with a defect identification tag on the equipment. The defects were a leaking pump gland on condenser tube cleaning equipment, a rotameter on a boiler feed pump cooling water line and a leaking flange on a boiler feedpump. A field operator was questioned about his responsibilities for defect identification and he clearly understood his responsibilities. It was confirmed that the tours by management personnel check for defects and confirm their existence in the SYGMA system. This system appears to have the elements necessary to raise standards but it is too early to see the effects. Continued efforts will be required*

Conclusion: *Satisfactory progress to date.*

3.6 Work Authorizations

Work control in Cattenom NPP is done by a computerized system, with one programme managing work orders and a second programme handling work authorizations. From the work request initiation to the approval of a work order, no paperwork is needed. A well established system of personnel codes for approvals on the computer, allows a work request to be reported and approved and a work permit to be planned and approved using the SYGMA programme.

In each shift there is a Tagging Supervisor, who is responsible for work control during that shift. The Tagging Supervisor undergoes a comprehensive training and qualification programme. This post on shift highlights the importance that Cattenom management gives to the work control system, and the effort that has been made to make it comprehensive and reliable. The tagging system specifically links the authorizations for fire hazard permits, access to the reactor building and containment annulus and radiation protection test permits.

(a) **Good performance:** The Tagging Supervisor is one of the members of the shift teams in each unit of Cattenom NPP. The training and qualification required for this position is such that most of the technicians in this position were experienced control room operators. The Tagging Supervisor is required to issue and control the plant tagging and work permits.A specific office is located near the main control room where computer terminals, printers and a well organized file serve as tools for accomplishing these responsibilities. This post on shift, filled by a highly qualified person, highlights the importance given by the plant management to the Work Control System, and the efforts taken to make it comprehensive and reliable.

An administrative equipment isolation policy is established in Cattenom NPP to ensure that operating safety related components are in their right position according to the status of the unit. Compliance with this policy ensures that the safety system availability requirements are met to protect the nuclear safety functions (safeguard, containment and reactivity). These safety components are divided by criteria of risks (eg. primary dilution and containment integrity), and receive specific tags. The administrative system is periodically checked by supervisors and the actual position of the components is verified following a surveillance test.

(b) **Good performance:** The safety-related component administrative tagging in Cattenom, in the administrative control and in the tagging, indicates the group of risk analysis for each component and the required operating position. The system identifies the risk analysis and makes the operations staff relate the operating status of each component to the safety function it is designed to accomplish. The system is submitted to a comprehensive periodical surveillance. The correct implementation of this procedure ensures that operating safety related components are in their right position in order to comply with safety system availability requirements to protect the nuclear safety functions.

A weekly schedule meeting is held between the Operations and Maintenance Departments, the Site Technical Support Group and the Joint Modification Structure. During this meeting, all activities to be carried out during the following week by the operating unit are reviewed and the schedule is established. The schedule, which includes the periodic tests to be carried out, the work orders and modifications scheduled, and safety unavailabilities, is approved by the Operations Manager.

For Units 1/2, the surveillance tests are scheduled with aid of a computer system that ensures that tests are conducted at the specified frequency. Installation of this computerized system is in progress in Units 3/4.

All the temporary modifications installed in Cattenom are classified as mechanical and electrical, and the normal plant computerized tagging system is used to identify the modifications. Several deficiencies were noted in the administrative control of temporary modifications. Two temporary electrical installations were made last January without an approval signature on the temporary modification documentation. Also, an I & C installation was carried out without the required verifier signature and several documents were not identified whether they were safety or not safety related, which would determine the correct level for approval.

(1) **Recommendation:** Actions should be taken to better control the temporary installations in the plant. The rigourous control of temporary modifications will help ensure that safety margins are not reduced. Actions to be considered include:

- Establishing a strict quality control on the documentation generated to proceed with a temporary modification.

- Training plant staff (operations, maintenance and technical support) on the temporary modification process.

- Requiring field operators to check that temporary installations are in accordance with the approved procedure.

Plant response: *(June 1995) The on-shift operations manager performs a quality control check of the documents generated in connection with any temporary modification (risk analysis sheet).*

2. *Basic safety and quality training (FBSQ in French) and refresher courses in this area include a training session in management of temporary modifications. Shift teams are systematically reminded of this organization during pre-outage presentations.*

3. *Besides the quality check performed by the on-shift operations shift manager and the training courses on temporary modifications, formal periodic checks ensure that temporary modifications have been implemented in accordance with the approved procedure.*

IAEA comment on status: *(June 1995) As a consequence of this recommendation, EDF carried out a fundamental study of how temporary installations are controlled and carried out at the plant and found that the process was confusing and not well understood by plant staff. This led to a complete overhaul of the process and has resulted in a clearer more rigorous system, which has only recently been introduced. A review will be carried out on each unit to ensure that all temporary modifications are identified and included in the new control system. To date Units 2 and 4 are complete, Unit 1 is in progress and Unit 3 will be completed in July 1995. All staff who interface with this system received initial training from their supervisors when this system was introduced. Further training is carried out in Preparation for specific outages and formalized training is included as part of Part of the initial and continuing training programme. A field operator was questioned to determine his knowledge of the new system and his responsibility to check conformance of temporary installations with the new system in the field. He demonstrated a good understanding. A request for a temporary installation was observed in preparation and was found to be satisfactory. Every two months a check is carried out to ensure that the approval process for temporary installations is correctly carded out. The result of this check indicated no errors on units where the system was fully in service. Completion of the introduction of this system to all units and completion of the training will fully resolve this issue. It is noted that EDF intends to make other sites aware of this system sites after satisfactory introduction at Cattenom.*

Conclusion: *Satisfactory progress to date.*

The administrative procedure for temporary modifications is being reviewed and will include two basic amendments: the identification of risks concerning safety, availability and industrial safety: and a modification will not be considered as a temporary modification if the risk analysis indicates that there are no concerns related to safety, availability and industrial safety.

Although the process for temporary modifications is generally 'Comprehensive and reliable, two items were identified as needing further analyses and improvements. These are: the inconsistency in actions that the Tagging Supervisor is allowed to take with respect to installation of electrical jumpers and the modification of settings compared to mechanical modifications; and the absence of written criteria for applying results of risk analyses in determining whether or not a modification should be treated as a temporary modification.

(2) **Recommendation:** The administrative procedure on the temporary modification approval process and form should be assessed and improved. The assessment should determine whether the present revision which delegates the electrical temporary modifications approval to the Shift Supervisor or Tagging Supervisor, thus giving to these installations an unjustified lower importance should continue or whether all temporary modifications, mechanical and electrical must be approved by the Operations Manager.

Plant response: *(June 1995) Henceforth, the on-shift operations manager has to approve the risk analysis done prior to implementation of a temporary modification.*

IAEA comment on status: *(June 1995) As a consequence of this recommendation, EDF carried out a fundamental study of how temporary installations are carried out at the plant and found that the process was confusing and not well understood by plant staff. This resulted in a complete overhaul of the process and has resulted in a clearer more rigorous system. (See IAEA comments on the status of recommendation 3.6 (1) for more detail.) Part of this upgrade is a clarification of the approval process carried out by the Operations Shift Manager. The requirement now is that he/she must approve all temporary installations including the need for a risk analysis and its conclusion. This is required whether or not the temporary installation is safety related.*

Conclusion: Issue resolved

(3) **Recommendation:** A written criteria to support the decision of whether a temporary modification is or is not related to nuclear safety, availability and industrial safety should be established in the administrative procedures. This criteria should be documented and sufficient guidance should be provided to ensure an accurate assessment of the modifications. Clear assessment and documentation of risks prior to the implementation of temporary modifications would minimize the potential for errors and therefore safety would be enhanced.

Plant response: *(June 1995) For a better quality of analysis concerning the implementation of temporary modifications, a guide has been prepared: this guide takes all safety aspects into consideration (i.e. impact on safety functions), as well as availability and industrial safety. This guide is used in association with a check-list of key points appended to each risk analysis.*

IAEA comment on status: *(June 1995) As a consequence of this recommendation, EDF carried out a fundamental study of how temporary installations are carried out at the plant and found that the process was confusing and not well understood by plant staff. This resulted in a complete overhaul of the process and has resulted in a clearer more rigorous system. (See IAEA comments on the status of recommendation 3.6 (1) for more detail.) This new system was confirmed to contain criteria to enable a clear decision on whether the temporary installation is related to nuclear safety, availability and industrial safety. Additionally, risk analysis must be documented and approved by the Shift Manager prior to installation.*

Conclusion: *Issue resolved.*

3.7 Accident Management

The emergency procedures for Cattenom NPP are well organized, providing to each shift post a specific 'control by state approach' procedure. Administrative procedures clearly define responsibilities, and strong support is established by a network of teams involving local level, corporate, safety authorities, and plant designer. All of the teams have specific responsibilities and clear lines of communication.

Based on risk analyses and beyond design basis accident investigations, procedures and installations have been developed at corporate and plant levels to cope with a series of events such as unavailability of diesel generators, loss of safety injection pump and containment spray pumps. All the alternative equipment for these events are well documented. A procedure specifies their storage and operational location, main objectives, basic specifications, as well as surveillance and emergency procedures that would require the alternate equipment installation and operation.

(a) **Good practice:** EDF and Cattenom NPP have developed a group of facilities to support the plant beyond design basis accident, which resulted from risk analyses and beyond design basis accident investigations. Alternatives to diesel generators, safety injection pump, containment spray pump, and maketip pump to the auxiliary feedwater tank are some of the alternative equipments that are either on site or at an accessible nearby location. A procedure lists all these alternative facilities, and gives the main purpose, specifications, related surveillance and operating procedures, storage and installation locations. The equipment on site is well maintained. As a result, the plant is able to cope with some severe accidents that were not considered in the original design.

The controlled access system in Cattenom uses the personnel magnetic code card, which unlocks the turnstiles to access and exit the main areas of the site. It was observed that the system failed numerous times, delaying the access or exit of personnel. An interphone system located close to the access or exit is easily reached and the security personnel rapidly give the access or exit. This system does not significantly disturb the personnel transit during normal operation of the plant. In the event of an emergency when fast action or even partial evacuation could be needed, a procedure exists to unlock the turnstiles to permit the evacuation of personnel.

The operation staff participates in drills and simulator training and have an effective basic training on emergency plans. A programme for classroom training on a regular basis has been established in 1994.

3.8 Fire Protection Programme

The goals of the national policy of fire protection developed by EDF are to protect personnel, to guarantee that safety functions are operating, and to limit the cause of long unavailabilities. A new national fire protection action plan is being implemented to update the policy. The policy requirements of fire protection are correctly followed in Cattenom.

Each unit of plant is divided into fire zones. The fire fighting systems are manually operated from the control room, such as fire fighting pumps, sprinklers, and from local cabinets for isolation of fire zones. One alarm monitoring system is located in the control room of each unit and consolidates the alarms given by first memory cabinets installed at the various building entrances.

The control room operators are responsible for alarm monitoring. When an alarm is activated, the field operator is sent to check the origin of the alarm and informs the control room operator of this assessment. The Shift Supervisor has overall responsibility for operations in the control room. The Tagging Supervisor is the head of support and is responsible for conducting fire fighting in the field and leads a shift crew (four field operators) that provides the immediate fire protection actions. The Tagging Supervisor also co-ordinates the municipal fire brigade. The fire brigade is located in the town of Thionville 6 km. from the plant and is called by the control room operator with direct line communication.

In the fire protection centre, a computerized system manages the required resources and can automatically establish communication with other brigades to obtain support. When the outside support is called, site security staff guide the civil emergency services to the affected plant unit and unlock access doors.

Four common drills of the plant and the Thionville fire brigade are carried out each year. In addition, each shift team carries out a drill once a year based on fire fighting action sheets (FAI). The fire fighting training for each shift team comprises a day on-site with drills using the fire truck and a week in the corporate training centre at La Roche Bernard. The other employees of the department receive one day of training on-site. A day of refresher training is carried out once a year for the entire department staff and for the shift team a refresher training is conducted each third year.

4. MAINTENANCE

The maintenance activities at Cattenom NPP are performed by several departments in the plant, and are based on co-operation between the Twin Unit Groups and the Site Technical Support Group to achieve the common goals and objectives of the maintenance programme during operation and outages. The responsibilities of the various departments and maintenance staff are carried out by qualified personnel.

The plant is well supported by the EDF corporate organization, which provides a national maintenance policy and strategy. Maintenance experience feedback to EDF is clearly defined and effectively implemented.

The maintenance programme covers the functions and tasks necessary to ensure high quality, plant safety and availability. Plant operation and management policies influence the contribution of the maintenance staff to safety. In this regard, the Quality Safety Plan, the Maintenance Committee, work co-ordination meetings and detailed work procedures are examples of activities and programmes that enhance safety culture. In addition, the quality plan risk analyses of the planned work at the component level further promotes safety culture. Preventive and predictive maintenance programmes are well established and use a comprehensive computerized maintenance management system. Maintenance managers systematically check work reports, outage summaries and event reports to ensure that the maintenance programme is carried out effectively. The use of maintenance performance indicators is a good tool for objective assessment and improvement of the work activities.

The overall condition of plant equipment and systems is generally very good, but some suggestions for improvement were offered during plant tours. More time should be spent by managers touring the plant where they might detect deficiencies like the improper storage of welding rods. Storage areas, workshops and document archives were found to be in good order and provide good retrievability. The in-service inspection (ISI) programme is well organized and inspections are rigorously performed by qualified personnel. However, a concern was raised relating to the improper storage of flammable records. The outage planning process, outage programme implementation and outage follow-up are very well managed. The pride of the staff is evident and reflected by the equipment and working conditions. These in turn reflect a well managed maintenance operation and a strong safety culture.

There were three issues in the maintenance area, two of which were resolved and one which has made satisfactory progress.

The issue which made satisfactory progress concerned the improvement in the storage of in-service inspection records to give them better protection against fire and water damage. The final solution is to store them in a controlled environment in the *basement of the new administration building. Special care will be needed to protect them against flooding particularly, since many of the records are not duplicated.*

A suggestion was made that more cooperation take place between sites in the process of updating procedures and that SYGMA be used for this process. Cattenom explained their process, which uses other communication methods to achieve the same result. They include regular meetings between maintenance experts at different sites and meetings of maintenance managers. This issue is now resolved.

The final issue concerned the need to improve storage for welding wire. This is another example where Cattenom went beyond the requirements of the suggestion and improved their whole Process for controlling contractor welding, including new training courses for personnel involved in supervising welding.

4.1 Organization and Functions

The Cattenom operating organization is composed of two twin unit groups (TUG), Units 1 and 2 (Cl/2) and Units 3 and 4 (C3/4). The two TUGs operate under the direction of the plant director, who acts as the owner of the two TUGs. The managers of the TUGs are responsible for the availability and safety of the unit facilities and decide on the maintenance activities to be carried out. They are also responsible for the maintenance budgets. The TUGs use on a contractual basis the Technical Support Group (SUT), which is located on the Cattenom premises and is headed by the SUT manager. The SUT has responsibility for the maintenance activities of electrical, mechanical equipment, valves, piping and welding during normal operation and outages of all units and acts as a prime contractor as delegated by the two TUG's. The TUG maintenance department is responsible for all the maintenance activities for the 1 & C equipment both in operations and outages. The Joint Modification and Works Organization (SCORE), a civil engineering group, is responsible for maintaining the buildings and all the other civil engineering structures and for modifications.

The EDF Generation and Transmission Division Nuclear Power Plant Operations, provides site maintenance with the national maintenance policy, strategy, personnel and material resources that are necessary to conduct the maintenance programmes. Additional services include technical advice and support such as the performance of in-depth analyses and reviews of significant incidents. anomalies and non-conformities; operating experience feedback and direct site support such the Site Engineering Groups. The principles employed in organizing maintenance at Cattenom are laid down by the EDF Corporate Technical Support Department (UTO). Local services in the maintenance area are supported by EDF national services and by work performed by local and/or national contractors.

(a) **Good performance:** EDF has recently introduced a policy to include more predictive maintenance. The aims are to reduce both corrective and preventive maintenance to minimize unavailability due to corrective maintenance and to reduce personnel radiation doses. To support this approach Cattenom introduced the concept of Site Engineering Groups. They are staffed by members of the twin-unit groups (TUG), the site technical support group (SUT), the Safety and Quality Team (MSQ) plus special engineers. The groups operate on a project basis and bring high technical competence to the site. The site engineering group adds value through a quick and thorough assessment of anomalies and events/incidents by use of root-cause methodology and comparison to design intent and lifetime operation of equipment. This change brings the advantage of single-unit utility, (activities taking place locally with direct and short communication paths), without losing the advantage of EDF's large, standardized nuclear programme (3 basic designs with the accumulation of valuable experience on a statistically founded basis).

Cattenom has recognized the importance of maintenance in regard to safety. They have adopted the strong headquarters policy *Choice of maintenance, EDF corporate policy*' and many of the policy issues are already implemented at the site in work procedures. The material presented during the review by many different individuals and the way the personnel involvement was reflected, indicates that safety consciousness is high in the maintenance area.

With respect to maintenance quality, Cattenom operates under the guide for risk analysis - *Quality Safety Approach, May 1993 Revision 1*. In this guide, experience feedback (REX) is identified as an important cornerstone on which the plant should develop practical methods to enhance nuclear safety, quality and productivity. One method that has been implemented involves the conducting of risk assessments before work is carried out.

(a) **Good performance:** A programme has been established to incorporate quality and safety policies into a plant specific structured methodology. The programme has been implemented on a pilot basis in the area of I and C and for selected mechanical safety related (IPS) equipment. The work to be done in these areas is first analysed by the method of risk assessment using a checklist approach. The list contains safety significant questions which have to be considered. If the questions are determined to be applicable, special precautionary measures must be taken that are listed on the evaluation sheet. The benefits from this process include the process of developing the evaluation sheets, a careful consideration of the risks by the workers involved, the application of appropriate precautionary measures, a resulting reduction in errors, and experience feedback of the programme benefits to other members of the NPP staff. For steam generator safety relief valves, primary pumps and steam generator loop closures, the analyses have been approved and applied, thus reducing the risk on equipment where common cause failures are important. Other IPS equipment is scheduled and is being reviewed.

The memo *Quality-Safety for maintenance interventions under quality control*, which is distributed to all Cattenom personnel, demonstrates that managers fully support the actions needed to reach and maintain a high level of quality and safety in Cattenom.

4.2 Maintenance Facilities and Equipment

The cold and hot workshops at Cattenom are operated by the SUT. They are sufficiently large and properly equipped to perform the necessary maintenance work. Equipment such as valves, small pumps or parts are stored in the workshop before refurbishment or repair. The equipment is identified with its repair sheet, and after repair, is put back into the warehouse.

The history of the component or part is documented in a computerized parts-history file. For specialized work the SUT can also use EDF, manufacturers' or contractors' workshops. The buildings in the uncontrolled areas are large enough to install suitable work places on a temporary basis. The tools to support all the maintenance work on the site allow workers to perform work to a high quality. Suitable hoists and cranes are available to lift and transport heavy items; there are built-in features where hoists may be mounted,

The SUT also operates a hot workshop outside of the controlled area that is used by all four units. The same building has decontamination facilities, a steam generator mock-up for training, and space to maintain and store the special tools used in the four units. In addition, each unit has a small hot workshop. Sufficient work space is allocated when setting up temporary work places in the controlled area. Some areas are equipped with local air filtration to control contamination, and the ALARA principle is fully respected.

Workshop facilities are available for refurbishing and calibration of I & C equipment. Specialized calibration and repair of electronic cards are subcontracted to the original vendor.

In addition to the normal standard tools for conventional work on electro-mechanical equipment, many special support devices and tools are used to reduce individual and collective radiation exposures. Examples of this special equipment are the steam generator manhole stud tensioners and the RPV stud tensioner. All units have a tool room in the controlled area where standard equipment is issued. tools administration is well controlled.

Highly specialized tools such as steam generator eddy-current and ultrasonic inspection tools are obtained from the EDF/national contractors pool. A feature of the Cattenom policy is to have at least two contractors, who can supply special tools and perform inspection work. The reactor pressure vessel tools are standardized.

Cattenom is linked to the Corporate. Technical Support Department (UTO) for special tool development. Out of the experience feedback from the NPPs, UTO extracts the need for special tools and initiates programmes in this area. Workers at Cattenom who believe that special tools in their area are beneficial can start the process by issuing a work request (DI). This process assures that workers' initiatives are considered, thereby promoting personnel motivation.

