NENS/OSART/94/66/F
January 1995
Distr.: Derestricted
Original: English

INTERNATIONAL ATOMIC ENERGY AGENCY

OPERATIONAL SAFETY OF NUCLEAR INSTALLATIONS

FRANCE

OSART MISSION

GRAVELINES NUCLEAR POWER STATION

15 MARCH TO 2 APRIL 1993

AND

OSART FOLLOW-UP VISIT

7 TO 10 NOVEMBER 1994

IAEA-NENS/OSART/94/66/F

OPERATIONAL SAFETY OF NUCLEAR INSTALLATIONS

UNITS 3 AND 4

GRAVELINES NUCLEAR POWER PLANT

FRANCE

15 MARCH TO 2 APRIL 1993

AND

OSART FOLLOW-UP VISIT

7 TO 10 NOVEMBER 1994

REPORT TO THE GOVERNMENT OF FRANCE

nens/osart/94/66/f
gravelines.rpt/kwh
1994-12-22

PREAMBLE

This report presents the results of the IAEA Operational Safety Review Team (OSART) review of Units 3 and 4 at the Gravelines 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 7 to 10 November 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/April 1993 mission has been revised to include the results of November 1994 Follow-up Visit.

Distribution of this OSART report is at the discretion of the Government of France and until it is derestricted the IAEA will make the report available to third parties only with the express permission of the Government of France. Any use of or reference to this report that may be made by the competent French organizations is solely their responsibility.

nens/osart/94/66/f
gravelines.rpt/kwh
1994-12-22

FOREWORD

by the

Director General

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

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

Essential features of the work of the 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/April and the text in italics relates to the Follow-up Visit of November 1994.

CONTENTS

Page

nens/osart/94/66/f
gravelines.rpt/kwh
1994-12-22

INTRODUCTION

At the request of the government of France, an international IAEA Operational Safety Review Team (OSART) of experts visited the Gravelines nuclear power plant (NPP) near Dunkerque, France, from 15 March to 2 April 1993 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 Gravelines OSART was the fifth mission to France.

The team (Annex 1) was composed of experts from Belgium, Germany, Japan, Slovenia, Spain, Sweden, the United Kingdom, the United States of America and IAEA staff members with scientific visitors from China, the Czech Republic and Hungary.

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 Gravelines, the team of experts, using techniques derived from their collective nuclear experience of 289 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 Gravelines OSART mission from 7 to 10 November 1994. The team comprised experts from Canada, the United Kingdom and the United States of America and an IAEA staff member. Two of the experts were members of the OSART mission. The purpose of the visit was to discuss the actions taken in response to the findings of the OSART mission conducted from 15 March to 2 April 1993, to comment on the effectiveness of the actions and to make judgements on the degree of progress.

During the four day visit, team members met with senior managers of Gravelines nuclear power plant and their staff to assess the effectiveness of the power plant' s response to each recommendation and suggestion given in the official report of the Gravelines OSART mission (IAEA-NENS/OSART/93/66). 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 presented in a quantitative manner in Table 1 and detailed comments are to be found against each finding in the pages that follow thereafter.

Plant description

The Gravelines NPP has six 910 MW(e) (net) pressurized water reactors (PWRs) that went into commercial operation between 1 December 1980 and 25 October 1985.

Gravelines NPP was built by Framatome and is located midway between Dunkerque and Calais. The condensers are cooled by salt water from the Pas de Calais.

Each reactor core consists of 157 fuel assemblies with 53 containing control rod clusters. Each fuel assembly consists of 264 fuel rods arranged in square array. The fuel is 3.25% enriched UO_2 with a core thermal output of 2785 MW. Units 3 and 4 contain some UO_2/PuO_2 mixed oxide (MOX) fuel elements. The primary circuit pressure is maintained at 15.5 Mpa with the coolant temperature on exit 323°C. The primary circuit is served by three loops each having a vertically mounted steam generator and a coolant pump.

Safety systems to cope with design basis accidents are provided in addition to normal and auxiliary systems. These safety systems include the protection systems, emergency power system, emergency core cooling systems, emergency feedwater system and containment systems. The protective systems initiate a reactor scram or activate other safety functions whenever the limits of the safe operating range are approached. The emergency power system comprises two diesel generators and associated controls for providing power to the emergency core cooling systems, emergency feedwater system and containment systems. The emergency core cooling systems have enough capacity and redundancy to maintain core cooling until the reactor is in a safe cold shutdown condition within pressure boundary limits. Subsystems of the emergency core cooling systems include the three high head injection pumps, two low head injection pumps, two residual heat removal pumps and three core injection accumulators.

The emergency feedwater system for the supply of the steam generators is a three train system. The system consists of two motor-driven pumps and one steam-driven pump and a large auxiliary feedwater storage tank.

The nuclear steam supply system and its high pressure auxiliaries are contained within the reactor building which is made up of a prestressed concrete containment with a steel liner. The inner height is 60 metres and is of a leak-tight design to confine the effects of the most improbable severe reactor damage to the interior. The outer prestressed concrete wall is capable of withstanding external impacts including that of an aircraft.