4.3 Maintenance Programmes

It is the responsibility of TUG, SUT and SCORE to propose maintenance programmes that ensure that a minimum of corrective maintenance is necessary during normal operation and that the safety margins are met per the technical specifications. The lead in the I & C work is taken by the TUG's (C1/2 and C3/4) and the SUT for all the rest. The programmes are based on suggested maintenance work from suppliers, work requested by authorities according to French regulation and experience from Cattenom NPP and from similar plants in EDF.

Fuel cycle maintenance programmes are prepared for each unit. It is the plant owner's (C1/2 and C 3/4) responsibility to review and verify the programmes and sign a contract with SUT (for general maintenance) or with its own services (for I&C), who then prepare programme details such as resources and material planning and scheduling of the job orders.

Planning takes accounts of the risk to the plant while performing the work. The level of in depth analysis is in accordance with the safety significance of the work. The programmes include the analysis of the job orders to demonstrate the effectiveness of the maintenance programmes. Cattenom uses maintenance performance indicators to optimize their programmes which are part of contract between owner, SUT and TUG (for I & C) as mentioned above.

(a) **Good performance:** The use of maintenance performance indicators (PI) allows Cattenom to optimize the programmes of preventive and predictive maintenance and thereby, to reduce the total maintenance activity. The goal is to lower the proportion of preventive maintenance, based on the results of predictive maintenance. Corrective maintenance is also reduced for equipment where it can be shown that it will reach its end-of-life without compromising safety. Preventive maintenance is optimized based on analyses of the safety consequences of not carrying out the maintenance. In making decisions, factors such as results of previous inspections, effect of possible high radiation doses and the risk of malfunction after assembly, are taken into account. Confirmation of adequate functioning in most cases can be assured by predictive maintenance. The collection of data for calculation of PIs is well advanced at Cattenom and in some areas the data is used as a basis for management decisions to reduce corrective maintenance, radioactive doses and costs. The introduction of the predictive maintenance is to be followed by indicators in relation to investments in predictive maintenance means (tools, software, personnel and training to analyze this maintenance activity and to verify the efficiency of the process).

The preventive maintenance (PM) programme consists of a large number of individual PM jobs (IPs). The source information for the IPs comes from vendors' recommendations and EDF's national experience feedback programme (REX). Every IP is a preventive job and Cattenom uses the PM system (PRV) module from the SYGMA computer system to manage the programme.

Daily and weekly programmes can be extracted from the programme and the job released for execution. The programme allows the planning of the resources and work loads together with other work in the plant. Changes in the programme due to REX are easily integrated into the system, particularly changes of time interval of IPs. The PM programmes once negotiated with the owner are re-negotiated periodically to incorporate changes.

Predictive maintenance is a programme to predict failures and allow repairs to be completed at an optimum time that avoids losing the availability of the safety equipment during operation. Sources of information to determine the condition of the equipment rely on the monitoring of process parameters such as pressure, temperature flow, vibration, chemical parameters, stroke times of valves, electrical consumption of motors, oil-condition, thermographic and infra-red, for comparison against a baseline. Deviations from the base line are analysed to predict the condition, (i.e. the degree of degradation) of the equipment and to judge whether maintenance is necessary. Cattenom. is well advanced in the implementing of the programme and collects data in the above mentioned areas for systematic analysis and intervention planning. Once the need for maintenance is decided, the planning of the job file is handled by the standard procedure laid down by SYGMA. The results of maintenance are compared with the predicted condition and the information is filed.

Upon detection of a deficiency anywhere in the plant, any Cattenom staff member can open a work request (DI) and report the observations made. Dedicated persons can then check and approve the DI for being processed into a work order (OI). Rejected work requests are returned to the person who initiated the request with the reason for rejection. It is then the duty of the initiator to delete the work request in SYGMA, thereby accepting the reason for rejection. This process shows the dedication of EDF to safety culture and the respect given to these individuals who had taken the time to file an observation which they judged to be of concern. This process has proven effective in using workers' ideas in developing special tools to improve work performance in their area.

Approved work requests are processed into work orders. Priority of the work is primarily assessed by the Operations Department which is fully responsible for safety and power production. Urgent cases can be started by calling people from the maintenance group, SUT or TUG. Other cases of less importance are handled and prioritized at the daily meetings. A work order (OI), once in the work order management system, causes the initiation of the preparation of the job file. When it is assured and verified that all the resources are available and scheduled, the maintenance departments release the OI for execution. The work is performed in accordance with the safety tagging procedure and conforms to special precautionary measures. Industrial safety and radiation protection measures for the work are provided and controlled.

The work processes are carefully monitored in accordance with the safety plan. For important IPS activities, a quality safety plan (PQS) is mandatory, including inspection points required by work co-ordinators.

Post-maintenance testing is under the responsibility of the Maintenance Department. After verification of adequacy of the corrective measures taken, the equipment is returned to the owner's responsibility. Depending on the technical specification requirement, an integrated system or a functional test is performed by operations similar to a surveillance test during operation. The OI is completed by performing an analysis and documenting the work in the archive as a 'job history file' closing the work in SYGMA and storing the data in the equipment history file SAPHIR.

4.4 Procedures, Records and Histories

Cattenom NPP has a comprehensive computerized maintenance management system called SYGMA, which is used in all maintenance activities, from work request issuance to work completion. The system works on a simple work order principle, and is applied to corrective as well as preventive and predictive maintenance activities. In all of these activities, work procedures are promptly prepared. Each maintenance procedure (work sheet) is requested in the SYGMA system by an appropriate designation such as the procedure code, the activity description and the revision number. The system is effective and accepted by all the personnel.

It is SUT's and TUG's responsibility to develop and update the maintenance procedures. The work is accompanied by a consequent checking and approval process by the supervisor and department manager, respectively. Approved procedures are sent to the documentation secti6n where any new revision is registered and copied. The updated maintenance procedures are stored in the main archives as well as in the satellite archives. Once the updated procedures are registered within SYGMA, the new procedures are to be used. Although Cattenom improves maintenance procedures for components within the scope of their responsibility on site, there is no co-ordination with other sites.

(1) **Suggestion:** Consideration should be given to having other EDF sites participate in the process of updating procedures. SYGMA can be used to alert other sites of the initiative taken. This could improve the consistency of maintenance procedures for all EDF NPPs and bring procedures into agreement for generic applications.

Plant response: *(June 1995) The SYGMA application includes a feature called "Between site consultation" This feature enables a user to consult data coming from other sites. The structure of a site information system implies organizational choices. This means that SYGMA consultation is limited and cannot be the channel* *for exchange of information between sites. A consistent corporate approach and experience feedback on maintenance methods are made possible using the following*

- *Common reference documents (corporate maintenance policies, basic maintenance programmes, maintenance data sheets, operations and maintenance guides, etc ...).*
- *Committees that meet regularly at the corporate level, made up of specialists for the equipment involved. These committees are privileged sources for exchanging Information and taking experience feedback into account.*
- *In accordance with a corporate instruction, the gradual transition to a single structure for maintenance procedures, and to using standardized computer files (SGML).*

IAEA comment on status: *(June 1995) The process described fulfills the requirement of the suggestion that other sites should participate in the process for updating procedures, alert other sites to initiatives taken, improve consistency and bring procedures into agreement. Additionally the current plant process has safeguards against uncontrolled transfer of information between sites which could have undesirable results. Cattenom considers that this process can be adequately controlled without the use of the SYGMA system.*

Conclusion: *Issue resolved.*

The maintenance records generation starts with the opening of a job file. The job file for safety relevant equipment is the most comprehensive as it contains all the activities required to meet the high standards that are required. When root cause analysis is required by the job request, the maintenance department is obliged to perform the analysis as part of the contract with the owner. Trending of equipment failure is a part of the equipment history.

Two types of equipment history files are generated and maintained which meet the safety standards according to French regulation, paper files in the archives and in the computer module SAPHIR which also links up to the national EDF feedback system. The paper form contains information such as: general data, special studies, monitoring modifications, fault analysis and summaries, operating problem summaries, equipment health report from condition monitoring, and long term and local programmes.

4.5 Conduct and Control of Maintenance Work

When the work order is fully prepared (spare parts, maintenance procedures, human resources for work execution and control), it is released to the Operation Department which carries out and verifies the tagging to ensure worker safety from the plant. Industrial safety, radiation protection and quality assurance are the responsibility of the personnel conducting and monitoring the maintenance work. The work is conducted and controlled in accordance with a planned activity and schedule. The planned activity contains hold points for inspection and verification. If the work has to be modified due to unexpected findings, the new tasks are included in the work plan, which then has to be verified and approved by the person in charge of planning.

The work order documents are used in the field by the workers; as found/as left conditions are written into the documents. The work is monitored in accordance with its importance by supervisors. Progress of work is monitored and fed into SYGMA, and deviations from the plan are discussed in the appropriate routine meetings where corrective actions are taken. Based on the observed cleanliness and tool control, foreign material intrusion in pipes is improbable. In general, the field work areas were well organized and clean, although one deficiency in welding rod control was noted in which stainless steel welding rods for inert gas welding were lying on the welding machine not protected from dust and grease.

(1) **Suggestion:** Consideration should be given to keeping welding rods in containers well protected from dust and grease until they are used. This will ensure both the cleanness of welding material and thereby the quality of work performance.

Plant response: *(June 1995) Contractor companies supply all welding materials necessary for repairs.' Conditions of acceptance, storage and distribution before use comply with specifications mentioned in the Quality Manuals for welding contractors, and with rules stated in the R CCM (Design and Mechanical Construction Rules). For work site storage, coated welding rods are subject to very strict rules stated in the specifications followed by contractors. Ordinary welding rods used in repairs are not subject to specific storage rules if they are provided to contractors' staff.*

Actions launched at Cattenom NPP since the OSART mission

- Besides storage standards regarding coated electrodes mentioned in the CSCT (Manuals on Technical Specifications and Provisions), additional requirements have been added on the storage of welding rods.

- A two-week welding training session is completed by the EDF work organizers and staff who monitor contractors' work.

- On-site welding stations have been fitted with storage containers for welding rods, and additional containers are at the contractors' disposal. Furthermore, portable work site ovens for coated welding rods are also available at the tool warehouse.

IAEA comment on status: *(June 1995) The suggestion was prompted by a field observation that welding wires were not adequately stored at job sites. The plant response has encompassed a broader review of how welding is carried out at the Plant. Since this welding is done by contractors, the contractual documents were reviewed and upgraded to reinforce the importance of welding rod control at the work site. The two week training course for technical supervisors involved in the supervision of welding is a theoretical and practical course coveting many aspects of this subject from the various welding processes used to destructive and non~ destructive testing. This course was started in 1994 and all of the manager and technical supervisors involved in welding supervision will have completed this training by the end of 1996. A field inspection of welding sites indicated that the storage facilities both for coated rods and welding wire are satisfactory. The plant confirmed that their site inspections have not indicated any problem with control of welding materials at the job site in the last twelve months.*

Conclusion: *Issue resolved.*

The heart of the work control is the computerized maintenance management system SYGMA. The base module of the program is a computer mainframe system which is in use in all EDF NPPs. SYGMA includes the key modules for maintenance such as the spare parts file, material and sites database, work request handling and work order management. SYGMA further interacts with stock control and maintenance costs; a computerized tagging system; operator and work management; and equipment history analysis

Only designated personnel (by name and computer signature) are permitted to enter information into the databases and follow-up on work request handling (DI) and work order management (OI) during work preparation and execution. On the other hand, access to obtain information from the system is made available not only to Cattenom personnel, but also to other EDF NPPs.

The coding system for equipment and data identification is such that an unambiguous location is assured for the equipment in the four units, and the spare parts at the site or in national warehouses. Via the same coding and identification system, the necessary supporting base documentation as well as history files and characteristics (e.g. for I & C, valves, rotating machinery, pipes, hangers and supports, heat exchangers) can be found in the archives. All this information is necessary for a thorough job file preparation.

With the modules in SYGMA it is also possible to determine the backlog of the work requests and work order delays for operational reasons. The close interaction of maintenance work and configuration control is facilitated by the integrated computer system. The daily resolution of interface problems takes place during the morning meetings. During these meetings, the prioritization of operational and maintenance tasks is performed and corrective actions are entered in the SYGMA system such that all the parties involved are updated on the schedule and near term work activities. The extra maintenance workload for replanning due to operational reasons is analyzed through use of a performance indicator.

4.6 Material Conditions

With a very few exceptions, the equipment and the plant housekeeping is in a very good condition. The system and component labelling is unambiguous in all four units. When temporary work-places are used for local work, the protective measures (e.g. industrial and radiation protection) are of a high standard. Sufficient lighting and ventilation is provided. These are excellent prerequisites to the performance of high quality work. Upon completion of the work, the workplace area is restored, cleaned and materials (reusable and waste) are returned to their proper storage area. Upon detection of leaks (steam, water, oil, gas), the conditions are assessed and appropriate measures taken. Personnel are encouraged to report and/or eliminate housekeeping deficiencies promptly.

4.7 In-service Inspection

The reference document, *Compendium of rules for monitoring mechanical equipment during operation of nuclear islands* (RSEM), issued by EDF-UTO-GDL, in 1990 is the basis for in-service inspection (ISI). The document awaits the approval of the regulatory safety authority. RSEM makes reference to all the rules required by French regulations. The components at Cattenom are classified in accordance with these rules and monitored by non-destructive test (NDT) methods at periods in accordance with the safety class.

Just prior to and during commissioning of the equipment, baseline measurements were taken, recorded and stored for comparison with new data in following inspection. The areas to inspect, type of inspections and periodicity are defined and negotiated by EDF-GDL with the safety authorities. The approved test programme for each outage is passed to the site Where the work is scheduled and integrated into Artemis (a computer project management tool). Serious conflicts with outage plan and ISI work are re-negotiated with the nuclear safety authority. Test acceptance criteria are approved by the authority.

All NDT methods such as ultrasonic, eddy current, visual, liquid penetrant and gamma radiography are well established at Corporate Chemical and Metallurgical Laboratories (GDL) and qualified for the particular component and location at Cattenom. GDL's responsibility is to provide the qualified resources to the site for the test execution. The co-ordination of maintenance ISI work is the responsibility of the outage team at the site. ISI work is given appropriate attention. The tool and material laboratory at the site is of a high standard and well organized. ISI documentation and records are well structured and stored in an easy retrievable way. The computer supported handling is excellent. A high level of transparency to any user is provided as a result of a systematic methodology. Data collected earlier will be treated, labelled and identified to today's well advanced methods. The method of data storage allows an on site quick review (Level 1). The on-site ISI archives contain original radiographs in cardboard boxes in one room. Ultrasonic and eddy current data on magnetic tapes and disks as well as the paper output from tapes and disks in another room. The rooms are protected by a manually operated fire extinguishing system (water). The room are under surveillance of smoke/fire detectors.

(1) **Suggestion:** Consideration should be given to reviewing the on-site ISI archives and determining whether additional measures should be taken to avoid damaging the cardboard boxes and the ISI paper records if a fire occurs, or by water when trying to extinguish a fire.

Plant response: *(June 1995) Paper archives, magnetic back-up tapes and films have been separated and stored in separate metal cabinets. These cabinets are located in a room complying with national rules (Directive No. 38) concerning risks resulting from fire. With the construction of a new building, an area in the basement will be dedicated to archive storage. A solution will be implemented to allow archives on different media to be stored in different rooms. This new building, to which all corresponding archives will be transferred, will be ready by the end of 1996.*

IAEA comment on status: *(June 1995) The means of storing in-service inspection (ISI) records (on paper, magnetic tape and films) to protect them from damage by fire has been adequately reviewed by EDF. Both the interim storage facility and the final storage location in the administration building basement have facilities to ensure separation of these groups of information in different cabinets in rooms which conform to the requirements of the national rule for fire prevention. Also some of the records are duplicated and stored at the headquarters of EDF. Fire fighting facilities consist of a sprinkler system because CO_2 fire extinguishing methods are not permitted due to personnel hazards.*

The plant has reviewed the potential damage to records which may be caused by using water to fight fires and are satisfied that the records will be adequately protected against losses due to water damage. In response to the potential for flooding in the proposed storage area in the basement of the new building, it was stated that they are 30 metres above the flood plan at the Cattenom site. The plant agreed to review the design of the new building to ensure that flooding of the basement from other causes has been adequately considered and appropriate precautions taken, since many of the records stored items are not duplicated.

Conclusion: *Satisfactory progress to date.*

4.8 Stores and Warehouses

The Corporate UTO has set up a very well established material and spare parts procurement organization for NPP spare parts, which is operated by use of interlinked computer systems. UTO procures all the equipment and parts subject to specifications and some spares not subject to specification, e.g. catalogue parts. The QA requirements for spares and material are negotiated with the authorities. UTO also handles the paperwork and assures documentation control and proper labelling.

QC during manufacturing is carried out by UTO, who operates three large warehouses. The storage facilities are governed by UTO Organization Procedures and Instructions. At any time, UTO is fully informed of the number and storage location of parts in their three warehouses, as well as the warehouses operated at the NPP sites. Preservation and monitoring procedures are handled by UTO. The materials not subject to specifications are purchased by NPP local organizations based on UTO general procedures and instructions. This interlinking of all spare parts and material gives the maximum flexibility and support among NPP sites.

Cattenom NPP places orders for parts and material as described above for immediate use or storage. Administratively the material and its documentation is treated in the same manner as UTO. At the reception point, parts are checked for condition and identification in accordance with the order. For special packaging during storage the warehouse has the necessary material and tools available. Additional information to ensure proper handling in storage is entered into the database. Labels are attached to the materials, that include the information needed to locate all the QC documentation for the material. The QC documentation is also checked and sent to the archives.

The material is then transported to its storage location. The storage location in the warehouse is chosen with the necessary ambient conditions for the material and any hazard (e.g. spray-cans under pressure and other hazardous material are separated from other material). IPS and non IPS material is identified by the difference in labels. The shelf life is properly controlled. Procedures are available for items requiring PM, and PM activities are recorded. Humidity and temperature of the warehouse are recorded and checked. For material highly sensitive to humidity, such as electronic cards, a humidity control inside the package (visible from outside) is provided. Items that were issued for work and are returned, get identical handling. Opened packages are restored prior to further storage. The quantity of stock items available can be determined on a real time basis and the movements of the items are promptly documented. The stores are monitored by a fire alarm system and protected by a sprinkler system.

4.9 Outage Management

Outage planning starts 12 weeks prior to the shutdown. Approximately 40 persons are assigned to the outage team. The team has full responsibility for the outage and includes the Outage Manager and his deputy; .Operations engineers; test engineers; safety engineers (industrial, radiation protection, nuclear regulatory body liaison); maintenance (planners, general services); National Laboratory staff (non destructive tests); purchasing staff (placing orders to contractors); assignment co-ordinators (senior staff members); main equipment suppliers; and SCORE (plant modifications and civil engineering).

The central laboratory of EDF is responsible that NDT work in each outage is performed and meets the requirements of the national nuclear regulatory commission, as well as the French code for pressure containing installations, while respecting long term programmes. Long term agreements have been negotiated with both bodies.

The outage management tool for scheduling and control is a computerized system called Artemis. During the planning of the outage, all the OIs are arranged on Artemis such that the work package can be completed within time, safety and quality standards. During the scheduling of the OIs, the team solves any interface problems.

Work orders from unexecuted corrective maintenance are included in the process. Safety is also covered and the list Safety planning for normal outage, includes the - allowable plant configurations with respect to nuclear safety by ensuring the availability of core cooling water systems, core sub-critical controls and by providing adequate ventilation and light for safe working conditions. The UTO provides information for outage probabilistic safety assessment (PSA) studies that assess safe configurations. The planning and scheduling is performed with a high level of professionalism by the personnel involved, who utilize computerized tools to produce various lists, bar charts and critical path analyses that are essential for controlling the outage.

The organization during the outage execution is the same, as during the planning phase. The outage team executes the work as planned. The responsibilities with respect to individual work requests have been described in previous paragraphs. The outage is controlled by checking the progress of work against the schedule and making necessary corrections.

A work order and job file are opened for unexpected anomalies that are treated in an expeditious way respecting the same quality procedures as other jobs. Complex anomalies are treated in special work meetings. Throughout the outage, components are re-qualified by post-maintenance testing and, upon approval by designated personnel, returned to the owner. Work requests issued as a result of modifications, in-service inspection and preventive maintenance activities are handled the same way. Post-maintenance analysis is performed once the equipment is turned over to the owner and the job is closed as described in earlier paragraphs.

5. TECHNICAL SUPPORT

No single plant department is responsible for all Technical Support activities and in practice always several are involved. They receive considerable assistance and sometimes also direction from the corporate organization. Technical support functions are appropriate in scope, are well documented and are carried out by enthusiastic, knowledgeable and competent management and staff.

The surveillance programme (periodical testing) is extensive, well scheduled and of high quality. The execution of the tests was found professional. Some improvements could be made in procedures to be more user friendly and it is recommended that an approved comprehensive surveillance test procedures document be issued in accordance with the agreement made between the Regulatory Safety Authority and EDF.

The operational experience feedback programme was found to be well structured and implemented at the site. Some good performances and a good practice have been recorded. It has been suggested that the human factor analysis is extended as soon as possible to all events that affect availability.

The plant modification system at corporate and site level is of high quality and modifications as properly controlled. The operation teams, that manage the operating procedures and documents affected by the modifications, were found as a good performance. However, it was suggested that more responsibility be given to the site to control modifications that influence operation and that the Site Engineering Group have a larger involvement in control of the design and adaptation of corporate modifications to local conditions.

The functions of reactor engineering, fuel handling and safety related computer applications were observed to be comprehensive in scope, well documented and well managed.

Technical support area personnel are aware of the significance of safety culture. The organization is adapted to promote and support safety culture and the training, and retraining of personnel contributes to this objective. The individuals are aware of the importance of their work and perform it correctly. Decentralization of the operating experience feedback programme contributes to the safety culture. The publication that includes reports of external events is very popular at the site and contributes to the safety culture awareness of the staff.

In the technical support area there were seven issues comprising one recommendation and six suggestions. Satisfactory progress was made on the recommendation. Three of the suggestions were resolved and three had made satisfactory progress. The first issue concerned the use of charts to explain responsibilities and communication links between organizational units. This issue is resolved.

There were three issues concerning the surveillance programme. The first of which deals with the approval by the regulating authority of changes to General Operating Rules. These changes are made necessary by extension of the surveillance tests to cover more systems and the changes to these tests resulting from site modifications. Cattenom policy is to change the tests as required, prior to approval of the changes to the general operating rules. However, as part of the defence in depth philosophy, it is desirable that the safety authority approves the changes as soon as possible to give added assurance that the changes to the rules are appropriate and have resulted in the necessary surveillance tests. Although there is satisfactory progress to date, it is suggested that EDF and the regulatory authority review the process for approval of change to the General Operating Rules with the objective of reducing the time during which surveillance tests are carried out based on unapproved operating rules.

The second issue in the surveillance area concerns the special identification of surveillance tests which have the highest potential to cause a reactor trip. At present only eight surveillance tests have been identified, based on experience feedback on trips which have occurred during testing on French plants. Although this constitutes satisfactory progress, it is suggested that other tests, which have resulted in near misses, or that by their nature pose a special hazard, should be included.

Trending of key parameters which are measured during surveillance testing is the last issue in this group. A comprehensive programme has been put in place to collect and trend this data and the programme also includes monitoring and trending of vibration readings on rotating equipment. Since it has only just be placed in service it is not possible to evaluate the results. However, satisfactory progress has been made on the resolution of this issue.

Significant progress has- been made in resolving the issue in the area of human factor analysis. The number of staff involved in this analysis has- been increased from one to eight people and human factor analysis of events containing human errors is being effectively carried out.

Improvements were required to be made to the plant modification system. Concerns included the long lime required to produce modifications and the amount of changes required when installing them on site. A site engineering group has- now been created which is empowered to carry out some modifications on non-safety related systems at Cattenom. This group also reviews proposed corporate design changes to ensure compatibility with the site conditions at Cattenom. EDF recognizes the long lime involved to complete changes, but believes that this is necessary, since changes may effect all reactors of one type and must be carefully reviewed and then introduced on a pilot project at one site before introducing the change to other sites.

The final technical support issue concerns EDF's policy of reloading fuel with known minor leaks. During a site presentation on this issue it was a concern of the team that the financial incentives to reloaded leaking fuel were presented prior to the safety *analysis. However, it is noted that the safety analysis is thorough and is backed-up by experimental evidence that these small leaks will not increase to the extent that they will result in significant contamination of the primary circuit. However, many other utilities have decided not to reload leaking fuel, even though similar safety analysis and financial incentives also apply to them. It is noted that EDF will continue to keep in close contact with other utilities on this subject and will pursue further research to guarantee safe operation. It is concluded that there was satisfactory progress in addressing the concern raised by the OSART team who urged EDF to re-evaluate their policy in the light of differences between EDF and other utilities around the world concerning the reloading of leaking fuel.*

5.1 Organization and Functions

Technical support functions reside with different groups and departments at the site such as Twin Unit Group Cl/2 or C3/4, Site Technical Support Group, Site Administrative Support Group and Safety Quality Team; Site Engineering Team; site committees (eg. Safety, Processing and Maintenance); Events Examination Group and different corporate bodies.

The documents that define the organizational structure and present the division of responsibilities between different organizational units in the technical support functions are complicated. Not all are supported by adequate charts. Such charts have been produced for the purpose of explaining to OSART experts the responsibilities of the groups and communication links between them.

(1) **Suggestion:** Consideration should be given to using charts to explain the responsibilities and communication links of organizational units. This would supplement the reference documents that define the responsibilities of groups involved in technical support functions. The use of the se charts would make the documents easier to understand and could enhance performance for personnel involved.

Plant response: *(June 1995) The organization documents for surveillance tests, experience feedback, fuel, modifications and information systems now have flowcharts included describing the responsibilities of the various departments and groups and their interaction.*

IAEA comment on status: *(June 1995) Cattenom concluded that the organizational charts, which were prepared to explain the technical support organization to the OSART team, would fulfill the same purpose for making the plant organizational documentation easier to understand by their own employees. Organization charts have been appended to the five documents which describe the main sub-units in the technical support area. They are surveillance, fuel, modification (local), experience feedback and computer/information systems.*

These charts are well constructed and clearly indicate interactions between each sub-group.

Conclusion: *Issue resolved.*

The responsibilities and authorities for management, supervisors and professional positions are defined in job descriptions. Communication links between the groups at the site and the corporate support organizational units are defined.

The job descriptions of personnel involved in technical support activities are related to the organizational units where the personnel are employed. Required experience, training and retraining also are included in the job descriptions. The specific .requirements for performance of technical support activities-are included. The staff size and resources are sufficient to carry out assigned tasks.

The organizational structure is complicated and so the technical support activities involve many groups and departments at the corporate level and at the site. Site groups from Cl/2 and C3/4 are also involved in the technical support activities. Personnel in the technical support area are aware of their responsibilities and the interfaces between the groups.

Objectives and goals exist for the technical support activities and there is a feedback loop for monitoring the results and influencing management policy.

5.2 Surveillance Programme

Performance of the surveillance test programme involves twin unit group Cl/2 and C3/4 operations, site technical support group, the safety quality team, the site engineering team and a few corporate bodies. Based on interviews with site groups and a review of headquarters support, the structure for performing the surveillance test programme has been found to be satisfactory. The personnel involved in surveillance activities have been found to be suitably qualified and trained. They are aware of the importance of their contributions.

EDF has produced documents for performing the surveillance tests of safety related equipment and systems. The regulatory safety authority had not approved all the documents and therefore, Cattenom NPP has separated them in two files. One file is for approved documents and is a part of the chapter nine of the safety document of the site. The other file includes test procedures of similar importance for safety but is not yet approved.

(1) **Recommendation:** The regulatory safety authority and EDF should reach agreement and issue an approved comprehensive surveillance test procedures document as soon as possible for all safety systems. This will ensure that the current test programme is adequate for checking all necessary functions of systems important to safety.

Plant response: *(June 1995) As part of the startup authorization for Cattenom units, the surveillance test programme laid down in the General Operating Rules includes an overall de facto contract concerning its comprehensiveness and its capacity to check all operational aspects of safety-related systems. In according with the rotes, chapters III and IX of the General Operating Rules and their successive updates are also subject to approval by the Safety Authorities. Since the startup of Cattenom, there have been several updates of all or part of Chapter IX, aiming at:*

- *extending the systems covered by formal surveillance tests,*

- *taking on-site modifications into account if they have a partial impact on any rules already approved.*

Such updates are implemented on a regular basis. Some surveillance test rules ***belonging to both categories*** *mentioned above also have to be sent to the Safety Authorities.*

The Safety Authorities are currently examining and approving these rules. Some 50% of these rules have already been approved, and the Safety Authorities' objective is to have most of them approved (i.e. approximately 80%) before summer 1995. However, we wish to point out that because of the operator's prime responsibility as far as safety is concerned, Cattenom NPP performs surveillance tests to check equipment availability regardless of whether the surveillance test rule has already been approved. At the end of each outage, the operator formally informs the Safety Authorities of this test completion. In conclusion, three points are worth mentioning :

- *Chapter IX at Cattenom Nuclear Power Plant is fully approved and the latest update was submitted to the Safety Authorities in February 1995.*

- *EDF and the Safety Authorities are keeping a close watch on this update as well as on other generic updates. In 1995, the Safety Authorities will decide on many surveillance test rule updates.*

- *In accordance with Chapters IX and III, Cattenom NPP tests safety-related equipment on a regular basis and formally informs the Safety Authorities thereof, namely after each outage.*

IAEA comment on status: *(June 1995) It is noted that Cattenom modifies conditions of the surveillance tests it carries out on the basis of experience and as a result of site modifications. Changes may also be needed to the underlying rules* *given in the General Operating Rules, Chapter IX. If the changes require more restrictive rules or addition al rules the amended tests are carried out without waiting for the approval of the revised Chapter IX by the safety authority. However, as part of the defence in-depth philosophy it is desirable that the safety authority reviews and approves the changes required to the operating rules as soon as possible, to give added assurance that the rules are appropriate and hence have resulted in the necessary changes to the surveillance tests. Although the response indicates that 80% of the approvals will be obtained before the summer of 1995, the schedule has been changed to have all amendments approved by the end of 1995. It is suggested that EDF and the regulatory safety authority review the process for approval of changes to the operating rules, with the objective of optimizing the process to limit the rime during which the plant is carrying out safety system tests based on unapproved operating rule modification.*

Conclusion: *Satisfactory progress to date.*

Administratively controlled procedures exist for the surveillance activities. This documentation identifies the rime intervals for each surveillance activity as well as tolerances on these rime intervals. These procedures are also well developed and include defined contents of the tests, preliminary conditions necessary for performing the tests and some precautions associated with performing the tests. These precautions do not include the risk of causing the reactor to trip when performing the tests. Such warnings are attached only to the steps in the procedures that can cause a trip. Such precautions are used in the nuclear industry and colours or other codes are sometimes used on the first page of the procedures to alert the operators of the potential risk.

(2) **Suggestion:** Consideration should be given to using special identification, such as colours or labels, to alert the operators of the surveillance test procedures that can cause a reactor trip. The possibility of a reactor trip will be reduced by using these or similar techniques.

Plant response: *(June 1995) The first page of surveillance test procedures for tests that may cause a reactor trip bears the indication "Surveillance test that may cause a reactor trip" in the paragraph entitled "Specific Conditions". This list currently applies to eight surveillance tests, and is being extended in light of experience feedback.*

IAEA comment on status: *(June 1995) The identification process introduced fulfills the intent of the suggestion. However, the extent to which it has been implemented is less than expected and it is suggested that the criteria for identifying which tests pose a reactor trip hazard be reconsidered. The current criterion is based on experience feedback of actual trips which have occurred in EDF. On this basis, the warning List only contains eight tests and would not be lengthened until a further trip occurs. It is suggested that near miss events, or* *those which by their nature pose a' significant hazard should also be considered for inclusion. In this way a trip that may be avoided.*

Conclusion: *Satisfactory progress to date.*

A special computerized programme is being implemented for detecting degradations of the components and taking corrective actions before the components become inoperable. Nevertheless, the surveillance test programme results are only used as input data for detecting degradation and trending analysis when the predicted data are not achieved during the testing of components.

(3) **Suggestion:** Consideration should be given to systematically using surveillance test programme results as an input data source for the programme that is used for detecting degradations of the components. A large amount of data is measured and collected by the surveillance testing programme and some of this data could be used for equipment degradation trending and analysis.

Plant response: *(June 1995) Although operating surveillance tests mainly consist of checking threshold values, we have selected some twenty parameters which are considered as being important for sensitive equipment. As of June 1995, these values will be sampled during surveillance tests performed at least every four months. This data will be entered into a software program which creates a monitoring curve. After analysis thereof, the objective is to anticipate thresholds in excess and plan corrective actions. Furthermore, the software application can be consulted by any authorized staff member in charge of equipment behaviour monitoring.*

When performing surveillance tests on rotating machinery, a team of equipment specialists take readings of vibration measurements and main operating parameters. These measurements are then handed over to the Operations Department where compliance with acceptance criteria is checked.

Since the OSART mission, this team has carried out a vibration trend analysis, comparing previous recordings. If necessary, special monitoring is implemented. Since the beginning of this year, this analysis has been gradually extended to main operating parameters of rotating machinery.

A summary of how equipment has behaved during a cycle is then performed in order to adjust the maintenance programme.

IAEA comment on status: *(June 1995) A well designed comprehensive system has been put in place to enable the trending of parameters measured during surveillance testing. This will facilitate checking for degradation of equipment before an allowable test threshold value is violated. The inclusion of vibration monitoring of rotating equipment in this programme is a good idea. However,* *since the system has' only been introduced in June 1995 it has not yet produced any significant trend information. It was stated that the process described in response to this suggestion is part of a broader programme involving the use of reliability centered maintenance at EDF.*

Conclusion: *Satisfactory progress to date.*

The surveillance tests that are approved by the safety authorities, those not yet approved and tests of non safety equipment are scheduled and performed according to the same type of procedures. A time deviation of 25 % is allowed for the tests and this limit is strictly followed. Co-ordination with other activities is done at weekly meetings for scheduling the test programmes for the following week. Distribution of the responsibilities is clear and performance of the tests are well co-ordinated. A computerized system has been added to the existing manual system to improve scheduling and thereby avoid repetition of an event in which one unit was shutdown as the consequence of not performing the test on time. There is a closed loop for controlling surveillance testing evaluation, the handling of the results and corrective actions.

5.3 Operational Experience Feedback System

The operating experience feedback programme (OEF) is well developed at the corporate level and at the site. In the last two years the programme has been reorganized. More activities and responsibilities for the analysis have been assigned to the site. This enhances the site engineering structure and operating engineering sections in both twill units to establish a good OEF site programme.

The on-site programme identifies and screens all events including significant and non-consequential events. The screening includes precursor events. The events are analyzed at the site in two levels. The first level is done by shift personnel which collect records and data, write up OEF sheets and suggest actions. The second level includes the root cause investigation process for which the investigators have been trained and are familiar with various root cause analysis techniques.

(a) **Good Performance:** The decentralization of the Operational Experience Feedback (OEF) programme has been performed by Electricité de France in the last two years. Before this change, almost all analyses had been done at the corporate level and a number of less important events were not analysed adequately. Now all the events are screened by the on-site OEF programme, including precursor events. The site analyses are performed on two levels. The first level is done by shift personnel or other personnel that were present or involved in the event. It also contains collected recorded data, OEF reporting sheets and suggested actions. The second level includes root cause investigations. The staff have been adequately trained to be familiar with various root cause analysis techniques. This new OEF organization has also been enhanced by the site engineering structure and operating engineering sections of bath groups at the C1/2 and C3/4 twin units by establishing and performing a comprehensive and good OEF programme.

The site OEF programme is backed up by a corporate (national) programme. The corporate programme reviews the site programmes, when necessary, carries out analyses of the generic problems and helps the site organizations when requested or necessary. A well developed centralized database exists. The corporate organization also collects the worldwide and national events, selects and sends to the sites those that are applicable.

The external events are analyzed in the same way as local events. The distribution of the external events is according a distribution list, and they are also published for the general staff every two months.

(b) **Good Practice:** The distribution of the external events, corporate and worldwide, in the Cattenom NPP is carried out according to a distribution list of interested and responsible managers for personnel to take actions. In addition, a special publication is issued every two months to communicate external event (mostly corporate) information to plant personnel. The publication has colour illustrations and is well designed. The publication has become popular among the staff and is contributing substantially to the safety awareness (culture) of the staff. In the future the content will include also a selection of in-house events

A specific programme at the local and corporate level has been developed for outage monitoring, called the outage experience feedback programme. Co-ordination between the sites and corporate is very good.

(c) **Good Performance:** An outage experience feedback programme has been developed by EDF for the site and corporate level. It contributes to the dynamic management of the outage experience feedback process and ensures a standard classification for outage evaluations and the validation of the experience feedback reports by various departments and plants. The outage experience feedback programme has substantially contributed to improving the outage organization, optimization of outage resources and shortening the outage length by approximately 10 days for each unit outage.

The OEF programme of Cattenom NPP is well developed. It includes nuclear safety, operation and maintenance events. Managers supports the programme and use the results. A system to record event information was set up last year (1993) and is being further developed. The event sheets are not closed until the corrective actions have been completed. The event sheets are evaluated by committees. They are used for all four units and shared at the corporate level for all similar units. The lessons learned from event evaluations are incorporated into the training programme of the plant.

There is a human factor analysis specialist at site, who now carries out human performance analyses of significant events. The goals for 1994 is for all significant events to be analysed from this point of view. This goal does not embrace legs significant events affecting availability.

(1) **Suggestion:** Consideration should be given to expanding human factor analysis as soon as possible to all events that affect availability. Analysing such events in this manner should contribute to an increase in availability.

Plant response: *(June 1995) Since completion of the OSART mission, the number of staff members involved and trained in "Human Factors" has increased from 1 to 6. This allows human factor analysis to be applied to events other than significant events. These specialists have various skiffs (Human Resources, Experience Feedback, Safety). This means that human factor analyses can be extended to other events related to availability. The site objectives for 1995 are to analyze the human factor aspect of all significant events with human error as one of the causes as well as at least three events affecting unit availability. These objectives will be stepped up in the coming years.*

IAEA comment on status: *(June 1995) The response to this suggestion fulfills its intent and the increase in staff in this area to eight people with a variety of backgrounds enables effective implementation of a hum an factor analysis programme. One example of an analysis was presented, which indicated that satisfactory results were being achieved.*

Conclusion: *Issue resolved*

Safety performance indicators (e.g. significant events and unavailability of safety systems) of the plant are monitored. They are trended and the statistics are analysed for the plant and compared with the statistics compiled at the corporate level. Plant and corporate managers are periodically updated on the safety performance indicators.

5.4 Plant Modification system

The control of plant modifications in Cattenom NPP is well organized. A number of site and corporate organizational units are involved, but the responsibilities for initiating, evaluating, designing, approving, executing and controlling the modifications, are well defined and understood. A unified guide, *Operations Engineering Guide (1994)* is provided for all stages of a modification. The process is strongly controlled from the corporate level but the Plant Manager approves all modifications that are carried out at the plant. The corporate policy is to reduce the number of modifications and to keep them standardized. Only those modifications that are not safety related affecting equipment or structures, or have no operational or availability aspects can be handled by the site and its engineering organizations. The modification system is strongly corporate controlled. The process for modifications is long, and the implementation of prioritized modifications (safety important) usually takes more than one year. Modifications often need to be adapted during the installation at the site. More responsibility at the site to handle also some modifications that can influence the operation and larger involvement of the Site Engineering Group to control the design and adaptations to local conditions could diminish such problems.

(1) **Suggestion:** Consideration should be given to reviewing the modification process and determining whether more responsibilities can be given to the site in the areas of evaluating design and approving corporate modifications. The long process for modifications and the amount of changes required when performing the modifications could be reduced.

Plant response: *(June 1995) French nuclear power plants are made up of a standardized series of identical units, that allows it to benefit from the experience feedback from many years of reactor operation. As far as safety is concerned, it is wiser to carry out modifications in batches rather than on a case-by-case basis. A single consistency and compatibility study is more reliable than just implementing sporadic modifications. Furthermore, this allows for a single update of documentation, thus ensuring compliance as regards a reactor series. The modification process is necessary to guarantee relevance of a modification, maintenance of each reactor series in terms of both physical and documentary consistency, and the quality of work performed for a given modification. This implies a relatively long processing rime for preparation of modification files but it is imperative to meet safety and quality requirements.*

The following provisions ensure the quality of modification:

- *Any modification performed is subject to approval of the job file by the site departments involved. The said departments validate feasibility in line with any specific site characteristics.*

- *Modifications are first performed on one reference unit for a given reactor series so as to obtain experience feedback covering all aspects. They are subsequently applied to all units of same reactor series, provided that corrective actions resulting from experience feedback have actually been taken into account. This process aims at reducing changes while modifications are being performed.*

The setting-up and organization of site engineering teams now enables the site to undertake modifications under ifs own responsibility, whereas in the past, the decision used to be taken at the corporate level. These so-called temporary modifications are prepared and studied by the site engineering team. Their preparation and implementation comply with site rules.