Main conclusions

Eight areas were subjected to an in-depth review by the experts who covered the areas of management, organization and administration; training and qualification; operations; maintenance; technical support; radiation protection; chemistry; and emergency planning and preparedness. Special emphasis was placed on the application of safety culture at Gravelines.

The overall mission results indicate that Gravelines has a1ready reached a good level of nuclear safety and quality performance. It is the policy of EdF to display transparency in the operation of its nuclear power plants and in the reporting of events. This is indicated by the good working relationship between EdF and the regulatory authority DSIN and the willingness to participate in international safety reviews such as the OSART programme.

Many commendable features were noted during the review of Gravelines. For example, considerable emphasis is placed on the implementation and achievement of plant and personal goals and objectives through the effective use of management contracts. In-plant training is enhanced by the participation of supervisory personnel. High quality maintenance is achieved by the use of Quality Safety Plans, work coordination meetings and detailed work procedures. High standards are set for housekeeping, the storage of equipment and the material condition of plant systems. Modifications to procedures and plant equipment are well controlled by effective planning, good use of resources and the proper use of experience feedback. There is a good radiation protection programme which encourages employees to be aware of radiation hazards and to take the necessary precautions.

The OSART team also made a number of proposals for management's consideration to improve plant activities. These improvements are primarily intended to stimulate the plant management and staff to consider ways and means to enhance existing programmes and to make performance more effective.

For example, even though there is an EdF corporate quality and nuclear safety policy, communication of this policy should be directed to individual employees in addition to the management level. There could be improvements made in internal communications and the coordination of management presence at the work place. Improvements could also be made in the performance of the industrial safety programme by placing more emphasis on accident prevention and the responsibility of individuals for their own safety. There should be more emphasis placed on refresher training and the evaluation of team training at the simulator. The experience feedback process could be improved by further developing the on-site capability to analyse significant operating events, in particular those events involving human error. Additional precautions should be

taken in the chemical laboratories to prevent the spread of radioactive contamination. Initial training of personnel relating to the
responses to be taken in the event of emergencies in the plant could be improved. There should be more drills and exercises in which responses to emergency events are practiced.

There is an excellent commitment to nuclear safety at Gravelines as well as a willingness to make improvements. The concept of Safety Culture is receiving good attention at the corporate and plant management level. However reinforcement is needed at other levels by improving communications, placing more emphasis on supervisory skills and reviewing the working relationships between the corporate departments and Gravelines NPP. The implementation of the OSART recommendations and suggestions will contribute to the goal of maintaining safe operation at the Gravelines NPP.

The Follow-up Visit team found that excellent progress has been made addressing and resolving the finding of the 1993 Gravelines OSART mission. This is the outcome of tremendous efforts of the staff of Gravelines nuclear power plant and EdF. Solutions had been identified, developed and corrective actions tracked to completion. The enthusiasm of the various groups of staff in tackling the issues was evident. The vast majority (97%) of the issues have been fully resolved or are progressing satisfactorily to completion. Only a few issues (3%) have made little or no progress.

The plant is planning important changes through the vehicle of the 'Five Projects'. When fully implemented with the new organizational structure they should have a beneficial influence on the operation of the plant not only in short term but also in the medium/long term. The Follow-up team believes that these changes will lead to the full resolution of the issues raised by the 1993 OSART.

The Follow-up team has seen improvements at Gravelines NPP in communicating EdF's policy related to quality and safety to the employees. This includes recent initiatives aimed at encouraging workers to develop good habits of a questioning attitude in the rigorous application of a sound safety culture as exemplified by the IAEA's publication, Safety Series No. 75-INSAG-4, Safety Culture.

The establishment of a centralized training organization for the site and the installation of a full scope simulator will significantly enhance the initial and refresher training of staff including the development of team work skills. Good progress has already been made in this area.

In response to comments of the OSART mission, Gravelines NPP has nominated an engineer experienced in human factors, who will assist in reviewing human performance in the analysis of events.

With respect to training in emergency response duties the plant has formalized the arrangements: specifications have been produced together with planning and monitoring arrangements.

Considerable improvements have also been made in response to other recommendations and suggestions made by the OSART mission. At the same time, much remains to be done to complete the actions planned in response to the OSART mission. Significant changes have been or are soon to be introduced. Care will be needed in their implementation. Also, just as important, the effectiveness of the changes must be monitored and corrective actions taken as necessary. The commitment of Gravelines NPP management and supporting EdF departments to continue progressing the response to the OSART recommendations and suggestions will be important to the continued enhancement of the operational safety of the plant.

1. MANAGEMENT, ORGANIZATION AND ADMINISTRATION

All nuclear operating facilities within EdF are managed by Nuclear Power Plant between Operations Division (EPN), which is part of the Generation and Transmission Group (DEPT).

The corporate organization of EPN is designed to ensure a coordinated functional support to the plant manager and a number of lateral organizational groups have been genuine recently established to assist in this.

The strategic planning process 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. The communication of corporate policy to all employees should be more direct together with a review of the frequency and method by which power plants are subject to an overall review process.

The plant management organization is well defined and effectively directed towards achievement of safety and quality objectives. The management team is competent and well qualified and adopts a professional approach in all areas.