IAEA comment on status: *(June 1995) The plant response indicates that a site review of proposed modification is now incorporated in the process for validating corporate modifications. This should help ensure that proposed modifications are* *compatible with the specific situation at Cattenom. In addition, there is now a site engineering organization which can carry out non-safety related modifications which are specific to Cattenom's requirement. The site engineered modifications follow the same standards and are permanent rather than temporary modifications. The difference between them is transparent to plant operations. EDF believes that the long time which is required to carry out modifications which affect all reactors of the same type is necessary to ensure that all aspects are carefully considered and that experience is gained with a modification at one plant before it is applied to other plants of the same type.*

Conclusion: *Issue resolved.*

Activities such as safety reviews, approvals, prioritization, and scheduling the assessment of modification requests are well controlled. This is also the case for local modifications where the assessment is done by a plant committee. The scheduling of the installation of modifications is a well controlled process at the corporate and site level.

Upon completion of the field installation and testing, all departments responsible for updating the documentation are informed and the new revised documentation is issued. The issuing of operating documentation is a hold point.

Each modification is controlled from its initiation to the retraining of personnel with a single file and a single project leader. Operating teams at the site are responsible " for updating and managing the operations documentation modification. Operating procedures and necessary documentation changes are carried out and controlled by the operating teams which are responsible for the systems at the units and site. Control in ensuring that all aspects of a modification are completed is the responsibility of the QA team. These activities contribute to a modification programme that is well controlled.

(a) **Good performance:** At the site with four units and seven shifts for operating each unit, there are 28 operating teams. All the unit and site systems are divided and assigned to these teams. The teams are responsible for changing and managing the operating procedures and documents that are affected by the modifications. Operating teams at the site are responsible also for controlling the temporary and permanent modifications to operating documentation. The operating teams ensure that all kinds of operating procedures and documentation, in the control rooms and other operating locations are at all times updated and well controlled.

5.5 Reactor Engineering

Reactor engineering tasks at Cattenom NPP are performed by the field and corporate groups. The interfaces are strong, the division of responsibilities is well defined and adequate procedures (protocols) exist. A corporate computer program is used for reload calculations. The basis of the se calculations is that the fuel burn-up reflects the status of the core of the end of the fuel cycle as closely as possible. This is well demonstrated. All core calculations are independently checked by the fuel manufacturers by completely different and independent calculation codes and standards. Reload safety evaluations are approved by the regulatory authority.

The resources for the reactor engineering functions are sufficient. Personnel at the site and corporate level are well trained.

Surveillance of the core is performed regularly. The conclusions of the reactor engineering performance is regularly reported to the management. The corporate group is regularly audited by corporate QA and regulatory authorities. For each twill unit group, Cl/2 and C3/4, there exists one Testing Section in the Technical Inspection Department for core surveillance monitoring. Responsibilities of these groups are well defined and their tasks are supported by clear and understandable procedures. The groups' tasks primarily occur during preliminary operations at cold shutdown, the zero power test, the neutron flux instrumentation calibration, determining the power levels and setting up the protection systems, tests carried out during power increase and core surveillance monitoring during operation. Some of their work was evaluated and found to be satisfactory.

Fuel integrity parameters are trended under the responsibility of plant chemistry. A full scale sipping programme is in place for each refuelling and the integrity of the fuel elements carefully calculated.

Fuel integrity is monitored during outages by performing sipping tests. A qualitative test is performed to determine whether the fuel element is leaking, and then a quantitative test is performed to measure the extent of the leak. This determines whether or not the element can be reloaded. Operation is allowed with up to 1 % of leaking fuel. Fuel cladding cracks of less than 35 microns are the first criteria for fuel reloading. The second criteria is that the liquid samples taken show an absence of activity from solid fission products. This fuel integrity management policy is based on a large amount of experimental data and long operating experience. The fuel leak rate is small (average one per reactor per reload). However, a large part of nuclear industry has implemented a policy of not reloading leaking fuel. During operation the condition of the fuel is monitored by assessment of the radiochemical analysis data.

(1) **Suggestion:** Consideration should be given to evaluating the differences between EDF and international policies regarding fuel cladding cracks and the reasons for different practices. The eventual changing of the EDF policy could contribute to diminishing the already small number of fuel leaks and potential fission product concerns.

Plant response: *(June 1995) EDF compares its practices with those of other operators on a regular basis, namely in the area of fuel management. This comparison is made in particular through various international nuclear operators' organizations (W ANO, International Nuclear Power Operators' Conference,* *International Working Group on fuel behaviour co-ordinated by the IAEA) or as part of information exchange agreements (Commonwealth Edison Co, Kansai Electric Co, TEPCO, Taiwan Power Co, INPO, power plant twinning agreements). In a majority of countries where reloading leaking assemblies is not authorized (Japan, Germany) assembly leaktightness is checked only when a defect is suspected.*

In countries with specifications on reactor coolant activity (United States, France, China), assemblies are checked only if their activity level is higher than a threshold indicating fuel cladding defects. In the United States, leaking assemblies are not reloaded. In France and in China, leaking assemblies can be reloaded if they comply with specific criteria.

As part of fuel management policy, EDF - together with the French Atomic Energy Commission - has developed criteria for reusing leaking assemblies. These criteria were investigated and approved by the Safety Authorities (DSIN) in July 1980. EDF in turn had to lower its technical specification criteria for reactor coolant activity. Therefore, our specifications concerning reactor coolant activity level are stricter and compel us to shut a unit down at a relatively low activity level (1.85 x 10^{10} Bq/t equivalent to I^{131} in France and 3,7 x 10^{10} Bq/t in the United States).

By the end of 1994, this policy indicated that out of 32 150 assemblies used, 443 were found to be leaking. Out of those, 162 were reloaded in accordance with very specific reloading criteria (equivalent defect size smaller than 35 microns, absence of solid fission products such as La, Ba and Np) and checked with related test facilities (qualitative sipping test in the reloading mast and quantitative sipping test in the sipping cells). The related experience in this field shows that cracks appear at the beginning of a cycle and do not increase significantly in the short term and, in particular over a cycle. This policy, implemented over 13 years, has not resulted in exceeding the technical specifications limit for reactor coolant activity and has only contributed to an increase of about 1 % of the annual exposure to personnel.

The technical methods used (sipping test as against ultrasonic testing) allow for better control of fuel cladding condition. This is a guarantee that the first barrier is effective in terms of safe operation. This is confirmed by the latest W ANO indicators (In France, Finland, Korea and Taiwan, the reactor coolant activity level is the lowest in the world).

France is well aware that its policy is different from that of other operators in the world. EDF will continue to participate in international meetings on this subject. EDF will pursue investigations and research into fuel in order to guarantee safe operation. If international experience feedback leads to accruing new knowledge, it is clear that EDF will be ready to take it into account.

IAEA comment on status: *(June 1995) The fuel cladding is the first barrier to prevent escape of fission products to the environment. The integrity of this barrier, and others, is vital to defence in depth. Although operators in other countries may not be required to not reload leaking fuel by the regulator, there is a movement towards not reloading leaking fuel. In the United States, for example, approximately 90% of the BWRs and 70% of the PWRs will not reload leaking fuel. EDF is urged to continue to reevaluate the financial advantages of reloading fuel with minor leaks against the risk of possible circuit contamination and a weakened barrier during an incident.*

Conclusion: *Satisfactory progress to date.*

5.6 Fuel Handling

All fuel handling activities from receipt of fuel until dispatch from the site are under the responsibility and carried out by the Site Technical Support Group. All activities are approved by the operating departments of twill units Cl/2 and C3/4. A good set of administrative and working procedures is available.

The reloading operation of Unit 4 and spent fuel handling operation in spent fuel pool of Unit 2 were observed. The work was done in a professional manner by experienced personnel, who demonstrated the knowledge and skills necessary for performing this work. Spent fuel pools are well equipped for carrying out fuel handling operations including packing spent fuel into casks for transportation.

All technical aspects for proper identification and positioning of fuel elements during reload and spent fuel handling are adequately addressed in procedures and the procedures have been followed.

Material and environmental conditions in the vicinity of spent fuel pools were found good and properly monitored.

5.7 Safety-related Computer Applications

The plant process computer consists of a local network (named ARLIC), the meteorological data processing and the plant process calculators KIT 1 and 2. The KIT is used for unit status report data recording and analysis and assists operators in activities such as neutron calculations and post-accident operations (in liaison with corporate level).

Maintenance of the process computer is carried out systematically on a monthly, quarterly and annual basis. The availability of the computers is high (for all four units 99.5% during the last year of operation). Help is available from the manufacturer for software maintenance, development and programming.

The management network is not yet connected to the plant process computer. A number of practical programs and data bases are accessible in this system. At the site, there is only a network of personal computers that is connected to the large centralized computers.

The personnel for support of the computer systems are knowledgeable and well trained. The organizational structure is well defined with clear responsibilities defined for the individuals. The overall corporate control is strong and results in maximum benefit from standard design, programs and equipment.

Adequate documentation is provided for the management of all aspects of computer use at the plant and at the corporate level. The process for software modifications is well controlled. Special training is given to the users for their specific applications.

Computer use at Cattenom NPP is extensive. Business computers provide a large number of services, among which the most important are the SYGMA system for work order processing and work assessment, for tagging, work protection and the SAPHIR system for operational experience feedback such as maintenance work event analysis.

A long term programme exists for the development and maintenance of the computer systems and relevant software at the appropriate quality level. Software security is based on a password scheme which appears to be adequate.

6. RADIATION PROTECTION

The organizational structure and responsibilities of radiation protection are clear and well defined. The EDF policy of radiation protection is consistently implemented at the plant to ensure the application of national regulations.
Managers, supervisors and technicians are well-trained and demonstrate a professional attitude to their assignments. In accordance with the Cattenom NPP approach, the plant staff are responsible for their own radiation protection. In line with this policy, the training of plant personnel is comprehensive and effective for them to fulfil their duties.

The ALARA programme carried out at the plant is extensive and well-coordinated; several strengths were observed in this programme such as: optimization of personnel radiation exposure and special training for this purpose.

An adequate programme for the surveillance of radiation and contamination conditions is established in zones. However, improvements in this area are needed to eliminate unidentified hot spots and use of similar dose rate units in portable radiation detectors.

A well-structured programme is implemented to reduce the volume of solid radioactive waste and minimize the liquid and gaseous releases which was considered to be a good performance. Nevertheless, it was suggested that alternative materials be used instead of wood for scaffolding and other purposes, in order to be consistent with this programme.

Safety culture is evident at the plant. The comprehensive radiation protection training programmes, the excellent cleanness and housekeeping of all the areas visited, in particular the controlled area, and the extensive ALARA programme where individuals area fundamental factor, support this assessment.

Good progress has been made in resolving the radiation protection items identified for improvement. Specifically, all of the recommendations and suggestions have been resolved or are progressing satisfactorily.

For example, to minimize the potential for personnel radiation exposure several actions have been taken to identify, label and remove hot spots. In addition radioactive waste drums are monitored, and either located in areas away from personnel walkways or biologically shielded. Actions taken in response to other suggestions include the decision to replace wood scaffolding and to implement consistent standard units on all portable radiation survey instruments over the next five year period.

This progress is indicative of a good radiation programme that is well supported by department and senior management as well as a willingness and receptiveness to continued improvements. The radiation protection staff were particularly open and responsive during this visit. It should also be noted that some of the items not yet completed will require continuing support over the next few years.

6.1 Organization and Administration

Radiation protection in Cattenom NPP is integrated with industrial safety which involves the areas of prevention of conventional risks, radiation protection and fire. The existing policy in EDF is that every member of staff is responsible for their own radiation protection. The plant supplies the necessary means and provides advice, recommendations, training and retraining to support this arrangement.

The implementation of the industrial safety and radiation protection guidelines and the verification of the application of the French legislation is the responsibility of the Plant Manager. Each TUG, C1/2 and C3/4, has an Industrial Safety and Radiation Protection Section which is independent from the Maintenance and Operations Sections. The manager of the Radiation Protection Section reports directly to the TUG Manager through the Deputy Manager.

The Site Technical Support Group (SUT) has an Industrial Safety and Radiation Protection Section. This section assists the departments of the plant in job preparations and supplies of personnel to the twill units during the refuelling outage. The SUT includes a General Services and Environmental Department (SAT) which is responsible for management of effluent releases and environmental impact. Both the Department and Section report to the SUT Manager.

The Industrial Safety and Radiation Protection Heads (SUT, TUGs C1/2 and C3/4) are members of the interdepartmental committees (e.g. NPP Industrial Safety Committee).

The qualification of the radiation protection personnel at Cattenom NPP is adequate to fulfil the established programme. New staff members in the section receive an individual training- plan which is updated annually in accordance with the position. In addition to the training plan, specific training is conducted within the section which covers areas such as transport of radioactive materials, use of radiation protection instruments and application of ALARA principles.

A group to study hot radiation spots at Unit 1 was established in 1991. Two years later this group became the ALARA group at the plant. The ALARA programme is comprehensive and systematic, several good practices were identified in this programme.

(a) **Good practice:** The ALARA programme carried out at Cattenom NPP is comprehensive, activities are established and approved annually by the Plant Deputy Director. Several steps are followed during the application of the ALARA programme.

- Pictures are taken of the work areas to be assessed. Radiation points are identified and dose rates measured at these points.

- Radiation distribution pictures are taken using a new technique, called 'gamma-teletopography'. This is a relative radiation measurement that is used to identify hot spots and supplements information on the doses measured at the radiation points.

- Shielding is calculated and collective doses are estimated, based on this calculated shielding.

- To reduce general dose to workers as part of the ALARA programme four filters of 25 microns are placed in the nuclear island vent and drain system (RPE) to retain radioactive particles mainly cobalt-60. These filters are shielded with lead. This shielding is remotely operated to permit the periodic change of the filters. Nineteen of these filters have been changed in 18 months. This installation has resulted in a dose reduction for operator staff, chemists and maintenance staff.

- The ALARA Committee has authority to implement of radiation reduction measures. The current objective for EDF is to achieve of 1.6 man Sv per unit by 1,995. Most personnel receive ALARA training in addition to the required radiation protection training in accordance with the Integrated Radiation Protection approach.

6.2 Radiation Work Control

In accordance with the policy that all staff are responsible for their own radiation protection, radiation work permits are not used at the plant. The radiation protection instructions are included in the work order. For work to be carried out in green and yellow zones < 2 mSv/hr), it is the work team leader' s responsibility to define the radiation protection instructions. Dose rates, hot spots and contamination levels in rooms in the controlled zone are available to the personnel on the SYGMA database.

The Radiation Protection Section is responsible for the classification and labelling of areas in accordance with French regulations (green, yellow, orange and red zones). The red zones are administratively controlled, closed and chain locked. Work in orange zones needs permission from the head of department responsible for the work and approval from the Radiation Protection Section. For red zones the Twin Unit Group Manager's authorization is also required.

At the entrance to the controlled zone, Radiation Protection staff check that workers are carrying electronic dosimeters and personnel dosimeters (film) and wearing protective overalls. They also verify that access cards are within the authorization dates.

During a tour in the reactor containment high radiation levels (one hot spot and one radioactive waste drum) were noted in transit passages above the permissible levels (using a portable gamma detector). No identification or warning of radioactive risk was observed in these two cases.

(1) Recommendation: High radiation level zones (hot spots) should be identified and adequately posted to alert personnel of the potential risk. This would prevent plant personnel from receiving unnecessary dose, and ensure that the current ALARA approach is implemented on site.

Plant response: *(June 1995)*

Unit in operation: *During a visit of the Unit 4 reactor building that took place during the OSART mission, a radiation monitor detected an activity level of 0.20 mSv on a pipe in an area where personnel frequently pass. No radiological risk was identified and thus there was no warning.*

Since that rime, the following actions have been launched:

1. The following hot spot criterion has been defined:

A hot spot is a specific spot locally generating an equivalent dose rate which is ten rimes higher than room surroundings. Signalling such a spot improves the site ALARA approach.

This definition is included in the corresponding procedure.

2. In procedures concerning preparation of survey maps, industrial safety technicians are reminded to identify a "hot spot" on the survey map for any unit where a hot spot has been detected since the last survey was conducted.

3. For better prevention, other actions have been launched as part of the approach to reduce radiation exposure, ALARA. The following are examples of such actions:

- *Installation of on-line filters to trop radioactive sources.*
- *Implementation of specific biological protection for reactor cooling pump seal injection lines. These lines include several hot spots.*
- *Modification of Nuclear Island Vent and Drain System in order to avoid sump overflow.*

IAEA comment on status: *The 0.2 mSv hot spot that was the initiator of this recommendation was not identified or labelled by the plant staff because its activity* *was much less than the existing 2 mSv criterion being used at the rime. However, a number of actions have been taken that should minimize the potential radiation exposure from similar hot spots. For example:*

- *plant criterion for hot spots is now 10 times background;*
- *existing hot spot labels have been replaced with larger, more visible signs; the relevant procedure has been revised;*
- *areas with potential for hot spot radiation exposure are surveyed and mapped monthly, and hot spots are identified on the survey maps;*
- *a number of actions have been initiated to minimize hot spots, such as flushes, shielding and on-fine filters to trap particles.*

Conclusion: *Issue resolved.*

(2) **Recommendation:** Systematic surveillance should be improved for better identification of high radiation level zones and to remove unnecessary sources of radiation such as radioactive waste drums in passages or corridors where personnel frequently pass. This also will prevent plant personnel from receiving unnecessary doses and ensure that the ALARA principle is followed at the site.

Plant response: *(June 1995) Since the OSART mission:*

- *Waste storage areas have been marked on the floor at several locations in this area. During storage, biological protection is set up.*

- *A guide given to workers when they first come on site enhances awareness of waste and waste treatment.*

- *A memo posted in front of the personnel air lock at the waste area exit reminds the workers of instructions concerning waste treatment and radiological protection.*

- *The industrial safety team is responsible for monitoring equivalent dose rates from waste storage. Radiological personnel perfo111ls this inspection on a daily basis. The industrial safety team measures equivalent dose rates which, if in excess, may result in immediate warning signs or waste removal.*

IAEA comment on status: *(June 1995) The status is as described in the response. In addition, the identified waste storage areas are normally located out of personnel pathway s. Where such a location is not possible (eg. personnel air lock area) appropriate biological shields are used. Personnel compliance with the use of these storage areas appears to be generally good based on plant monitoring of this aspect over a three month period.*

Conclusion: *Issue resolved.*

A large amount of wooden beams are stored in the Controlled Area which are mainly used for scaffolding and equipment support in the Reactor Containment and the Control Zone. The plant has been considering the change from wood to a more suitable material, but no decision has yet been made.

(3) **Suggestion:** Consideration should be given to replacing wood used for scaffolding and equipment support by other more suitable material that can be decontaminated more readily. Elimination of wood in the se areas would reduce the solid waste generated and would reduce the fire risk by reducing the amount of combustible material stored in the controlled area.

Plant response: *(June 1995) Since the OSART mission, the site has launched a campaign to gradually replace wood scaffolding with metal scaffolding. This operation will be completed within five years. In the context of this campaign, the site has already procured special scaffolding for work performed on the refuelling machine mast. Scaffolding will be purchased next for the reactor vessel head worksite.*

In addition, former provisions for fire protection have been consolidated since the OSART mission:

- *Two storage areas per unit have been identified. The storage areas are adaptable and dismountable on the floor covering the filter storage room located inside the auxiliary building and the reactor building personnel air lock.*

- *.The wood volume stored in each area may not exceed 13 m^3: this corresponds to the findings of a study of calorific potential.*

- *There are lire protection and fire-fighting devices in these areas.*

IAEA comment on status: *(June 1995) The status is as stated and is an appropriate response to the suggestion. It was also noted that:*

- *replacement of wood scaffolding is a national programme;*
- *replacement of scaffolding in areas most likely to be contaminated is being accomplished on a priority basis;*
- *the general approach to reduce radiation dose is to assemble the scaffolding in a low radiation area and then relocate it to the area of use.*

The actions being taken are considered appropriate. However, continuing emphasis is required over the next few years to achieve completion.

Conclusion: *Satisfactory progress to date.*

An adequate programme for the surveillance of radiation conditions is established in areas/rooms. According to this programme radiation surveys are carried out every one, two or four weeks depending on the area/room requirements. The database which contains dose rates in rooms and areas is updated on a monthly basis.

6.3 Internal Radiation Exposure

Surveillance of air contamination of the facilities is carried out by means of fixed area airborne contamination monitors which have indications and alarms in the control room. In addition mobile equipment to measure air borne contamination is used and local air samples are taken for specific work activities.

The person responsible for the work takes and measures the sample, using portable beta detectors. If the value of the sample is greater than an established value, the radiation protection personnel are informed and an analysis of the sample is carried out. Commencement of the work is not authorized until the result of the sample is received. Routine sampling is also carried out by radiation protection using the same instruments. The Derived Air Concentration Limit (DACL) is posted at the entrance of the control zone.

Control of personnel contamination is performed using the exit monitors. Gamma and beta counters are used to detect body contamination.

Several methods are used for preventing the spread of airborne contamination. *Static Confinement* consists of a leaktight plastic tent in which the work is performed. The tent is slightly depressurised by a pressure lowering device which may discharge to another room through an absolute filter or to a ventilation duct. *Dynamic Direct Confinement*, where contamination from the worksite is captured at the source by an airstream (flow greater than 0.4 m/s created by pressure lowering equipment. *Dynamic Confinement* depressurizing which consists of maintaining piping or equipment under a slight vacuum pressure. throughout the duration of the work.

There is a cleaning programme which provides quick intervention should a leak occurs. The overall result of this programme is good as the cleaning of the plant in general terms is excellent.

6.4 Radiation Protection Instrumentation, Equipment and Facilities

The Radiation Protection Section is well equipped with fixed and portable detectors adequate to support the plant during normal operations, outages and accident conditions. The maintenance and calibration of portable detectors is the responsibility of the Industrial Safety and Radiation Protection Section of the SUT. The instruments are calibrated yearly by a supplier who is accredited by the Bureau National de Metrologie. The calibration date and the identification of the detector is provided on a sticker on the instrument.

The maintenance and calibration of the fixed activity channels are the responsibility of the I & C Department which performs the annual calibration. These detectors are checked periodically for the Industrial Safety and Radiation Protection Section and Operations Department.

The Radiation Protection Section uses a comprehensive computer program that among other features is used to control the calibrations of the detectors and provides the location of every detector on site. The main storage for radiation protection portable detectors is near the entrance of the controlled area. Portable detectors are available at the request of the personnel. The operability of these detectors can be checked before use by means of a check source.

During one of the plant tours of the control area it was observed that different radiation dose units were being used in the portable radiation detectors provided. Readings were in *Rem* in the electronic dosimeters and *mSv* in the portable radiation dose rate meters. Conversion units were attached to the instruments.

(1) **Suggestion:** Consideration should be given to using the identical radiation dose rate units in portable radiation detectors throughout the plant. This would prevent mistakes when reading or comparing dose rate measurements and would also improve the understanding of these terms by plant personnel.

Plant response: *(June 1995) Switching from old to new measurement units occurs when measurement equipment is replaced. On the equipment currently used, labels indicate the corresponding measure so as to facilitate conversion to and from the new unit. We plan to replace all equipment within five years. This approach is explained in a corporate procedure and instruction.*

IAEA comment on status: *(June 1995) It is noted that the planned replacement of portable radiation detectors, with units measuring radiation levels in Sieverts, over the next five years is consistent with corporate guidance. Although it would be desirable to change over to Système International (SI) units on an earlier schedule, apparently Cattenom has not experienced problems or confusion in using the two measurement units. As a result the current approach is considered to be acceptable.*

Conclusion: *Satisfactory progress to date.*

Protective clothing and equipment in Cattenom NPP is adequate to fulfil the criteria that every worker is responsible for his own protection. Different items of clothing are correctly located at the entrance of the controlled area with easy access by workers. Overalls and shoes are well organized.

Breathing mask apparatus is forbidden in EDF due to personnel experience feedback. As a result, a large number of semi-autonomous breathing apparatus (with air supply from the plant compressed instrument air system) are available for use at the plant.

6.5 Personnel Dosimetry

Film dosimeters for personnel radiation protection control are required by regulation. The Department of Safety and Radiation Protection (DSRE) of the Corporate Organization supplies and evaluates the dosimeters. The whole process is supervised annually by the Central Department of Protection Against Ionizing Radiation (SCPRI).

Contractors are directly controlled by SCPRI. Gamma and beta doses can be calculated from the readings of the film dosimeters in use. However, neutron dosimetry is carried out by using portable neutron detectors of dose rate. This dosimetry is mainly conducted during the transport of spent fuel.

EDF has developed and implemented in all NPPs a computerized program that permits the dosimetric follow-up and control of all EDF personnel and contractors. In the database, DOSINAT, records are kept for the last five years. This database is updated daily using the operational dose.

The SCPRI has established common regulations for all NPPs in terms of gamma body counting equipment, measurement results, estimation of effective dose and types of surveillance

The SCPRI delegates this responsibility to the Medical Services of the plants. There are two levels of control of internal contamination. Routine periodic monitoring established for EDF personnel and permanent contractors is six months for Category A workers and annually for Category B workers. The temporary contractors are subject to examination upon arrival and when leaving the site. Special monitoring is carried out if contamination persists after showering or is located on the face, and during random checks for potential contamination.

If the action level established by the ICRP is reached, bioassay analysis is carried out for three consecutive days. If the result of this analysis is greater than 1/100 of the annual limit of intake, the effective dose attributable to the internal contamination is estimated and assigned according to the ICRP 54.

Provisions are made by EDF to evaluate film dosimeters in an expeditious manner (24 hours) in the case of abnormal radiation doses.

6.6 Radioactive Wastes, Storage and discharges

The management of solid radioactive wastes is the responsibility of the National Radioactive Waste Management Agency (ANDRA). The DSRE of EDF establishes the guidelines to comply with ANDRA specifications. Cattenom NPP is responsible for waste classification, drumming, calculations of activity of the drums, storage and disposaI. Each department involved is responsible for the proper application of its own procedures. Solid radioactive wastes are classified in three categories. *Process wastes* are generated when liquids and gases are treated to reduce their activity. This waste includes filters, iodine traps, concentrates and resins which are related to plant operation. *Technological wastes* are generated by routine work in the plant (maintenance, repairs or the replacement of active or contaminated equipment). *Miscellaneous wastes* in which the type of drumming is selected according to the dose rate (> or < 2 mSv/hr) and type of waste.

Compactable wastes under 2 mSv /hr of dose rate are compressed in metal drums after classification is made in the waste treatment building (BTE). All waste produced in the plant is carried to the BTE. All wastes > 2 mSv/hr are packaged in concrete containers whose contact dose rate must be < 2 mSv/hr for transport (ANDRA requirement).

A study to explore incineration capabilities is being carried out at the corporate organization as well as the reuse of metallic waste by NPPs using a melting process. It was noted that a great effort has been placed by Cattenom NPP in reducing the volume of generated waste.

(a) **Good performance:** Considerable efforts have been made to reduce the volume of solid technological waste. Extensive dissemination of information to workers is implemented concerning: minimizing entrance of packaging materials into the controlled area (paper, cardboard, boxes); no superfluous equipment or tools; and preventing contamination of reusable packaging. In addition training of the work supervisors on these techniques has been implemented. The first classification for the waste is made on site by the work supervisor according to the dose rate and type of waste. As a result of this training, a large reduction in waste has been achieved.

French legislation regarding liquids and gaseous releases defines for Cattenom NPP the monitoring role of the SÇPRI, the annual radioactivity limits for the releases, the effluent treatment before storage, the storage capacity, the analysis of the releases, the release conditions and how environmental surveillance is carried out.

The TUGs are responsible for the production and processing of effluents within the limits and objectives established in the Unit Strategic Plan and specified at the beginning of the year. TUG Cl/2 is responsible for the storage and processing facilities of the effluent treatment building, the chemical and radiochemical analysis as well as the operations necessary for the releases.

The Environment and Releases Section is responsible for determining the release conditions, sampling analyses and keeping statutory registers up to date. Responsible engineers of the Chemistry, Operation of the TUGs and the Releases and Environment Sections are permanent members in the effluents weekly meetings. The purpose of these meetings is to study effluents produced per unit during the week, to analyze malfunctions and anomalies, and to eventually reduce malfunctions and anomalies as well as the amount of effluents to be produced during the following week. There is an established criteria for the evaluation of noble gases releases from the auxiliary building to the environment.

The procedures for sampling, measurements, results analysis and recommendations on waste processing are adequate. The process instrumentation for the permanent surveillance of releases to the environment is correct per international practice and the calibration of the instrumentation was verified in accordance with plant requirements.

Before any liquid effluent is discharged a sample of the tank is taken and analysed to determine the volumetric activity. During the discharge the volumetric activity is constantly recorded. However, the range of the instrument used is too broad for the current activity releases, and it is not possible to follow small changes in release activities.

(1) **Suggestion:** Consideration should be given to modifying the range of the volumetric activity recorder, to permit an adequate follow-up of the releases even at low activity levels. This implementation would ensure that effluents discharged are in accordance with procedures and that deviations or errors are identified and corrected.

Plant response: *(June 1995) The design of the 102 MA plant radiation monitoring system checks that effluent release complies with regulations. It has two alarm thresholds which are transmitted to the control room:*

- *The first one is set at one tenth of the regulatory value for stopping a release.*
- *The second one is set at 80 KBq/l, which is the regulatory limit value and which automatically stops a release.*

Since the OSART mission, no technological solution has been identified which complies with our specifications and is capable of recording extremely low volumetric activity such as that in the current releases at the Cattenom site. In case of spurious release, the monitoring device currently in place is fully operational and enables automatic manual interruption of the release. Therefore, in order better to control extremely low activity releases, the following compensatory measures have been taken:

- *During tank fill, computer determination of expected activity in tanks prior to release.*

- *Prior to the release, a comparison is peifol71led of measured activity with the expected value.*

- *Automatic release operation using on-Line monitors, real-time flow rate monitors, and automatic shutdown in case of malfunction.*

- *.The performance of a monthly surveillance test to verify the proper operation of instrumentation and control equipment. Results are recorded in the OPRI manual (French Bureau for Protection against Ionizing Radiation).*

IAEA comment on status: *The Cattenom effluents discharged are nominally about 200 Bq/L. There is an alarm at 8 000 Bq/L and an automatic stop of the release at 80 000 Bq. Although the discharges are recorded on the volumetric activity recorder, the low levels discharged appear as zero on the recorder and do not provide a cross check that no deviations are occurring.*

Cattenom has been unable to identify a system capable of properly monitoring the Low activity effluents being discharged. Consequently, they have implemented compensatory measures to ensure that the activity being released is monitored. Also, in view of the alarm at 8 000 Bq/L and the automatic trip at 80 000 Bq/L at the regulatory Limit, there is a high Level of confidence that there will be no releases in excess of Limits. Currently, there appears to be no alternative solutions to what is being done.

Conclusion: *Issue resolved.*

Credit should be given to the plant for reducing the percentage of the authorized liquid and gas releases. Currently these values are 0.5 % and 0.8 % respectively of the authorized limits.

Environmental monitoring is carried out in accordance with the Interministerial Orders on discharges of radioactive liquids and gases from the plant. These orders establish discharge limits and procedures, environmental monitoring measures to be taken by the plant and the inspection procedures of the SCPRI.

6.7 Radiation Protection support During Emergencies

During an emergency the Radiological Command Post (PCC) is responsible for the evaluation of the radioactivity release and estimation of the radiological effects on site and in the environment and provides the Management Command Post (PCD) with necessary data. Responsibilities of the PCC members are well described in procedures. Instruction sheets are filed for every command post which are clear and user friendly. The computer facilities at the PCC facilitate the calculation of dose at several distances based on the information received at the PCC.

The PCC team is composed of 15 members from several departments who receive adequate training to fulfil their specific tasks. Between six and eight drills are conducted every year. Refresher training is carried out once a year. A committee for the improvement of the PCC, composed of members from different departments with a position in the PCC, led by the head of the PCC, meets four rimes a year to improve local training, analyse OEF and improve the PCC organization.

The plant is well equipped to support emergencies. There are two specially designed vehicles for sampling the environment as part of the Emergency Plan. The vehicles are equipped with fixed radiometer gamma spectrometers, two automatic portable gamma monitors, one beta counter, sampling equipment, dosimeters, maps and individual protective material.

In the PCC room there are available telephones, radio, documentation, procedures, a computer with dose rate calculation software and maps of the surrounding areas. There is also on-line instrumentation (recorders) that receive data from the meteorological station and eight dose rate detectors located either one or four kilometers from the plant.

There are four laboratories, three at the plant and one in a nearby village to support sampling and measuring equipment during emergencies. In this village also there is a well designed decontamination building with capacity for 800 people.

7. CHEMISTRY

The Chemistry Sections at Cattenom have strong, highly motivated teams. The personnel are well qualified and trained to perform their functions. The laboratories are reasonably spacious. Control of the operational chemistry is good and adherence to corporate specifications is strictly enforced. The specifications take plant specific materials and industry practice into account. Laboratory equipment undergoes exhaustive testing before being recommended for use. Operational feedback implementation is particularly strong. Documentation control is good and history files are well maintained and readily accessible.

It was found that a definitive laboratory quality control programme did not exist and this should be developed, perhaps in conjunction with the Corporate Chemical and Metallurgical Laboratories (GDL).

There were few areas where problems were encountered; however, some suggestions have been made to strengthen operations. These include shift coverage during refuelling shutdowns, performing hide-out return studies, provision of on-line monitoring facilities in the laboratories and ensuring the operability of the post accident sampling system.

Individuals displayed a strong awareness of, and commitment to, safety culture in the Chemistry area. Management has set the development of a strong safety culture as a . performance objective; its ready acceptance within Chemistry was assured given the pre-existing concern over personnel safety as evidenced by the installation of polycarbonate sheeting around chemical transfer pumps at the water treatment plant.

Progress and responsiveness to resolving the chemistry issues identified for improvement has- been very good. AII of the recommendations and suggestions are either resolved or progressing satisfactorily.

For example, actions were taken to further strengthen and confirm the adequacy the chemistry quality control programme through additional inter-laboratory cross checks. Also, Units 1 and 2 shift chemist coverage has been established during the early stage of outages and a national programme for hideout studies has- been implemented. At the same time Cattenom decided for adequate reasons not to install a terminal in the chemistry laboratory. In addition, EDF corporate (SEPTEN and DSRE) have formally agreed that sampling is not required for at least the first 24 hours after a design basis accident, which provides a basis for not correcting previously identified post-accident sampling system deficiencies.

The actions taken on these and other issues are indicative of a chemistry organization that is responsive and willing to consider improvements, while also questioning whether such changes are sufficiently beneficial. As a result it is expected that *the selected initiatives when fully implemented will further improve performance in the chemistry area.*

7.1 Organization and Functions

The site chemistry function is shared among three organizations, namely the Chemistry Section TUG Cl/2, the Chemistry Section TUG C3/4 and the Environmental Release Section of the Site SUT. ln each instance the TUG Chemistry Sections, along with the Testing Section, are sub-units in the Technical Inspection Section of the TUG.

The Environmental Release Section of the SUT is responsible for the management and measurement (chemical and radiochemical) of all liquid and gaseous effluent releases into the environment. It is also responsible for all environmental monitoring inside and outside of the site boundary. A team of 15 persons, under the management of a Principal Technical Inspector, is assigned to this section. This seems adequate to perform the designated functions.

Each Chemistry Section is managed by a Principal Technical Inspector. The section is split into an operational and a functional leg. Total section complement is around 22 persons for TUG Cl/2 and 16 persons for TUG C3/4. The Chemistry Sections do not work shifts during normal periods of operation, but qualified members of staff are on call around the clock in the event of unscheduled transient conditions arising.

The Chemistry Section of TUG Cl/2 does not provide shift coverage during plant mode changes such as shutdown for refuelling although the Chemistry Section of TUG C3/4 does. The reason cited for this difference in approach is that all activities on TUG Cl/2 requiring a chemistry presence are scheduled during times when chemistry personnel will be on site. At other power plants the period covering shutdown for refuelling is generally considered to be one of the busiest times for the chemistry organization. Several transient events can occur which require the presence of chemistry staff for regular sampling and .analyses. Such events may extend over several days and sampling and analysis is required every 2-4 hours (or more frequently).

(1) Suggestion: Consideration should be given to requiring qualified chemistry staff to be on shift in Twin Unit cm to cover a refuelling shutdown. This would ensure that abnormal chemical conditions arising would be addressed immediately and ensure that all relevant chemistry data obtained during the shutdown would be promptly evaluated. In addition this measure would improve the consistency in the site operations.

Plant response: *(June 1995) Following the IAEA 's comment, the staff of the site Chemistry Section in Twin Unit Group 1/2 will be working on shift during the early stage of the outage (oxygenation phase). This decision allows for:*

- *hideout return monitoring,*
- *organizational consistency in site operations.*

IAEA comment on status: *(June 1995) Cattenom has completed the action by establishing chemistry section, Unit 1/2 shift coverage during the early stage of the outage as suggested. This change has already been demonstrated during the Unit 1 outage as being beneficial.*

Conclusion: *Issue resolved.*

A comprehensive series of operational feedback meetings, both internal and external to chemistry, keeps chemistry managers informed of all operational developments on site. This is consistent with proven international practice. Considerable external support is available to the Chemistry Sections from EDF Corporate bodies.

In the radiochemistry field, the Industrial Safety Radiological Protection and Environment Department (DSRE) provides specifications for the different circuits in different standard operating states. The Corporate Chemical and Metallurgical Laboratories (GDL) provides chemistry specifications for all of the circuits. The GDL also provides a Liaison Engineer who acts as a conduit for the feedback of information to the site.

Control of chemistry documentation conforms to the requirements of the site Quality Manuals. Satellite, or ancillary, documentation centres exist within the TUG Chemistry Sections.

Chemistry personnel are well qualified and highly motivated. Chemistry trainees follow a two year shadow training programme, incorporating structured and unstructured training. At some stage during this period the trainee will attend a six week chemistry training course run by GDL. At the end of this period the trainee will attain the first level of authorization. The shadow training is fully documented and credit is given for work performed when authorization evaluations are made at the end of the training period.

Continued training is carried out to enable the trainee to attain further authorizations, following a programme of compulsory and elective personal development initiatives. The personal development programme is jointly agreed upon by the employee and the supervisor.

Authorization is obtained by evaluation and validation of skills acquisition by an authorized superior (in the case of a Chemistry Technician, by the Operational Foreman).

7.2 Chemistry Control in Plant System

Chemistry specifications are provided by GDL, that cover major plant fluid systems and most auxiliaries. A guideline document outlining the bases for the specifications is also available. A new revision of the specifications has been prepared.

Local deviation from the GDL specification requirements is forbidden if this results in a slackening of the given specification, though stricter control within the allowable ranges is permitted and encouraged. Adherence to specifications is strictly enforced and compliance is reviewed daily by the Principal Technical Inspector. Since the Chemistry Section does not perform, shift work a system of alarm cards has been developed and made available to the operators, defining actions to be taken in the event of a chemistry alarm.

Each TUG Chemistry Section Cl/2 and C3/4, is responsible for the monitoring and control, in conjunction with the Operating Departments, of liquid effluents directed to the nuclear auxiliary building drain sumps. In addition C 1/2 is responsible for the monitoring and control of the liquid waste treatment system (TEU). Management of the liquid effluent is followed closely with the objective of minimizing the volumes of wastes which must be treated, thereby reducing treatment costs, and minimizing eventual radioactive releases to the environment.

Management of the liquid effluents begins at the drain sumps, where samples are taken to measure radioactivity and chemical composition of the waste. Management options are facilitated by the ability to transfer the contents of one sump to another sump after monitoring.

Preparation for the management of liquid effluents produced during outages begins two weeks prior to the outage with the establishment of an Effluent Release Team comprising a Chemistry Technician, dedicated to this task for the duration of the outage, an Operations Technician and a Drainage Technician (supplied by Support Services).

(a) **Good Practice:** The establishment of an Effluent Release Team, and the dedication of a Chemistry Technician to this team for the duration of the outage, has provided a significant contribution to reducing radioactive liquid effluent discharges at Cattenom. This team studies the outage schedule, identifies the activities likely to produce liquid effluents (and probable volumes and composition based on previous outage feedback), and plans the availability of equipment and routing to minimize cross-contamination and hence minimize waste treatment and effluent release requirements.

(a) **Good Performance:** Careful management of liquid effluent has enabled Cattenom to obtain a reduction in the volumes of liquid effluent treated. This has been achieved by monitoring and segregation of effluents at the source and diverting them to appropriate treatment streams. Training of personnel to perform functions and operations in a manner which minimizes effluent production has also made a , significant contribution. These efforts have allowed the power plant to not only reduce liquid effluent volumes treated, but to reduce the levels of liquid effluent radioactivity released to less than 0.5 % of the authorized annual discharge limits (excluding tritium).