The excellent progress made in the acceptance and pursuit of safety and quality objectives between each management level should be extended to encompass all groups of employees. This could be further enhanced by improvements in communication and a more coordinated approach to improving the current arrangements to achieve regular management presence at the work place.

The Quality Assurance Programme is well structured and documentation standards are high. The capability to perform human factor analysis following events should be improved and integration of action tracking systems that are used throughout the power plant could improve the overview capability.

The documentation control process is well structured and effectively controlled and implemented. However, there is some scope for reviewing and improving the archive storage arrangements.

The arrangements directed to the achievement of industrial safety are well defined and supported by high standards of site housekeeping and equipment storage arrangements. Improvements could be made in the pro-active elements of the programme directed to accident prevention and an individual responsibility for this aspect should be considered.

The plant management is fully committed to achieving a strong safety culture on the part of all employees. The discussions with staff confirmed their safety awareness. Further development should be directed towards improving effective communications between management and staff to ensuring that safety and quality objectives are jointly accepted and developed.

The responses by EdF corporate management and the plant management of Gravelines NPP to the OSART recommendations and suggestions in this area represents a genuine effort to achieve improvement.

Specifically the major local initiative, comprising the five identified priority projects together with the FORCE 6 organizational restructuring is a most acceptable response by Gravelines NPP management to resolve the root causes of issues which were contributory to many of the recommendations and suggestions raised by the original OSART mission. This initiative, although in its early stages of development and application, has been seen to have made progress in improving communication and common understanding between plant management and staff in the achievement of improvements in quality, safety and overall plant performance. The plant management have made positive efforts to strengthen the competence and expertise at Gravelines NPP and to focus and direct this resource to the benefit of the whole site.

In order to secure a process of continuous improvement in quality and safety the initiative directed to achieving unity of purpose between management and staff will need to be continued as a high priority. Visibility by management at all levels in the workplace has now been regularized and this should be developed to encourage staff to achieve high levels of performance of quality and safety during the execution of their work.

Action has been taken to achieve improvements in industrial safety and the results are clearly evident in the performance measures. However, it is considered that there is still scope for further improvement in this area by the development of a more systematic approach targeted at areas of weakness.

1.1 Corporate organization

Nuclear power plants in EdF are the responsibility of the Generation and Transmission Group (DEPT), specifically this responsibility is delegated to the Executive Vice President of the Nuclear Power Plant Operations Division (EPN).

As a result of the large investment in nuclear power by the Government of France and the high degree of standardization employed, the organization of EPN includes extensive central support functions.

The current structure of EPN, and the delegation of responsibilities within it, is influenced strongly by the desire to maintain standardization of the nuclear power plants in order to minimize the support resources required and to maintain consistent levels of performance and safety at all nuclear power plants. The structure of the organization is designed to ensure coordinated functional support to line management and contains a number of lateral organizational features to achieve this.

The strategic plan of EPN covers a three year period and is approved by the Generation and Transmission Group Management Committee. This plan assigns overall common objectives to the nuclear power plants and forms the basis on which the individual site plan is formulated and approved. This site plan is then implemented by a formal management contract, agreed on an annual basis, between the corporate line management and the plant manager. This management contract embraces all key objectives relating to safety, resources and performance.

Nuclear safety policy in all nuclear power plants is formulated by the corporate nuclear safety department and approved by the EPN management committee. This department, together with the Experience Feedback Promotion Team, forms strong co-ordination and monitoring roles to identify any areas for improvement. At the nuclear power plant the plant manager is responsible for compliance with safety policy.

A corporate policy directive on the subject of nuclear safety was issued by the Director General of EdF in January 1990 and circulated via the management chain to all Managers. However, there is currently no visible clear simple statement of corporate nuclear safety policy or corporate quality policy directly issued to all staff. It is acknowledged that it is the intention of EPN to issue a new Quality Management Manual together with a statement of corporate quality policy. It is intended that this will be introduced in late 1993. A similar approach is to be adopted for Nuclear Safety Policy and this is expected to be completed in 1994.

(1) **Recommendation:** Statements of corporate quality policy and nuclear safety policy should be available and directly communicated to all staff on an individual basis, detailing responsibilities of individuals and the commitment of corporate management to the promotion and assessment of quality and nuclear safety.

Plant response/action: *(July 1994) A new edition of Nuclear Safety Summary will soon be issued to all the personnel on all nuclear sites. This document describes all the provisions adopted by EdF to ensure safety during the design, commissioning and operation of nuclear power plants. It clearly indicates that beyond the rules and procedures described, the guarantee of safety depends on the commitment of each individual, in the spirit of INSAG-4.*

This document also underlines the commitment of EdF's General Management and the Nuclear Site Management to the respect of safety rules.

IAEA comment on status: *(November 1994) The new edition of Nuclear Safety Summary issued to all employees at Gravelines NPP in October 1994 together with the recent issue to plant management of the Corporate Quality Policy documents is recognized as a clear statement of commitment by EdF to the promotion and assessment of quality and nuclear safety. The issue of Nuclear Safety Summary at Gravelines NPP was accompanied by a personal letter from the Plant Manager. This could be further re-enforced by a site specific policy document issued to all staff which describes the local organizational responsibilities, which are directed to ensuring safety and quality within Gravelines NPP.*

Conclusion: *Satisfactory progress to date.*

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 relating to drugs.