Primary coolant specifications were designed with the goals of ensuring fuel clad integrity, minimizing circuit corrosion and minimizing end-of-cycle radiation fields. Best international practice and experience available at lime of preparation was taken into account.

A coordinated boron/lithium chemistry is specified which maintains the pH at approximately 6.9 at 300°C for most of the cycle. At the end of cycle the pH value is allowed to increase to around 7.3. The international trend is to operate with somewhat higher cycle pH values pH > 7.2. EDF has submitted to DSIN a revision of the technical specifications taking international practices into account.

A morpholine-based all volatile treatment is specified for the secondary side to combat erosion-corrosion. This allows higher pHs to be obtained in the affected areas of the secondary plant while avoiding increased copper corrosion of the brass condenser tubes. The secondary chemistry specifications have also been designed to minimize intergranular attack (IGA) and intergranular stress corrosion cracking (IGSCC) of the steam generator tubes and place great emphasis on the minimisation of impurity ingress.

7.3 Chemical Surveillance Programme

A comprehensive sampling and analysis programme for both chemical and radiochemical parameters has been prepared, covering both grab sampling and on-line instrumentation. Chemistry operational procedures cover normal operating conditions and operations such as shutdown for refuelling and startup. Secondary side layup procedures are available for both wet or dry layup of the steam generators and other major system components.

The basic philosophy of the chemistry surveillance programme is, wherever possible, to use on-line instruments to monitor critical parameters. Grab samples are only taken to supplement these measurements. Only on-line instruments tested and approved by GDL can be used on site. The GDL have established a test facility at the Chinon site (the YAC laboratory) at which testing is carried out.

Systematic hideout return studies of the steam generators are not performed at programmed shutdowns unless a chemical condition has arisen during a cycle such as a condenser tube leak, which suggests a compelling reason for doing so. There is currently no directive from GDL to carry out systematic bide-out return studies. The site considers that there is no benefit and hideout return studies have been discontinued. Since it is observing strict compliance with the GDL chemistry specifications, there is no particular danger of crevice corrosion at this time.

Hideout return studies provide valuable information on the condition of the chemistry environment in the steam generator crevices during the operating cycle. While it is recognized that assessment techniques are as yet imperfect, a number of simple techniques can be applied to the evaluation of data. These techniques suggest whether the operating crevice condition would have been acidic or basic and, from the relative position of the acidity or basicity, whether corrosion is likely.

(1) **Suggestion:** Consideration should be given by the Twin Unit Group Chemistry organizations to performing hideout return studies as part of the routine shutdown programme. Hold points for chemistry should be built into the shutdown programme. In support of these studies, the Chemistry organizations should develop the capacity to perform simple data evaluations (sophisticated software to perform the evaluations is available). The information obtained should be used to help optimize the chemistry control regimes. The hideout return studies would then become part of an overall continuing quality improvement programme.

Plant response: *(June 1995) The site staff has adopted the IAEA 's suggestion:*

- *A hideout return study was performed in Unit 1 on September 18, 1994*
- *Hideout return studies have been completed for Units 4 and 1 during their 1995 outages and are forecast for all occurrences of accidental contamination.*
- *Hideout return operations have been completed in compliance with EDF Corporate Chemical and Metallurgical Laboratories' instructions (GDL).*

To date, the Corporate Chemical and Metallurgical Laboratories analyze the data obtained. The, GDL is due to provide data analysis software in 1995. Such software will enable the power station laboratories to directly perform a detailed evaluation of equipment status.

IAEA comment on status: *(June 1995) Cattenom has begun implementing this suggestion, which was consistent with the corporate (GDL) planned national programme. Currently these studies are being performed by GDL and have been performed on Units 1 and 4 this year. These studies will be completed on all four units by the end of 1996. GDL is also developing data analysis software in 1995 that will enable Cattenom to directly perform a detailed evaluation. The direction being taken is acceptable. However, several actions have not been completed. These include the development and demonstration of data analysis software and hideout return studies for Units 2 and 3.*

Conclusion: *Satisfactory progress to date.*

Regular calibration of all on-line instruments is carried out according to a given schedule. The schedule is determined according to manufacturer's recommendations, GDL recommendations and the power stations internal programme, which may decide on a higher frequency than laid down by GDL but not a lower frequency.

With respect to grab samples analysed in the laboratories, the procedures specify the type of calibration and the frequency at which it must be carried out. Calibration standards are marked with a 'shelf-life' and must be replaced if this has expired.

A specific quality control programme for the control of laboratory analyses, incorporating the use of control charts and 'blind' samples to provide assurance that their chemical measurements are correct, does not exist. Nor do the laboratories participate in an inter-laboratory comparison programme, other than a radiochemistry programme run by the French Atomic Energy Corporation (CEA). The GDL does not operate such a programme.

If a laboratory measurement is suspect a check can be performed by the other TUG Laboratory. However, with the exception of boron measurements, there is no systematic cross checking between TUGs.

(2) **Recommendation:** The power station laboratories should implement a carefully constructed quality control programme suited to their situation. This programme should include a schedule of periodic cross checks between Twin Unit Group laboratories. Such a programme would provide early warning of a deterioration in calibration standards prior to scheduled replacement dates, or systematic faults in analyses caused by equipment malfunction or operator error (highlighting the need for retraining).

Plant response: *(June 1995) The power station laboratories use a quality control system based on:*

- *The site chemistry section management document. This document describes input, monitoring and checking of results of analyses and calibration of on-line measuring devices.*

- *The programme of chemical and radiochemical analysis, and control of chemical on-fine measuring devices and of the plant radiation monitoring system.*

After the 1994 OSART mission, the site management:

- *requested the Corporate Chemical and Metallurgical Laboratories to implement a national cross check (letter dated July 20, 1994). This request lead to the creation of a working group that includes a representative from Cattenom NPP.*

- *implemented two additional inter-laboratory cross checks between each Twin Unit Group Chemical Laboratory for:*
  - *total alkalinity (ALK) - twice a year*
  - *chloride and fluoride measurements - twice a year*

The following cross checks are performed on site:

Technical Support Group -Environmental Release Section:

- ***Every third month:*** *Cross checks performed by OPRI (French Bureau for Protection against Ionizing Radiation), of chemical and radiochemical analyses of water samples discharged into the Moselle river.*
- ***Once a month:*** *Chemical and radiochemical cross checks performed by OPRI of a representative sample of all releases.*

Twin Unit Group laboratories:

- ***Once a year:*** *Cross checks of a test sample provided by the Radiation Measurement Laboratory of the French Agency for Atomic Energy (CEA).*
- ***Every third month:*** *Cross checks of boron measurements*

IAEA comment on status: *(June 1995) The Cattenom programme for quality control, including cross checks is as described in the response.*

New actions taken since the 1994 OSART include:

- *A request to GDL to implement a national cross check, which led to the creation of a chemistry working group and a national test that will be added by the end of the year. The chemistry working group also adds the potential of improved communication, coordination and improvement of chemistry activities.*

- *Additional cross checks between each twin unit group chemical laboratory for total alkalinity as well as chloride and fluoride measurements.*

The results of the cross checks have been generally good with only one check found to be out of range. A specific process is defined for out of range cross checks. The trending of results is done locally and GDL has been requested to establish a policy in this area. This programme has not identified any generic problems. Consequently, the frequency of those quality checks appears to be adequate.

Conclusion: *Issue resolved.*

(3) **Suggestion:** Consideration should be given to requesting that the Corporate Chemical and Metallurgical Laboratories operate an on-going inter-laboratory comparison programme covering all EDF nuclear plant laboratories. This would highlight any weaknesses in the overall capability of a power plant laboratory.

Plant response: *(June 1995) After the OSART mission and as per Cattenom NPP's request, a national working group in charge of defining inter-laboratory comparison policy was created in April 1994. This group is made up of chemists from various NPPs (including Cattenom) and managed by the Corporate Chemical and Metallurgical Laboratories. Its assignment is to prepare an inter-laboratory comparison programme which specifies objectives, choice of analyses, and organization.*

As a first step, this working group suggests an inter-laboratory comparison for the lithium-baron pair, in accordance with the method of analysis recommended by the Corporate Laboratories (scheduled starting date: September 1995). A meeting on experience feedback is scheduled for the end of 1995. After this initial experience, the inter-laboratory comparison programme will be definitively implemented and applied to other analyses (sodium, silica, etc.)

IAEA comment on status: *(June 1995) As described in the plant response, efforts are in progress to define and implement an inter-laboratory comparison programme. A national working group has been established to define and develop the programme. It is expected that the first comparisons (lithium-boron) will be started in September 1995, followed by incorporation of the experience gained and subsequent inclusion of other comparisons. This effort is very new, but appears to be moving in the suggested direction.*

Conclusion: *Satisfactory progress to date.*

The on-line instrument performance audit carried out by the GDL occurs approximately once every six years at each site. The useful operating life of most on-line instruments is of the order of eight years. This means that on average, each instrument will undergo only one such performance audit during its operating life. Although local cross-unit checks are performed if a reading is suspect, the fact that the GDL instruments are traceable back to national standards gives greater credence to their reliability.

(4) **Suggestion:** Consideration should be given to inviting GDL to carry out an on-line instrument performance check on a more frequent time frame, e.g. every two to three years. Given the heavy reliance and emphasis placed on on-line measurement, as opposed to grab sampling, it is important that confidence in the results obtained is assured.

Plant response: *(June 1995) A letter was sent to the Corporate Chemical and Metallurgical Laboratories on July 20, 1994 (ref. D5321/CMO/SA-477) requesting* *them to take this suggestion into account. Calibration and maintenance of chemical automatic devices involved in performance control by the Corporate Laboratories are the site responsibility and are performed in accordance with corporate policy. At the Cattenom site, compliance with this policy has always resulted in satisfactory results. GDL checks have always confirmed these results.*

On the other hand, by performing regular checks of these chemical automatic devices, the Corporate Laboratories offer an advantage over current practices and we are not aware that this practice is applied in other foreign plants. Since no problems have been identified, we therefore believe that the EDF programme is adequate. Consequently, we do not intend to comply with the suggestion.

IAEA comment on status: *(June 1995) As indicated by the response, Cattenom has reviewed this suggestion. The review clearly shows that the existing calibration checks have not identified calibration problems. For example, GDL checks have found no instruments out of the tolerance. Based on this record of performance, Cattenom sees no justification for conducting more frequent checks. The suggestion is fully addressed and rejected for acceptable reasons.*

Conclusion: *Issue resolved.*

Raw water is taken from the Moselle River (with a backup supply from Lake Mirgenbach) and pumped to the demineralized water production plant (SDP). Ferric chloride and cationic polyacrylamide are added for flocculation and coagulation respectively. The water is then filtered and demineralized. The demineralization station consists of three trains, each of 130 m3/hr capacity. Each demineralization station comprises two strong acid cation beds in series, followed by a weak base anion bed, a degasser, a strong base anion bed and finally a mixed bed. The transfer pumps were screened off for personnel protection.

(a) **Good practice:** 1.5 (a) applies.

In general the area was clean and tidy and safety precautions were observed. Efforts to reduce water usage have been successful in not only reducing the amount of demineralized water produced, but have also considerably reduced the production of sludge and non-radioactive liquid effluents.

7.4 Chemistry Operational History

The site Chemistry Sections are responsible for the satellite documentation centres. In order to effectively manage the system and ensure maximum traceability, a micro-computer based library database system has been developed by site Chemistry. This system identifies at which work station(s) documents are held and enables rapid retrieval of any document.

(a) **Good performance:** All chemistry related documents and procedures are referenced and indexed in a micro-computer based library database system, which was developed using commercially available software. This enables the chemists to readily trace documents in the system, through the use of a selection of keywords and search criteria, (eg. date, issuer, classification code, nature of document). Currently the database contains information on about 1500 documents, including 200 chemistry procedures. This is particularly useful for rapidly obtaining information concerning previous operating history during plant chemistry transients. A substantial improvement in the efficiency of retrieval of chemistry documents, particularly during plant chemistry transients, has been obtained.

Controlled copies of relevant working procedures are held at the work stations within each operational laboratory/work area. Reference to the se documents is mandated by the managers prior to any work being carried out. Plant systems diagrams (certified 'as built') were also readily available for reference at the appropriate work stations.

Comprehensive tracking of out-of-specification chemistry conditions is maintained from first observation of the condition to close out after corrective action. When corrective actions have been completed, an event history is prepared and inserted into the chemistry operational history files.

All chemistry data is entered into a computer based system developed by the corporate Information Technology Section and is part of a network system. The system is common to all EDF power plants. The graphical trending capabilities are poorly developed. In fact data has to be posted out of the database to another application to perform graphical comparisons. By contrast, tabulated data can be readily retrieved. chemistry performance indicators are graphically presented on the notice board at the entrance to the laboratory.

On-line chemical instrumentation (indicators and recorders) are only available to the control room. This information is not transmitted to the chemistry laboratories or offices. Thus real-time information, and trending of important chemistry parameters, on the effectiveness of the applied chemistry control regime is not immediately available to the chemist.

(1) **Suggestion:** Consideration should be given to locating a terminal in chemistry laboratories or offices which provides access to real-time trending of the important chemistry parameters captured by the plant process computer. Ready access to real-time information would enhance the Chemistry Sections' capacity for predictive evaluation of data and facilitate the initiation of preventive rather than corrective actions.

Plant response: *(June 1995) The current organization of the site Chemistry Sections has proved entirely satisfactory as far as monitoring of parameters is concerned. A terminal installed inside the laboratory would have limited interest.*

It could only be used for eight hours a day, five days a week (since the chemistry staff do not work on shift). In our opinion, this would not improve current results. If necessary, on-call chemists are available outside working hours. Consequently, we do not intend to install a terminal in the laboratory.

IAEA comment on status: *(June 1995) Cattenom management believe strongly that no actions should be taken that could be seen as reducing operator responsibility for chemistry. They assert that there is absolutely not a problem in monitoring or adjusting chemistry parameters. Also, since chemists are normally assigned only during the day shift, there would be a minimal opportunity for them to even monitor a terminal. For these reasons, Cattenom management believe that installation of the suggested terminal would not improve chemistry performance and could impact the operators' sense of responsibility of chemistry. Consequently, they have rejected this suggestion for reasons that are acceptable.*

Conclusion: *Issue resolved.*

A comprehensive series of feedback loops has been established on a number of levels within chemistry, within a TUG, between TUGs (regular meetings), among power plant chemistry organizations at different sites and between GDL and site chemistry to ensure that operational feedback is relayed to the workforce.

Off-site feedback occurs in two ways, via the GDL or directly among power plant chemistry organizations. If considered sufficiently urgent, information will be faxed from one power plant to another, bypassing the GDL.

(a) **Good performance:** There is a highly developed system of feedback loops to provide operational chemistry experience feedback on local, national and international levels. This system is common throughout EDF and is achieved through regular feedback meetings on site, with the Corporate Chemical and Metallurgical Laboratories Liaison Engineer, at an annual meeting of all EDF power plant chemistry managers, and, if deemed necessary, by telefax transfer of information between power station sites. Cattenom has worked to optimize this system internally, ensuring that lessons learned are readily assimilated, that procedural changes necessary to avoid repeat conditions or implement improvements, are made in a timely manner, and that the information is made available to the workforce in an appropriate manner.

For less urgent experience feedback, the GDL provides each plant with a liaison engineer. The liaison engineers meet with the power plants on a quarterly basis. The GDL also facilitates an annual meeting, of all power plant chemists, who se main purpose is operational experience feedback.

7.5 Laboratories, Equipment and Instruments

The chemistry laboratories in the TUGs are reasonably spacious and well equipped. The layout of the laboratories was developed with active participation of chemistry staff in an effort to optimize work flow.

Duplication of the laboratory facilities for each TUG means that almost complete redundancy is available to the site. However, only one ion chromatograph is available that is located in the TUG C3/4 laboratory, which performs liquid chromatographic measurements as a service to Cl/2.

Radiochemical samples are collected and transported to the appropriate laboratory for sample preparation and counting. The radiochemistry counting rooms are well equipped. The counting rooms for the TUG Laboratories are located in the respective cold laboratories. The access point into the counting room is at the entry into the cold laboratory, the reason cited being to minimize background activity levels. Although a sample hatch, providing direct communication from the hot laboratory sample preparation area into the counting room, ensures that radioactive samples are not transported past the entrance to the cold laboratory, the lack of control over personnel entry into and out of the counting room raises the possibility of accidental contamination of the cold laboratory.

(1) **Suggestion:** Consideration should be given to establishing some control (eg. step-over barrier and a contamination monitor) at the entrance to the counting rooms to provide assurance against accidental contamination of the cold laboratory area.

Plant response: *(June 1995) Since the OSART mission, radiochemistry counting rooms of twin units 1 /2 and 3/4 have been classified as "Monitored Area". This led us to:*

- *post a notice indicating "Monitored Area" and "Danger, handling of radioactive materials" on the outside of the counting room door.*
- *establish irradiation and contamination survey maps twice a year and post results thereof.*
- *require a dosimeter film badge to be worn in this room.*
- *perform a compulsory contamination check with a frisker (MIP 10) before leaving the premises.*

IAEA comment on status: *There is a very small potential for contamination in the counting room and such contamination has not occurred. Cattenom has, however, been responsive to this suggestion. Although the door area is not suitable for a step-over barrier and none is planned, other actions have been taken to* *minimize the potential for contamination and to prevent the spread of contamination if it should occur. These actions are described in the plant response.*

Conclusion: *Issue resolved.*

Laboratory housekeeping is of a high standard with all work areas being clean and orderly. Equipment is kept in allocated areas, either in drawers or on bench tops. Spillages are cleaned immediately. Instruments are in good condition and appear well maintained.

Industrial safety facilities, such as eye wash stations, showers, protective equipment and fire extinguishers, were available and clearly marked. Inflammable materials are kept in specially designed, locked flammables cupboards. Poisons are also kept in a locked cupboard. Separation of reactive chemicals, (eg. acids and alkalis) was observed.

A post accident sampling panel, located in a room remote from the normal primary system sampling room (REN), is available for primary coolant sampling. Boron measurement is available via the normal neutronic boron detector. A specially developed portable sampling device, shielded to minimize operator exposure, is used to collect reactor coolant samples. The as found situation was that none of the se samplers is as yet available on site.

A specially designed sample degassing and dilution system has been constructed for containment sump samples which can also handle the specially designed reactor coolant portable sampling devices. The system is well engineered and all operations are well shielded. Thus operator exposure is minimized. The samples are degassified to reduce contamination risks and then diluted to bring the sample into the normal radioactivity working range. All operations are deliberately designed to be performed manually to minimize maintenance and training requirements and simplify the engineering. Degassed-and suitably diluted liquid samples undergo boron and gamma spectrometric analysis.

The off-gas from the degassing operation is captured in a specially designed and shielded gas sampling device. Simples cannot be analysed on site because of the lack of a suitable connection between the sampling device and the measuring instrumentation. A modification to correct this situation is outstanding.

Containment atmosphere sampling is effected via a specially engineered mobile sampling cabinet. This cabinet is connected to the containment air sampling points (ETY) system and operated remotely. Samples are drawn into the same type of device-as used for the off-gas of the degassed liquid samples. Thus the same measurement equipment problems exist. In addition there is an outstanding modification to supply services (air, rinse water, cabinet venting and electrical power) to the sampling points.

A number of outstanding modifications prevent the post accident sampling facility from operating as intended. It is understood that implementation of these modifications is being delayed pending a joint decision on post accident needs by the DSRE and the Fossil and Nuclear Generating Plants Studies and Projects (SEPTEN). The modifications in question are the provision of services (rinse water, electrical power, venting and air supply) for the containment air sampling cabinet and a connector to transfer gases from the special sampling devices to the measuring equipment. The special shielded sampling devices for reactor coolant sampling should also be obtained.

(2) **Recommendation:** The Corporate Nuclear Operations Department (EPN) and Fossil and Nuclear Generating Plants Studies and Projects (SEPTEN) should expedite agreement over the requirements for post accident monitoring. These requirements de fine the samples to be taken and the analyses to be performed. This may result in certain of the present requirements being deleted and may make certain pending modifications unnecessary. Finalization and implementation at an early date would help to avoid the possibility of chemistry personnel being unnecessarily exposed to high dose rates.

Plant response: *(June 1995) The necessary information and the related means implemented to obtain this information are defined in a SEPTEN document (Fossil and Nuclear Generating Plants Studies and Projects) dated June 1995 (ref. EN SN 95011 A).*

1. *For any type of accident, which might occur inside the containment building the information available (core temperature, reactor building airborne dose rate) has allowed us for several years to:*

   - *evaluate potential source terms,*
   - *make the necessary decisions for the protection of the population.*

   Consequently, the modification to the sampling device on the containment atmosphere monitoring system suggested in 7.5(3) is therefore not necessary in order to help make this decision.

2. *Currently , no sampling need has been identified for beyond design-basis accidents and the related crisis management. It is therefore not necessary to take samples at the beginning of a beyond design-basis accident. For design-basis accidents, reactor building air sampling can be carried out using "normal operation" equipment (24 hours after the accident at the earliest).*

3. *In the long term (1998), in order to complement the information already available and after a corporate-level decision (expected June 1995), an automatic meter for continuous monitoring of hydrogen content will be installed in four locations in the reactor building.*

In view of the above information and the continuing post accident studies being performed by EDF, recommendation 7.5(2) and suggestion 7.5(3) are no longer considered to be applicable.

IAEA comment on status: *(June 1995) This response was totally changed during the Follow-up Visit as the result of a new analysis described in SEPTEN document, EN SN 95011 A, dated June 1995 and summarized in a presentation by the corporate DSRE representative. This analysis projects a much reduced source term for design-basis accidents. DSRE has also confirmed that the installed monitoring capability (eg. core temperature, reactor building airborne dose rate), without additional sampling, is adequate, for an accident which might occur inside the containment building, to predict results outside the plant and to protect the public. Also, no sampling is required at least for the short term (first 24 hours) after a design-basis accident. For severe accidents, it is planned to install hydrogen meters in the reactor building. At present, this parameter is assessed by calculation. Subsequently, the modification previously being considered for the sampling device for containment atmosphere monitoring is no longer necessary [see Suggestion 7.5(3)]. The question of post accident sampling continues to be studied and additional monitors may be required in the future.*

Conclusion: *Satisfactory progress to date.*

(3) **Suggestion:** Depending upon the outcome of the EPN/SEPTEN discussions, consideration should be given to completing the outstanding modifications, particularly those related to the containment air system. Provision of sampling and analytical capability in this area at least will assist the Emergency Controller in decision making regarding public safety under accident conditions.

Plant response: *(June 1995) See plant response to 7.5(2).*

IAEA comment on status: *See status for 7.5(2).*

Conclusion: *Satisfactory progress to date.*

7.6 Quality Control of Operational Chemicals

Specifications are issued by the GDL which controls the type and quality of bulk chemicals used on site. Procedures are available specifying the samples to be taken, and by whom, and the analysis to be performed prior to off-loading of bulk chemicals.

It is standard practice to manage the use and consumption of chemicals in such a manner as to avoid the necessity for handling unsealed or partly emptied containers. Thus chemicals are only prepared when needed and when it is known that the contents of a container will be completely utilized.

Housekeeping in chemical storage areas was good, with safety precautions clearly posted on the walls. The chemical preparation and injection rooms in the turbine halls were locked off from the general area.

Diesel fuel is analysed annually by a contractor laboratory. The analyses performed conform to international practice.

7.7 Radiochemical Measurements

The TUG Laboratories perform radio-chemical analysis on primary coolant samples, on baron recovery loop (TEP) samples and gaseous (TEG) effluent treatment systems. The TUG Cl/2 Chemistry Section is responsible for the monitoring and control of the liquid (TEU) effluents.

The Environmental Laboratory of the SUT is responsible for environmental monitoring on and off site and for monitoring and control of effluent discharges. Equipment for alpha and beta counting is available in all laboratories. Procedures are available for separation of alpha and beta emitting nuclides prior to counting.

8. EMERGENCY PLANNING AND PREPAREDNESS

There is a strong co-operation between Electricité de France (EDF) and the national and local authorities responsible for nuclear safety, radiation protection, security of population and the supporting organizations. This forms a very good basis for coping with a nuclear emergency on-and off-site resulting from a well defined structure, good communication systems and transfer of data from the plant computer to national centres.

The emergency plans prepared for on-site and off-site emergency management and all command posts are comparable with international practices, and procedures, generally, are well defined. Symptom-based procedures have been prepared to cope with the reactor deficiencies, and the technical resources and special technical equipment adapted to support the se procedures is available.

Training and exercises are performed at all levels to train the personnel and to identify potential deficiencies of the plans. Care is taken to feedback experience from the exercises to improve the plans and programmes.

Communication with the public is effective; well equipped press centres at the local, regional and national level ensure that the media are promptly informed about the status of the plant and the consequences of an accident on the environment.

Some good practices were identified, such as the availability of autonomous sample systems (BAP) to take samples after a radioactive release, the symptom-based procedures, the alarm system and on call system for the emergency staff and the backup station to decontaminate personnel off-site.

In some areas improvements could be achieved. Recommendations have been made to review radiation protection procedures used in normal operation and adding guidance covering special conditions in an emergency.

Overall, emergency planning and preparedness at Cattenom NPP is of a high standard. Personnel at all levels in charge of emergency planning and preparedness are motivated to improve the performance in emergency planning; they perform regular internal reviews to resolve open issues and to correct deficiencies. This reflects that a good safety culture philosophy is applied.

A new set of guidance documents have been prepared for the special actions needed to be taken to protect persons and the plant in the event of unusual events. Plant staff have assessed the dangers of off-site and on-site toxic releases as well as the risk of polluting the environment for events such as chemical releases. They conclude that such events have a low probability of occurring. Nevertheless, carefully documented step-by-step guidance is provided in the form of flow charts for staff who will be called upon to make early decisions for the safety of persons and plant in advance of the arrival of specialist staff.

Procedures that chemistry and radiation protection staff would use in an emergency which are procedures in use in normal circumstance are being progressively reviewed to ensure that additional precautions for elevated dose levels and contamination are explicitly included. Specific changes have also been made to procedures and equipment with respect to vehicles and equipment used to survey environmental conditions during a radiological emergency. These vehicles are to be stored in a fully covered garage once a new building is constructed. These measures when fully completed will further enhance emergency preparedness at Cattenom which was noted during the OSART mission to be of a high standard.

8.1 Emergency Organization and Functions

The framework of emergency preparedness of Cattenom NPP is a close co-operation between the local and national organizations of the utility and the public authorities. The decisions and actions to be taken in an emergency by the local organization of the utility and by the authorities in charge of the emergency preparedness at the regional level are supported by the national organization of EDF and its contractors and by national authorities or institutions working on behalf of national authorities.

The management of the plant has appointed an emergency co-ordinator to ensure proper planning, implementation and control of the activities on-site in an emergency, The co-ordinator is responsible for adapting the generic internal emergency plan to the site and to de fine the policy. The co-ordinator determines the composition of the command posts necessary to cope with an emergency, and is responsible for arranging exercises and providing feedback on exercise experience. ln the se duties the emergency co-ordinator is supported by staff members who are in charge of the command posts.

The local on-site emergency management organization is the Management Command Post (PCD). It is responsible for making decisions, for liaison with the authorities and off-site emergency organizations, and for providing information for the public. It co-ordinates the activities of the Assessment Command Post (PCC) that is responsible for the assessment of the radiological situation on- and off-site; the Local Command Post (PCL) that is in charge of the operation of the affected unit and of first aid; the Resources Command Post (PCM), Which has the task of protecting personnel and providing resources on-site in the event of an accident; and the Emergency Technical Centre (LTC) which has the task of analysing the situation and identifying remedial actions. In an emergency, the latter post would be supported by the national corporate organization in Paris.

The local authority responsible for emergency response and emergency planning is the Prefect, who prepares the off-site emergency response plan (PPI) and decides the actions to be taken in the emergency. He is supported by the utility and by the national organizations in charge of radiation protection (SCPRI) and nuclear safety (DSIN) and by the regional organization responsible for nuclear safety (DRIRE). The fire brigade, police, gendarmerie, medical services, civil defence organization and the army will also perform tasks in an emergency.

Due to the integration and co-operation of all organizations on the local and national level, the organization and responsibilities are well defined. The organization assures a high standard in the development of the emergency plan on- and off-site and .forms a competent basis for emergency preparedness.

8.2 Emergency Plans

The emergency plan prepared for the Cattenom NPP describes the organization and co-operation of all institutions participating in an emergency. The responsibilities for emergency preparedness on site for the utility organizations at the local and national level as well as the authorities responsible for planning and preparedness off site are well defined.

The on-site responsibilities in case of an emergency are laid down in the emergency plan. The PCD will be responsible for decisions and for liaison with the authorities. A security specialist was recently added to the PCD staff.

(a) **Good performance:** In the implementation of the Internal Emergency Plan (PUI), due to a public demonstration at the plant, it was recognized that the experience and knowledge of a specialist for site security was needed in the Management Command Post (PCD) to support the decisions in the PCD. As a result a person experienced in site security has been assigned to the PCD staff. The availability of site security experience will result in the prompt handling of security problems that could adversely affect the conduct of an emergency exercise.

The local organization on-site works in close co-operation with the national corporate organization. There are counterparts for the PCL in the corporate organization and for the LTC at the national level.

Responsibility for off-site emergency preparedness is with the regional authorities. The Prefect is responsible for planning and implementing actions off-site.

The DSIN and its technical support on the national level (Institute for Nuclear Safety and Protection of the French Atomic Energy Commission) and the DRIRE on the regional level cover the field of nuclear safety. Advice on health physics will be provided by the Central Service for Protection Against Ionizing Radiation, SCPRI.

There are agreements and contracts on local level with the police, the fire brigade, the medical transportation services and several hospitals including a military hospital to give support in case of an emergency.

The structure of emergency preparedness assures a close co-operation of all partners involved on the local and national level and forms a good basis for the management of an emergency.

The emergency plan is prepared as a generic plan for all plants and adapted to the situation at the site. It covers four classes of events encountered on-site. These classes are 'Significant Events', 'Demonstration, Acts of Aggression, Sabotage, Industrial Action', 'Non- Radiological accidents' and 'Radiological Accidents'. Criteria are set for the implementation of the last two classes. These last two classes may lead to the implementation of the Internal Emergency Plan (PUI) to cover all the actions for countermeasures in an emergency.

Those classes not triggering the PUI, eg. work accidents, small fires, persons injured and contaminated, will be dealt with by the manager on call on the basis of action sheets which are part of the emergency plan. The action sheets for some events to be dealt with by the manager on-call, do not contain guidance on special actions that might be necessary in a very short time either to protect persons on-site or to protect the technical equipment of the units. This, for instance, might be necessary in the event of releases of toxic or aggressive/corrosive material on site.

(1) **Recommendation:** The action plans for events of the classes 'Outstanding Events', 'Demonstration', 'Non Radiological Events' should be reviewed and amended, if necessary, to identify whether there is a need for guidance on special actions to be taken to protect persons and the plant in case of special events ego chemical releases. The availability of guidance on special actions to be implemented immediately would increase the protection of the personnel and of the facilities available on site.

Plant response: *(June 1995) The "Notable event" action plan is a response to events which are important to the life of the site. Our off-site partners have to be informed thereof, but these events do not put staff safety into question.*

In case of demonstration, aggression or sabotage, the staff in charge of site protection take necessary measures in accordance with the rules so as to ensure staff and installation safety.

A study based on the documentation concerning Emergency Planning and Preparedness, Cattenom Final Safety Analysis Report (FSAR) and studies on Installations Classified for Environment Protection led us to prepare an action sheet for on-call management staff. This data sheet concerns staff and site safety in three improbable cases:

- *off-site toxic danger*
- *.on-site toxic danger*
- *risk of contamination*

Furthermore, in case of on-site injury, accident or fire, first aid is given by staff members shift (Operations and Site Protection). Provisions have been added to existing procedures that define alarms to be given, initial staff actions, and require isolation of the accident area.

Training of on shift teams is scheduled for the second hall of 1995.

On a broader scale, "staff industrial safety" has been developed and clarified when the various chapters of the Internal Emergency Planning and Preparedness were updated.

***IAEA comment on status:** (June 1995) The new instructions provided for shift safety staff and the on-call senior manager (PCDI) provides sufficient guidance to ensure that appropriate actions are taken in the short term to protect staff and plant and that specialist staff from on- or off-site organizations are called in to support those managers responsible for controlling the response to the incident. The approach taken by Cattenom in considering how they should react to such incidents and the guidance they have provided to staff called upon control the emergency response could be of interest to other utilities.*

***Conclusion:** Issue resolved.*

According to the national criteria the PUI has three levels. A set of criteria for the implementation of each of these levels is provided in the emergency plan. The source term adopted and taken as an upper bound for emergency measures is contained in the plan.

The utility has a good system for alerting people to the existence of an emergency. On-site people are alerted by alarm signals according to the national alarm code with spoken messages giving more information, if necessary. Notification of personnel at home is performed by the Emergency Callout System. The system recognizes that the person has answered the telephone call and this information is available on a computer for the PCM to schedule personnel resources. There is also a special list to inform on-call personnel of their specific schedule for duty.

(b) **Good practice:** The alert system to be applied when implementing the Internal Emergency Plan (PUI) allows contact with all personnel having emergency duties by redundant means. The acknowledgement system available to the alerting system allows the confirmation that the persons have been reached by the alert and a documentation system is available to identify the persons. By this means it is possible to perform personnel management and planning in case of emergency for replacement or relief of personnel. The acknowledgement system is judged to be a good method to support the management of emergency response personnel in the event of an emergency because it allows calling people from their homes and shortens the effort for calling in personnel.

(c) **Good practice:** For the personnel working on-call, the utility has worked out a special list to inform them about the scheduling of their duties. This list not only gives the schedule for on-call services for technical support and for the position in the event of implementation of the Internal Emergency Plan (PUI) for the next week, but also gives lists of the persons assigned to a special posts in PUI. It gives the individual telephone numbers of the personnel to be contacted in the event of an alarm. The compilation of the actual data necessary to identify persons in charge of special duties, including updated information to alert personnel individually, in one document distributed to all personnel on call, is considered a good practice. This document eases the identification of specialized personnel and the alerting of these personnel in case of a need of a replacement.

Communication lines are provided and the national organization is alerted at the same time as the local organization. Information available on the plant computer is sent to the national corporate organization and to the Technical Crises Centre of IPSN as a computer display. If necessary data can be transferred via fax.

In the event of an emergency, direct communications lines, equipped with a special fax machine, are used to inform the responsible authorities in Metz (the Prefect) and authorities in Germany and Luxembourg. The information systems form a good basis for information transfer for all the organizations who need to cooperate during an emergency.

Assessment of the accident consequences is performed by the PCC on the bases of predetermined source terms or on the basis of the data acquisition system. Data taken by the measuring vehicles guided from the PCC will form the actual bases for the evaluation of an accident. The PCC and the system of applying theoretical source terms for the initial evaluation form a good approach for providing information on a worst case scenario. In the first stage of a release there may be a lack of data from actual measurements due to the small number of stations around the site that send real time data to the PCC. The data taken by the measuring stations in the stack and at the outlet of the sand bed filters have to be transferred to the PCC by fax. The vehicles used for taking samples are well equipped. Autonomous measuring stations (BAP) are also available in the vehicles and can be placed at specific locations to collect data.

An emergency planning zone (EPZ) was derived from the accident condition assumed for the plant by the national corporate organization. The plant provides data of the assessment of the accident to all institutions involved by special communication lines. Recommendations on protective measures will be given by the national organization in charge of radiation protection. This is a good solution for supporting the off-site authorities in charge of emergency management.

The planning basis for the Off-site Emergency Preparedness Plan (PPI) is the source term evaluated for the plant considering a core melt accident and a relief of the containment via a sand bed filter. The PPI has three emergency classes, which are the same as applied in the on-site plan. The authorities are alerted by phone and fax.

Communication lines with the plant also are available. For information transfer in the off-site organization, in addition to the conventional communication systems, internal lines of the Minister of the Interior and communication systems of the civil defence and the supporting organizations (eg. fire brigade) can be used. The information flow necessary in case of an emergency is well defined.

The plant supplies the results of the evaluations performed by the PCC to the authorities. National organizations also evaluate the situation. After a release samples are taken on regional level by the plant and by groups of specialists of the fire brigade. On the national level, SCPRI supports the evaluation by the taking and evaluation of samples.

According to the source term of the planning basis an evacuation zone of five km and a sheltering zone of 5 km is defined. Evacuation areas and evacuation routes are also defined. Access control is planned and will be performed by the Gendarmerie.

Logistics, transportation, medical welfare, decontamination and housing of people is taken care of by agreements and contracts with transport companies, hospitals, and the use of public institutions. If necessary the army supports further actions. Long term planning is not implemented in the PPI, but will be performed as necessary based on the situation at hand.

The public is informed about the plan, and special leaflets have been distributed to inform all families about emergency preparedness and the actions to be taken. Notification is performed by loudspeakers of the fire brigades and transmissions of wireless stations.

The emergency plan covers necessary actions to protect the public in the event of a nuclear emergency. The plan presents an integration of all regional and national organizations to protect the public, and is consistent with international practices.

8.3 Emergency Procedures

All actions to be performed by personnel in case of an emergency on-site are defined in procedures or action sheets, and provided in the command posts and in the LTC in a prepared folder. As necessary the action sheets can be used as checklists. The necessary forms for the transmission of data to the other organizations as scheduled by the plan, are provided in each command post.

Symptom (state) based procedures are used to classify the accident and to perform actions to correct the abnormal situation. The procedures prepared on a symptom (state) oriented approach 'Control by state' (APE) form a basis for the evaluation of the measures taken. These procedures are strongly linked to the event based procedures which are applied in the PCL to operate the plant and to carry out countermeasures and mitigating actions. The classification is used to evaluate the maximum potential consequences, to decide on the activation of the appropriate emergency response arrangements and measurements, and to notify and alert, to the extent necessary, the persons in charge in the command posts.

(a) **Good practice:** Procedures have been prepared on a symptom (state) based approach to guide the personnel in the control room in coping with the status of the nuclear system, to perform actions to bring the system into a safe state and to take countermeasures in the event of an emergency. The procedures are very detailed and give excellent guidance to the personnel. The procedures are designed to be implemented by the personnel in the control room in co-operation with the personnel in charge. Mutual checks and points of alignment of actions for the personnel are implemented and reconsideration of the actions is taken care of by checks of the results. The sets of procedures are stored in the control room and the respective set of procedures provided for each person in charge is sealed to assure the completeness of the set when it has to be implemented. The evaluation of the procedures and the special way of assuring completeness of the procedures assures effective action to mitigate the accident and to bring the plant into a safe condition.

There are no fixed action levels to trigger the distribution of iodine tablets (except a special procedure regarding fuel handling) and the evacuation of the site or of the control room of the unit affected. The plant manager in charge will decide on these actions on the basis of the data and the situation at hand. The development of reference levels is, however, under consideration in the national corporate organization. Except for this lack of reference levels the status of the procedures is considered to be comparable with good international practice. There is, however, some lack in guidance of the personnel in those cases, when procedures used in normal operation will be used in emergency situations. For example, the procedures for the taking of samples are well prepared for the normal operation but have no special precautions mentioned when they are to be used in an emergency situation. For example, discussions showed that specific aspects to be considered in the event of high contamination levels were not covered and there was no guidance on how contamination protection equipment such as protective gloves and overshoes should be handled. Further, the recovery of BAPs after use requires that the potentially highly contaminated BAP be placed in a car. This may lead to a high contamination inside the car thus endangering the personnel and their ability to take accurate dose rate measurements particularly with the sodium-iodine spectrometer.

(1) **Recommendation:** Procedures for actions in normal operation which also are to be performed in emergency situations should be reviewed and be amended to cover the special aspects of emergency situations (eg. high contamination or high dose rate) and to provide guidance on how to perform the tasks under the special r conditions at hand. Consequently technical equipment should be modified to the extent necessary. These actions would improve the safety of the personnel in emergency situation and keep the equipment applied in this situation operable for further use.

Plant response: *(June 1995) All sampling procedures applicable in accident situations have been reviewed so as to check their validity in case of contamination or high dose rate. Sampling procedures used by the staff that drive environmental vehicles have been modified so as to integrate special measures to be taken in incident or accident situations. The procedures applied by chemists have been validated. The sampling procedures applied by radiation protection technicians are currently being updated. This validation process will be completed by the end of June 1995.*

In case of work or checks being performed in an accident situation, maintenance staff for example may have to use procedures applying to a normal situation. These procedures have been validated for the site but if exceptional precautions related to operators' safety have to be added, they will be notified by the command post manager in compliance with instructions by Member N°5 of the Local Command Post and Member N° 12 of the Assessment Command Post. Their assignment is clearly defined in the Emergency Planning and Preparedness data sheets for these two radiation protection experts.