(2) **Suggestion**: Consideration should be given to providing a corporate policy relating to drug use.

Plant response/action: *(July 1994) The Corporate Nuclear Power Plant Operations Department (EPN) together with the Industrial Medicine Department of EdF-GdF has defined an alcohol policy. This policy led to the publication of Instruction IN29.*

Gravelines NPP has extended the directives of Instruction 29 by a series of internal actions:

- *Reminder of the prohibition of alcohol drinks on worksites (internal regulation)*
- *Informing management, supervision and staff of the dangers of alcohol: the product, taking care of the habitual drinker and acute alcoholism*
- *Development of a Good Conduct Charter*
- *Setting up 'Alcohol Groups', supervised by works doctors, with the objective of publicizing alcohol effects and listening to staff problems.*

In so far as drugs are concerned, the policy is little different.

- *Close medical surveillance of staff with individual monitoring accompanied by possible biological checks. The checks and monitoring are the* *responsibility of the works doctor. Staff can be sanctioned for lack of aptitude, in particular for posts involving safety, or by compulsory medical guidance.*

- *Individual or collective health information conforming to current rules.*

The actions we are taking at Gravelines NPP are possible as a result of several factors, namely:

- *The presence on site of our works doctor*
- *Good knowledge of the state of health of our staff as a result of continual medical monitoring throughout their professional career (two checks per year for controlled area workers, one per year for the others)*
- *Close collaboration between the site doctor and our contractors' works doctors because of the requirements of the Decree of 20 February 1992 concerning 'services or work done by a contractor on an EdF or GdF site'.*

IAEA comment on status: *(November 1994) Clearly, EdF have recognized and responded to the need for a policy related to the consumption of alcohol and the possible detrimental effects on individual performance. At Gravelines NPP this has been followed up by a series of actions directed to the avoidance of such problems. With respect to drugs, guidelines are only issued to site medical staff, which results in observation and surveillance during routine medical checks. This could be followed by biological checks in certain cases if recommended by the works doctor. This strategy would benefit by being issued as the formal policy of EdF and be clearly visible to all employees. Further improvement could result from a programme directed to the training of supervisors to detect symptoms related to drug abuse together with appropriate remedial actions and a programme aimed at ensuring general awareness of the dangers related to drug abuse directed to all staff.*

Conclusion: *Satisfactory progress to date.*

Promotion of safety culture at all levels in the organization is a declared aim of corporate and plant management. This is currently the subject of a special study by the corporate operations division at four pilot sites and is currently being actively discussed at plant management level.

Supporting functions within EPN are provided from the Head Office Central Resources Group. More specifically this group provides services in three areas:

(a) Operating Support
(b) Corporate Services Support
(c) Co-ordination Teams

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 against specific objectives and indicators in strategic plans and annual management contracts. They are assisted in this task in a number of ways:

(a) The Plant Safety Review Committee, chaired by the Vice President for Technology, meets monthly to analyse matters relating to plant operating safety and quality, particularly on the basis of inspection reports by the Nuclear Inspectorate Department of EPN.

(b) The Plant Operating Review Committee chaired by the Vice President for Technology is the decision making body for all technical matters of a corporate nature, in particular proposals for modification.

(c) Management contracts are a short term management tools detailing the annual commitment from each tier of management to the next tier above. The commitments are clearly stated to make it possible to monitor progress by key indicators relating to safety, and general management. Periodic monitoring is organized to enable corrective action to take place and, at the end of the contract period, a report analysing variances is prepared.

Good practice: The use of management contracts is an excellent way of increasing the awareness of safety at all levels of the organization and provides the motivation to improve performance in all areas.

Internal monitoring arrangements are further supplemented by regular financial and legal audits at all levels, and by inspections directed by the Inspector General for Safety within EdF and boy the internal Nuclear Inspection Department within EPN. The inspections by the Nuclear Inspection Department include overall annual inspections which cover all aspects of nuclear safety at power plants, inspections directed to specific topics, a spot inspection following an incident or at management request.

Some peer review inspections (VISUREX) are conducted by EPN plant staff and staff from Belgian, French and American nuclear power plants.

The frequency of independent inspections covering <u>all</u> aspects of nuclear safety is relatively low on an individual plant basis. Typically one plant per year within EPN by the Nuclear Inspection Department and two VISUREX inspections per year.

(3) **Suggestion:** Consideration should be given to establishing a peer review system, internal to EPN, made up of staff from all levels within nuclear power plant departments that will increase the frequency of a total review per plant, propagate good practices, identify weaknesses and contribute to improvements in the safety culture of an participants.