As far as equipment is concerned, the cable of the independent sampling monitor is now longer. The sampling monitor no longer has to be put into the environmental vehicle which avoids contaminating the inside of the vehicle.

IAEA comment on status: *The response of the plant fulfills the requirements of the recommendation. On completion of the review of the sampling procedures used by radiation protection technicians and their amendments, if found to be necessary, the issue can be considered to be fully resolved.*

Conclusion: *Satisfactory progress to date.*

The off-site emergency plan contains all procedures needed to activate the support organizations and local and national organizations, to communicate with the organizations in charge and with the public. Procedures for environmental monitoring are well defined and the dose levels for the implementation of countermeasures are fixed in the plan. Emergency resources and supporting organizations are listed in the plan giving all necessary information about the support available and how to obtain it. The plan and its procedures are periodically reviewed.

Assessment of off-site consequences are performed by the utility and by national authorities as the SCPRI and the DSIN which are alerted in case of a PUI and PPI. Details of individual protection of the personnel performing emergency duties are not implemented in the plan. The procedures given in the plan provide an effective information and guidance for the actions to be performed in case of an emergency.

8.4 Emergency Response Facilities

The PCD on-site is responsible for all decisions regarding the operation of the units, the emergency measures taken on-site and communication during an accident. One person is sent to the command post of the civil authorities to provide a liaison.

The PCC is the local organization in charge of the evaluation of releases and doses in an emergency. Under the co-ordination of the manager of the PCC, the staff calculates the releases and doses, guides and operates two vehicles to take samples on-site and off-site and analyses the samples. In advance of any release the analyses of the situation have been performed on the basis of maximum potential releases, which have been predetermined in an evaluation by the national corporate organization. If a release occurs actual data submitted to the PCC will replace the theoretical evaluation. All data are exchanged with the national corporate organization in Paris. The manager of the PCD will utilize the results as a basis for decisions.

To evaluate the radiological situation after a release the plant relies on four monitoring stations at a distance of about 1 km and four stations at about 5 km, a sampling station at the Moselle to take liquid samples for radiological analyses and two vehicles to measure and take samples. Although the system for taking samples with the vehicles is sophisticated and 49 measuring points are taken into consideration, there might be a lack of information in the event of an accidental release reaching areas which are not monitored. Improvements of the monitoring are under consideration at the Corporate level. There also is a potential that the cars used to take samples could be contaminated, which should be taken into account.

The PCM is in charge of protecting personnel, implementation of countermeasures including providing transportation for evacuation. The L TC evaluates the situation of the incident and the possible developments that might be foreseen. Analyses are performed in close co-operation with the National Emergency Team (ENC) of EDF and the National Crisis Centre (CTC) of IPSN/CEA. The LTC is located in a room adjacent to the control room.

The PCL is a on-site support organization of the PCD, located in the control room of the unit affected. The shift team, which can be reinforced by other units, is part of the PCL but will stay in charge of the normal duties of operating the plant.

The PCD, PCC and PCM are located in the security building of the site. The security building as well as the area of the control room and the LTC have ventilation systems protected by aerosol and iodine filters; the security building has an emergency power supply and is equipped with an entrance air lock and a facility to decontaminate persons entering the building. The plant has an emergency communication system based on the INMARSAT satellite communication system to provide reliable external communications. The alarm system is designed to be redundant to the extent possible and allows monitoring the acceptance of the call by the person alarmed and displaying personnel availability after the alarm. Habitability, location, equipment and status of all centres is consistent with good international practice.

(a) **Good practice:** To cover the need for external communication in case of an earthquake destroying all communication lines off-site, the plant has an emergency communication system based on the INMARSAT satellite which can be connected to telephones or telex. This system is portable and quick and easy to install on the top of a building protected against earthquake and provided with a secure power supply, eg. the safety building. The INMARSAT system can utilize several satellites and optimize the relay station necessary. It can contact the France Telecom net via any external relay station available by the satellites. The availability of a satellite communication system is considered to be a good practice in providing back up communication lines in the event of an external emergency such as an earthquake. This will ensure that reliable communications are available in those cases where the local network and even local relay stations for radio communication are not available.

In case the LTC has to move due to unavailability of the control room area, the LTC can be set up in the other unit. As there is no possibility to switch the plant computer, KIT, of the unit affected to the new location, the information on the status of the unit is lost. To resolve this problem, some changes might be considered such as relocating the LTC in the Security building since the information from KIT for the affected unit is available in the security building. Also, the information on radioactive releases from the stack is only available in the control room and the information from the detection system used to monitor the releases from the sand bed filter is available on a mobile detection panel which is transported and linked to the affected plant. To address this problem, the respective information could be directed on line to the PCC to be available for further evaluation. In this case a member of the PCL who transmits data to the PCC via the PCD, would not be necessary; the test of the mobile station would not need transport and the system would be in a protected area.

The plant operates a medical centre for medical support, measuring external and internal contamination and for iodine prophylaxis. In the event of an evacuation of the site, decontamination can be performed in the fall back station in Entrange. The planning and preparedness in this area are in line with good international practice. An environmental laboratory is located in the Same building but is separated from the decontamination facilities. The laboratory processes and analyses samples taken in normal operation. This laboratory is also a fallback measuring station in case of an emergency.

(b) **Good practice:** The unit operates a fall back station in the small village of Entrange about five km from the plant in an area which is not normally down wind. This station is designed to measure and decontaminate personnel evacuated from the site in situations when detection of contamination and decontamination could not be performed on site due to high background radiation. The fallback station is equipped with a screening monitor which allows the automatic detection of the contamination of a person in a cycle of about ten seconds. Hand-held monitors allow the analysis of the contamination in detail, if necessary, and equipment is provided to check the contamination of the screening monitor. Facilities are available for decontamination and clean replacement clothing is provided. A bus shuttle is planned to bring persons to the centre. The centre can cope with a large number of persons in an acceptable time. Water used for decontamination is collected and brought back to the plant for further processing. The availability of a fall back station enables the decontamination of personnel in those cases, when decontamination facilities on-site are not available. This facility provides personnel protection as well as preventing the spreading contamination in other areas.

The corporate organization of EDF operates a national command post as a decision centre and a national technical centre as an evaluation centre in Paris. There is a close co-operation of the respective local and national centre for evaluation and decision. The technical centre in Paris has direct access to the data of the plant computer KIT and receives regular information on the plant status by Fax. Personnel of the centres are on call and a sophisticated alarm system is provided which can acknowledge the alarm and record the answers of personnel. The technical centre is supported by staff of the vendor Framatome on the basis of a contract. The approach of implementation of national and regional centres is a good solution for support in case of an emergency. For public information EDF operates a press centre in Paris to inform the media.

The authorities responsible for off-site emergency preparedness operate a local command centre (PCF) in Metz and a support centre (PCO) in Thionville, which supplies logistical support to the PCF; DRIRE has representatives in both PCF and PCO. There are also links to the national centre of SCPRI and the crisis centre (CTC) of DSIN.

The national centre of DSIN in Paris supports the local centre. The centre of SCPRI provides technical support regarding measuring devices for samples to the local emergency authorities and evaluates the radiological situation. The centres available on national level are well equipped and are able to provide data and recommendations to support the decisions of the local authorities.

The PCF and the support centres for the public are located outside the EPZ. The PCO is in the 10 km zone with a low probability of wind going from the plant to these centres. Communication lines are provided for by phone and radio for the fire brigade, medical services and civil defence.

A press centre with communication lines available for the representatives of the media is operated at the location of the PCF, and information is provided to the public by answering machines and by an interactive telephone system.

The local centres for decontamination and housing of members of the public are considered in the off-site emergency plan and are suitably located with respect to the emergency plan and the meteorological conditions.

8.5 Emergency Equipment and Resources

The responsibilities for the maintenance, testing and operation of equipment are well defined. Each unit has adequate specific equipment available to perform countermeasures. A sand bed filter is available for each unit to vent the containment. Radiological equipment and meteorological equipment is available to measure the releases from the stack and from the sand bed filters. Cars are located on the site, with the capability to take and evaluate direct samples and to place remotely operated autonomous measuring stations at selected locations. There is a potential that both cars could be contaminated and lose the ability to carry out measurements without a background of radiation caused by the contamination. The communication means on site are of high standard and redundancies are implemented between the command posts. Equipment, especially breathing apparatus with compressed air, is available on site (eg. in the control room and the security building) for personnel protection and for intervention. In addition to the material available on-site for emergency measures, specialized supportive material is available from the national corporate organization, from the joint venture for severe accidents (INTRA), and from contracted neighbouring power plants. First aid, support by the police/gendarmerie, the fire brigade and medical support in hospitals is assured by con tracts.

(1) **Suggestion:** Consideration should be given to protecting the cars used for radiation measurements from contamination or placing them in an area less likely to be contaminated. Protecting the cars from contamination would permit dose rate and contamination measurements to be performed without increased background from the car's contamination. This would reduce the exposure of the personnel as well as ensure a consistent basis for the evaluation of the radiological situation.

Plant response: *(June 1995) As part of the implementation of a new storage room for vehicles belonging to the Technical Support Department, the construction of two entirely closed garages is scheduled for vehicles dedicated to environmental activities. Work will begin in May 1995 and be completed during the second half of the same year.*

IAEA comment on status: *(June 1995) The plant response is satisfactory. The issue can be considered to be fully resolved once the survey vehicles are permanently parked in the enclosed garages.*

Conclusion: *Satisfactory progress to date.*

(a) **Good practice** To allow taking samples off-site and on-site in various locations the cars used to take samples are equipped with remotely operated autonomous measuring stations (BAP). These stations are operated on battery supply and are controlled by a micro processor which is programmed by the computer in the cars. The measuring station is able to measure the dose rate, to take samples of the rain water and to take air samples on filters. It is possible to activate two different sampling periods for all sampling techniques and the time schedule of sampling can be preset by the programming computer. It is possible to trigger the second sampling period by a certain dose rate to assure that representative data are taken for the passage of the cloud. The data taken on dose rate measurement are read out by the computer in the car, and the samples taken can be analysed in the car with the spectrometer available. The availability of BAPs systems supports taking data in locations considered important and allows evaluation of the time dependence of the activity passing the BAP. This gives a good basis to evaluate the off-site consequences without exposing personnel except during the placement of the BAPs and retrieving the data.

Off-site equipment and resources of external organizations such as police, fire brigade, medical services, hospitals and the army, are applied off-site in case of an emergency. Special groups of the fire brigade equipped with personnel protection are available to take samples and to perform measurements in the environment. Additional support is available from SCPRI on a national level. Decontamination equipment and contamination measurement devices, resources from research institutes also can be obtained. Meteorological information and weather forecasts are available from the regional and local meteorological services. The resources and equipment are operated and maintained by the supporting organizations. The resources and equipment are well adapted to the support necessary to protect the public. The resources of the army, if necessary, also can be made available for the off-site organization.

8.6 Training, Drills and Exercises

Functions in the command posts and in the centres are assigned to persons who have normal technical functions similar to the tasks to be performed. The qualification necessary is defined for all positions of the PUI personnel. Specialized training for PUI duties is performed on the corporate or local level according to the function in the PUI. The courses are initiated by the head of the respective command post and refresher training is performed according to the specific assignment in the PUI or in the use of equipment which is used infrequently. The attendance of the personnel on training sessions and exercises is documented and reviewed by the manager in charge of the command post.

Personnel take part in training exercises for their specific tasks in the PUI and to maintain their knowledge, to exercise communications, to evaluate and improve the implementation of the technical equipment and to evaluate the availability and capability of the personnel. There are four main groups of exercises performed in the plant. Large national exercises are conducted every two years with the corporate national level, including the participation of the authorities. Eight local exercises are performed to train performance in the functions of the command posts and in achieving the co-operation necessary. Four exercises are held in the summer to train personnel that may have changed units or duties, and to cover the key personnel of the command posts. Care is taken to involve especially new people to the fullest extent possible.

The plant also performs exercises to train in the evacuation of the personnel from buildings and to test and evaluate the alarm system and to test the time taken for people on call to arrive on-site. Exercises in cooperation with the prefecture are scheduled once a year.

The coordinator responsible for the PUI evaluates the exercises. A list is prepared of personnel with PUI functions that have not participated in exercises in order to consider their participation in the next exercise. The coordinator identifies any corrective actions necessary and any special request, and ongoing work of improvement is followed up.

The system of assignment of qualified technical personnel to special positions in the PUI, of training and retraining of the personnel for the duties and tasks to be performed in the PUI functions, of exercises for the personnel and of experience feedback is well defined and is consistent with international practices.

8.7 Liaison with Public and Media

The plant operates an information centre on-site and has personnel assigned to inform groups of visitors about the nuclear power plant and its operation. Regular publications and brochures inform the public about the activities on-site. In the event of an emergency, qualified personnel are in charge of informing the media, explaining the situation at hand and supporting the journalists on-site. An audio conference link to the press centre of the corporate organization in Paris supports and harmonizes the information transferred.

Public information is implemented in the emergency plan. A special procedure has been developed in case of an emergency. The plant releases information on technical aspects in agreement with the off-site organization, whereas information about the assessment of the impact to the environment is published by the off-site organization. A well equipped press centre with communication lines, fax and audio-conference systems for the media is operated on-site in the event of an emergency. The press centre of the Prefect will take over the public information tasks regarding the status of the plant at the local level should there be an evacuation of the plant. The plant also operates a system with two persons monitoring the media responses in an emergency and taking action for correction of misinformation.

The liaison of the plant with public and media in normal operation and in case of an emergency is of a high standard that assures that good and qualified information is provided to the public by the local and national centres.

(a) **Good performance** The plant in an emergency operates a press centre on-site with 160 places for journalists. Ten telephone lines and two fax machines are provided for the media to transmit the information released by the plant. Internal redundant communication lines allow the qualified personnel in charge of the press centre to provide current information to the media. An audio-conference technique is available to contact the national press centre in Murat; material is provided to explain the situation. Additional personnel monitor the news released by the media on the basis of the information provided and rapidly correct misinformation or rumours. The integrated approach of a press centre with good communication equipment for the media and the monitoring of the information released to the public by the media to prevent misinformation, rumour and panic is judged to be a good performance in the plant.

TABLE 1

SUMMARY OF STATUS AT JUNE 1995 OF RECOMMENDATIONS AND SUGGESTIONS OF CATTENOM OSART MISSION

	RESOLVED	SATISFACTORY PROGRESS	LITTLE OR NO PROGRESS	WITHDRAWN	TOTAL
Management, Organization & Administration	-- 1S	-- 1S	-- --	-- --	-- 2S
Training & Qualification	-- 5S	-- 1S	-- --	-- --	-- 6S
Operations	4R --	1R 1S	-- --	-- --	5R 1S
Maintenance	-- 2S	-- 1S	-- --	-- --	-- 3S
Technical Support	-- 3S	1R 3S	-- --	-- --	1R 6S
Radiation Protection	2R 1S	-- 2S	-- --	-- --	2R 3S
Chemistry	1R 4S	1R 3S	-- --	-- --	2R 7S
Emergency Planning & Preparedness	1R --	1R 1S	-- --	-- --	2R 1S
R TOTAL (%) S	8R (67) 16S (55	4R (33) 13S (45)	-- --	-- --	12R (100) 29S (100)
TOTAL (%)	24 (59)	17 (41)	-- --	-- --	41 (100)

ACKNOWLEDGEMENTS

The Government of France, the Nuclear Installations Safety Directorate (DSIN), Electricité de France (EDF) and Cattenom nuclear power plant personnel provided valuable support to the OSART team.

The close co-operation between France and the IAEA in all nuclear safety activities, including the hosting of five previous OS ART missions, bas already established many personal contacts and a common basis for efficient work.

Throughout the whole mission and the follow-up visit, Cattenom nuclear power plant management, EDF corporate office staff and counterparts were open minded, cooperative and supportive in creating a productive working atmosphere. Personal contacts occasionally extended beyond working hours and will not end with the submission of the report. The efforts of the plant counterparts, liaison officers and interpreters were outstanding. This enabled the OSART mission and the follow-up visit to complete the reviews in a fruitful manner. The IAEA, the division of Nuclear Safety and its Nuclear Power Plant Operational Safety Services Section wish to thank all those concerned for the excellent working conditions during the Cattenom nuclear power plant reviews.

DEFINITIONS

Recommendation

A recommendation is advice on how improvements in operational safety can be made in the activity or programme that bas 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. Absence of recommendations can be interpreted as performance corresponding with proven international practices.

Suggestion

A suggestion is either an additional proposal in conjunction with a recommendation or may stand on its own following a discussion of the pertinent background. It may indirectly contribute to improvements in operational safety but is primarily intended to make a good performance more effective, to indicate useful expansions to existing programmes 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 an indication of an outstanding performance, programme activity or equipment markedly superior to that observed elsewhere, not just the fulfillment of current requirements or expectations. It should be superior enough to be brought to the attention of other nuclear power plants as a model of the general drive for excellence.

Good Performance

A good performance is a superior objective that bas been achieved or a good technique or programme that contributes directly or indirectly to operational safety and sustained good performance, that works well at the station. It might not be necessary to recommend its adoption by other nuclear power plants, because of financial considerations, differences in design and other reasons.

ANNEX 1: COMPOSITION OF CATTENOM OSART TEAM

EXPERTS:

DIAZ FRANCISCO, José - IAEA
NPP Operational Safety Officer
Division of Nuclear Safety
20 years of nuclear experience
Review area: Operations II

DELPORTE, René - BELGIUM
Tihange-2 NPP
10 years of nuclear experience
Review area: Operations I

DOMENECH ROJO, Miguel - IAEA
Senior NPP Operational Safety Officer
Division of Nuclear Safety
23 years of nuclear experience
Assistant Team Leader

DULAR, Janez - IAEA
Senior NPP Operational Safety Officer
Division of Nuclear Safety
25 years of nuclear experience
Review area: Technical Support

GALT, Kenneth - SOUTH AFRICA
ESKOM
15 years of nuclear experience
Review area: Chemistry

GARCES, Jose Manuel -SPAIN
C.N. Trillo I
11 years of nuclear experience
Review area: Radiation Protection

HÄUSERMAN, Rudolf - SWIZERLAND
Leibstadt NPP
28 years of nuclear experience
Review area: Maintenance

HODGES, Graham - UNITED KINGDOM
Cliff Quay Training Centre
18 years of nuclear experience
Review area: Training and Qualification

MAROIS, Hemi - CANADA
Gentilly NPP
27 years of nuclear experience
Review area: Management, Organization and Administration

MOORE, Clarence - IAEA
Senior NPP Operational Safety Officer
Division of Nuclear Safety
29 years of nuclear experience
Team Leader

PFEFFER, Wolfgang - GERMANY
Gesellschaft für Anlagen-und
Reaktorsicherheit (GRS)
14 years of nuclear experience
Review area: Emergency Planning and Preparedness

OBSERVERS

GARBA, Alois - CZECH REPUBLIC
State Office for Nuclear Safety
23 years of nuclear experience

KRAMCHENKOV, Vladimir - UKRAINE
Zaporoshye I NPP
13 years of nuclear experience

ROEDEL, Frederico -BRAZIL
Furnas Centrais Eletricas S.A.
15 years of nuclear experience

ANNEX II: COMPOSITION OF CATTENOM OSART FOLLOW-UP VISIT TEAM

<u>Experts:</u>

HIDE, K - IAEA
Division of Nuclear Safety
Operational Safety Services
Team Leader
Area of Review: Management, Organization and Administration; Emergency Planning and Preparedness

MOORE, C. E. - USA
Management Consulting Services
Area of Review: Training and Qualification; Radiation Protection; Chemistry

TAYLOR, R. - IAEA
Division of Nuclear Safety
Operational Safety Services
Area of Review: Operations; Maintenance; Technical Support

ANNEX III: SCHEDULE OF ACTIVITIES

1.	Official request from the Governor of France to the IAEA to conduct an OSART mission to Cattenom Nuclear Power Plant	4 September 1992
2.	IAEA confirmation of OSART mission	9 October 1992
3.	Preparatory meeting for OSART mission to Cattenom Nuclear Power Plant	6 April 1993
4.	OSART mission to Cattenom Nuclear Power Plant	14-31 March 1994
5.	Submission of OSART mission report to the Resident Representative of France	November 1994
6.	Official letter requesting OSART Follow-up Visit to Cattenom Nuclear Power Plant	16 November 1994
7.	OSART Follow-up Visit to Cattenom Nuclear Power Plant	12-16 June 1995
8.	Submission of OSART Follow-up Visit report to the Resident Representative of France	November 1995