Plant response/action: *(July 1994) The system for monitoring performance on the different nuclear sites is undergoing changes at corporate level. It will be based, eventually, on three types of evaluations:*

1. *International evaluation: This consists of OSART missions at a frequency of one site per year, followed systematically by a follow-up mission, and of WANO peer reviews (one per year on average).*

2. *Self-evaluation: A self-evaluation methodology for each site is being finalized. In 1994, it has been tested on three sites (Chinon, St. Alban, Blayais). This evaluation is carried out by appointed members of the plant in question, specially trained in the audit method. The SQT of each site coordinates the evaluation process and the synthesis, which is passed on to the Management at corporate level. This type of evaluation corresponds to the INSAG-4 principles (a questioning attitude adopted by the site towards its overall performances in the area of safety).*

It is planned to have one self-evaluation every three years.

3. *General safety evaluations: In addition to the self-evaluation carried out by each site, there will be peer review type evaluations carried out by personnel not belonging to the site, with a frequency of one every 3 years for each site (with some serving as rehearsals for OSART evaluations).*

The evaluation team will be made up of approximately 15 people:
- *half of them specialists (corporate level departments, EdF Nuclear Inspection Team)*
- *half of them peers from other sites.*

The current schedule provides for around 6 evaluations in 95 and around 7 each year as from 96.

IAEA comment on status: *(November 1994) The proposals by EdF represent a commendable response to this suggestion. The two stage approach of self evaluation complemented by a programme of peer evaluations, will result in a self evaluation on each theme at an interval of two to three years per plant. The peer evaluation programme will result in 6 to 7 evaluations Per year throughout EdF* *plants. It is pleasing to note that a significant proportion of the proposed peer evaluation teams will be composed of peers from other EdF plants drawn from all supervisory and management levels of plant organizations. When fully implemented this programme should make a significant contribution to increasing staff awareness of safety and quality standards together with a propagation of good practices across all sites.*

Conclusion: *Satisfactory progress to date.*

1.2 Plant organization and management

Gravelines nuclear power plant has six nuclear units each of 900 MW capacity and these are directed by the Plant Manager, who 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 clear delegation of authority from the plant manager 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, that are responsible for activities across the whole site.

The five groups are:

(a) Three Generating Twin Unit Groups (SUC)
(b) One Site Technical Support Group (SUT)
(c) One Site Administrative Support Group.

The three teams are:

(a) The Safety and Quality Team (MSQ)
(b) The Internal Audit Team
(c) The Information and Communication Team.

The site management philosophy is one of assigning full responsibility to each sub-group manager responsible for operation. 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 Power Plant Manager, together with the Deputy Site Manager and managers of the groups and the leaders of the teams, form the Management Committee, which meets regularly to monitor and discuss matters relevant to the site as a whole and to formulate and agree matters of policy. To assist the Management Committee there are three specialized committees directed by the Deputy Site Manager: The Plant Safety Review Committee; the Financial Committee; and the Data Processing Review Committee.

The Plant Manager ensures that decisions made are correctly applied across the site, by independent checks performed by the MSQ in the field of safety, and in other areas by the Internal Audit Team.

At the sub-group level (SUC), the Twin Unit Manager of Units 3 and 4 has full delegated authority related to energy production and the availability of materials and is responsible for plant performance, nuclear safety quality, general safety and radiological protection, within the framework of constraints imposed by SPT with respect to placement of unit outages.

With regard to maintenance, the SUC Manager is responsible as the owner of the plant, and is responsible for implementation of his own maintenance programmes and for the nature and quality of the work undertaken. SUC has its own resources for performing these tasks. With respect to major maintenance tasks and shutdowns, the SUT Manager provides a full maintenance engineering service as a prime contractor.

The organization of twin unit group 3/4 is clearly defined in organization charts and management procedures. The structure is composed of the Manager, Deputy Manager, Engineering Coordinator and two department heads, one responsible for generation and the other for maintenance support services. The management team is supported by an Industrial Safety and Radiological Protection Section, a Quality Supervisor and an Administrative Section.

A separate committee is established, to deal with unit outage safety matters. This committee is established over the period of a refuelling outage to ensure that all changes of plant state are carried out in strict accordance with the plant safety report. This committee together with hold point procedures and check sheets constitute a quality assured system for safe startup.

(a) **Good practice:** The establishment of a unit outage safety group to over-see safety during the outage period is commendable and contributes to a quality assured outage management system.

Selection and promotion of senior management staff are done centrally by a career development process, as a result of an overall staff appraisal system. Individual management contracts form the basis of the personal performance appraisal system down to section head and team leader level. These contracts include safety and quality targets. The staff appraisal system is being implemented for all individual members of staff. Currently 70% of staff have had an individual performance appraisal. Plant objectives are set via three year strategic plans that are 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 all indicators specific to each contract. The management contracts contain clearly stated safety and performance related targets that are quantified and are easily monitored by indicators and are an excellent means of achieving improvements in quality and safety. However, additional improvement could be made in the overall process by further development of performance indicators at lower levels in the organizational structure and communication of the se indicators to all staff members.

(b) **Good performance:** The extent to which management contracts setting individual goals have been developed together with a high achievement in the implementation of individual appraisal is commendable.

(1) **Suggestion:** Consideration should be given to the development of safety and quality indicators relevant to natural work teams of employees. Team leaders need to be better informed and trained to effectively communicate information between senior management and staff. Regular team briefings will form the basis of improving safety and quality awareness of all staff.

Plant response/action: *(July 1994) As has been stated in the introduction to this document, internal communication (between management, supervisors and staff) was seen as being a weak point during the development of the Site Strategic Plan (diagnosis of strengths and weaknesses).*

To remedy this, it was decided to set up a Management/Communication Approach for the whole site to:

- *formalize management principles for the site by clearly defined objectives linked to those of EdF*
- *place responsibility for human resources at the centre of management in order to improve overall quality and performance*
- *progressively give supervisors the ability to communicate EdF's challenges and the plant's objectives.*

This approach will be instituted mainly by means of the management contracts negotiated between Heads of Departments and the Plant Director. In particular, these contracts set out departmental policy for human resources management in the medium term and development of internal communications for 1995.

Special actions affecting all teams have been instigated In 1994. Firstly, meetings have been held with supervisors for presentation and discussion of the Plant Strategic Plan. These meetings focused on the aims of the plant, in connection with those of EdF, and aim at improving safety and competitively thanks to significant progress in quality. In addition, developments envisaged in management and maintenance were also presented to all staff at two general meetings in June 1994. This gave the opportunity to present the plant's main quality and safety objectives.

Furthermore, within the framework of the Site Operations Project, four seminars have been held with operating team supervisors and two plenary meetings with the Plant Director, Heads of Operations Departments and shift team supervisors. All these seminars, which took place in the first half of 1994, enabled the main objectives for progress to be made coherent and the principal lines for development of Operations Departments organization to be shown.

These objectives and developments will now be discussed with all operations staff within their departments using methods adapted by each department management team (second half of 1994. A similar approach is envisaged with maintenance supervisors in the framework of setting up a unified site maintenance management structure (second halfof1994).

The setting up of quality and safety indicators for each team's work has not been pursued as a priority task given the significant actions taken for development of site organization and management.

IAEA comment on status: *(November 1994) The plant management at Gravelines NPP have recognized the need to improve communications throughout the organization to achieve improvements in quality and safety awareness. This is also recognized to be a key factor in improving the commercial performance of the plant. This has resulted in a major initiative involving major projects directed to achieving a sharper focus of responsibilities covering key activities across the site. This has been accompanied by a considerable increase in management activity directed at improving the awareness of all supervisors on the Plant Strategic Plan and also extensive discussions with all staff within operations and maintenance directed at the achievement of quality and safety objectives. It is recognized that a good start has been made by the plant management at Gravelines NPP and that* *successful implementation of the full extent of these changes will require a sustained effort for some time in the future.*

Conclusion: *Satisfactory progress to date.*

Records relating to the completion of work required by the General Operating Rules (RGE) are distributed in a number of separate manual and computer based systems. It is acknowledged that these records are well managed by the individual responsible groups. However, a total overview of compliance would be improved if a common system of recording were used for all work.

(2) **Suggestion:** Consideration should be given to establishing a common database for the recording of all safety related work.

Plant response/action: *(July 1994) Two independent databases are currently used. The first, SYGMA, is a Maintenance Management System and is common to Generation and Maintenance Departments but mainly aimed towards maintenance. The second, 'Events File " enables all impol1ant unit events to be gathered. These events are by nature linked to equipment functioning. An event does not necessarily give rise to a request for safety related work. The two databases are currently independent.*

Within the framework of a national initiative, the SAPHIR analysis system for recording experience feedback, was set up on site at Gravelines in June 1994. This will enable better use of experience feedback as the software is more user friendly and will also link the two current systems. Maintenance on equipment will therefore be able to be linked to an event which happened on the unit.

This system has the following characteristics:

- *single experience feedback information source*
- *link between local and national level*
- *link between an event and associated maintenance (overall view)*
- *various levels of analysis: operation, - maintenance - safety.*
- *wide accessibility*
- *transverse application (all specializations)*
- *ease of use.*

Recording work either by event or by maintenance work will greatly assist with safety analysis.

IAEA comment on status: *(November 1994) 80 people on site are trained in the use of SAPHIR and the goal is 150. Up to 400 situations (i.e. events and incidents) per unit per year can be stored and analysed in SAPHIR. The system is* *a tool for use by both Operations and Maintenance. SAPHIR and SYGMA (the maintenance management system) will be interconnected in 1995 and the SAPHIR system will also be connected to a corporate database in the future.*

Weekly meetings are held to discuss information in SAPHIR, to prioritize situations for analysis, decide and discuss actions, etc.

Conclusion: *Issue resolved.*

The physical presence of management on the site and in the work place is carried out at all levels but tends to be on an informal random basis. Management presence at the work place can be a major contribution to the promotion of quality and safety and demonstrates management commitment to this area.

(3) **Suggestion:** Consideration should be given to changing the current arrangement so that management tours of work areas are co-ordinated and planned on a regular basis, in order to ensure coverage of all work areas at an appropriate frequency.

Plant response/action: *(July 1994) Regular worksite visits have been organized for the various sub-units. They are subject to special scheduling and follow-up action.*

IAEA comment on status: *(November 1994) Management tours of work areas directed to indicating management commitment to safety and quality have now been co-ordinated and planned on a regular basis. The system that has been evolved is now visible and auditable and should contribute to regular contact between management and staff at the work place.*

Conclusion: *Issue resolved.*

The process of experience feedback is actively pursued within operation maintenance and radiological protection areas within the site organization. An overview of safety related events and incidents is maintained, analysed and trended at plant level and is the subject of more detailed analysis at corporate level.

A local nuclear safety policy statement has been issued by the plant management at Gravelines and forms part of the site policy documents. The Shift Safety Engineers are the persons responsible for staff safety concerns. A number of publications have been circulated to staff both from corporate level and at site level in order to raise safety and quality awareness. A new training course has been launched to promote safety culture as detailed in INSAG-4 and safety awareness. At departmental and section head level, regular plant tours are established on a formal basis, and on an ad hoc basis for senior managers.

For a large site like Gravelines, good internal communications between senior management and staff are a particularly important feature for promoting safety and quality awareness.

(4) **Suggestion:** Consideration should be given to improving the communication of management messages relating to safety and performance to generally assist in improving staff awareness. A possible way would be the installation of an electronic communications system, with display monitors in areas frequented by staff.

Plant response/action: *(July 1994) It is planned to install a video communication system on site in 1995. In the first stage (first half of 1995), the main administration buildings will have video screens linked to a site network and connectable to the national network. This network will be progressively extended in 1996 within each building.*

IAEA comment on status: *(November 1994) The plant management at Gravelines consider that improvements in communications is a major component of their improvement programme. A head of communications has been appointed and a communications strategy has been prepared directed to all aspects of internal and external communication issues. The proposed installation of an electronic communication system forms part of this strategy and staff surveys conducted at regular intervals is intended to be a measure of successful implementation.*

Conclusion: *Satisfactory progress to date.*

(c) **Good performance:** A number of excellent promotional documents have been issued by the MSQ team, aimed at increasing staff awareness of safety and quality. In addition, one booklet was produced by a team of maintenance staff, to promote safety and quality in the maintenance area, and is a positive indication of staff awareness and involvement.

The plant has benefited from a recent review of administrative and control procedures. Site policy documents and procedures were clearly identified and distinguishable from subunit application documents. Documents were subject to a defined process of review control and authorization, and form part of the overall quality assurance arrangements for the site.

(d) **Good performance:** The standard of documents throughout the site is particularly high, well ordered and controlled.

1.3 Quality assurance programme

The basic rules relating to the setting up of QA are defined in the National Quality Management Manual (MNOQ). The site documents are developed from these rules and form the basis by which quality assurance is achieved in all activities relating to nuclear safety. The Safety and Quality Team (MSQ) carries out independent audit and analysis and provides advice and support. QA training is a feature in all training programmes and is supported by specialist staff from the corporate nuclear safety department and by staff from MSQ. The plant safety committee is involved in the approval of all procedures in the site Quality Assurance Manual directly related to nuclear safety activities.

The QA programme is monitored by scheduled audits carried out by MSQ. These are formulated for a six monthly period and are approved by the site safety committee. Effective controls are applied to cover changes in operating status and changes to configuration of the plant during outage and subsequent startup. Significant incidents are examined at the site for root cause and subsequently by specialist groups at corporate level. Safety related events, and maintenance anomalies are also recorded as required by the appropriate reporting criteria.

The site QA policy is implemented rigorously in accordance with certain basic principles. The execution and verification of tasks are carried out by different people and quality checks are carried out by persons independent of operational departments.

Quality assurance systems are in place for implementing temporary operating procedures in accordance with the established principles. This also applies when temporary changes to the plant are required in conjunction with maintenance activities. However, the adequacy of the temporary arrangements should be fully assessed in relation to the safety system to which they are applied.

(1) **Suggestion:** Consideration should be given to the adequacy of the current safety evaluation of temporary changes to plant and operating procedures, and the authorization level at which it is currently carried out, to ensure that it is appropriate in all circumstances.

Plant response/ action: *(July 1994) The reinforcement of the strictness of operating procedures is a key point of the Operations Approach being carried out in French nuclear power plants. To attain this objective requires a permanent guarantee of the level of installation safety and also that this is not degraded during development of temporary operating procedures. Locally, from the development stage of such an instruction, an interrogatory process is carried out based on its impact on permanent operating instructions and the reason for its existence (temporary modification, equipment malfunction, etc.).*

At the very least, for temporary procedures affecting safety related equipment, an additional check is carried out by the operator (Operations Manager) and subsequent verification by safety engineering.

The number of temporary operating procedures is monitored by each generated department with a view to their reduction.

IAEA comment on status: *(November 1994) Temporary changes to plant equipment and operating procedures require the same level of verification as permanent changes. Temporary changes are presently verified by the shift technical engineer in the present shift structure. In some cases this could be considered not to be independent verification. With the new shift structure which comes into effect in March 1995, the shift supervisor will have a higher level of technical competence but there will no longer be a second engineer, or technical advisor on shift. A new document has been produced which defines the responsibilities and activities for plant operation. This document identifies those activities, which require independent verification and by whom. Temporary changes to safety related equipment and procedures are to be verified by the safety and quality engineering section (MSQ).*

Temporary procedures are retained in a special binder in the control room and are to be reviewed every two months. The station policy is to keep the number of procedures to a small number (< 20 per unit).

Conclusion: *Satisfactory progress to date.*

In some instances at the working level, the totality of documents associated with a single task and the number of signatures involved could result in a lack of ownership and prove to be a demotivating feature to the point that quality of work may suffer.

(2) **Suggestion:** Consideration should be given to establishing a working group comprising representatives of staff and management to review this situation and consider ideas for rationalization.

Plant response/action: *(July 1994) The simplification of maintenance documents, the appropriateness to the equipment (taking account of the environment, etc.), are being studied in the 'Methods' group of the Maintenance Committee.*

This group has the objective of achieving methods on site which are:

- *simple and effective*
- *similar and/or common for all specializations*

- *unique on site for a specialization*
- *coherent with internal and external contractors' practices.*

It is taking into account the remarks of audits by: SACFH, OSART and the Safety Maintenance Approach of the Nuclear Inspectorate. Its aim is to produce a Practical Methods Guide (GPM), which is:

- *doctrinaire, based on the principles of instructions/recommendations*
- *practical, proposing practical examples for each specialization.*

As the methods are defined like: 'the means to enable the planning and setting up all material and human resources to carry out maintenance work', they include amongst other things, worksheet and order themes for which an action is ready in hand targeted for the end of 1994. All other themes remaining to be identified will be started before the end of 1994 to produce an exhaustive GPM by the end of 1995.

IAEA comment on status: *(November 1994) The suggestion is being resolved in a major activity that also covers issues raised during other reviews and audits. The 'Methods' group have identified a number of topics (themes) which are being addressed in order of priority. The group does not have executive powers but passes its proposals to the Maintenance Committee for approval.*

The work of the group appears to be well structured and is likely to bring benefits to Gravelines. The time required to develop solutions for the issues is such that few changes have been introduced to date. However, changes have been implemented in the structure/format of quality plans that result in fewer signatures being required. Other changes to documentation and methods to meet the objectives of the group are being developed and will be introduced progressively throughout 1995 and 1996. Although considerable work has yet to be completed, the 'Methods' group has now developed sufficient inertia that ensure the satisfactory conclusion of its work particularly if it continues to be supported actively by senior managers of Gravelines NPP.

Conclusion: *Satisfactory progress to date.*

Root cause analyses following incidents and events are carried out both at site and at headquarters. However, with respect to events with a human factor element there is currently no on-site person, with a principal responsibility or training, able to carry out human factor analysis. Such analysis should be performed quickly and impartially by an independent member of the site establishment.

The current QA arrangements apply a single standard to all work. This may detract from giving greater emphasis to quality to those systems, which may warrant such treatment, for example, where systems important to safety are involved.

(3) **Suggestion:** Consideration should be given to a graded approach to quality assurance.

Plant response/action: *(July 1994) The application of the Nuclear Power Plant Operations Department's quality policy, which is in course of re-evaluation, will lead to instituting a quality system which will have 15 basic rules, amongst which the following are noteworthy:*

- *Rule 4: Definition of requirements*

  'For each activity, the technical requirements of quality assurance, of timescale and of cost will be defined by prior analysis to evaluate any consequences likely to be caused or any possible malfunctions.

  This analysis will lead to definition and adjustment of the quality assurance requirements to be imposed on the activity, and to identification of the basic rules to be applied.

A single quality policy is therefore applied, which leads to requirements adapted to the activity concerned.

In practice:

- *safety related systems (IPS) and major activities are subject to specific risk analysis and receive appropriate quality plans where necessary,*

- *an analysis will be carried out to identify operating phases deemed sensitive and therefore needing a special approach. In this framework:*
  - *study has been undertaken by a national work group which will produce an action plan before the end of 1994*

  - *a special approach has been undertaken in the framework of the file 'passage to PTB-RRA' and has led to different actions (training, the setting up of a special organization, document modification).*

All these actions should, in time, produce an analytical and modulated Quality Assurance Approach.

IAEA comment on status: *(November 1994) The application of the Nuclear Power Plant Quality Policy is being re-evaluated and directed to achieving an analytical* *and modulated quality assurance approach and this action together with a recognition by site management to acknowledge the views and practical suggestions of staff involved in the application of this policy should result in a significant improvement of standards.*

Conclusion: *Satisfactory progress to date.*

(4) **Suggestion:** As events involving human factors are often indicative of failures in training procedures or lack of safety culture, consideration should be given to facilitating and encouraging such investigations on-site, to enable the root cause to be identified and corrective action to be taken in a timely manner.

Plant response/action: *(July 1994) In order to take human factor analysis into account, a technical engineer has been nominated to carry out the junction of Human Factor Consultant with the following tasks:*

- *analysis after an accident: to analyse the incident and to propose corrective action after study by a work group involved in the incident and depending on any major problems detected*

- *analysis and advice on study subjects: either on his own initiative or on request by a department or twin unit group, to study the incidence of human factors during either organizational change or preventive maintenance*

- *verification of the application of action plans*

- *long term planning: to define major areas for progress towards safety improvement.*

This Human Factor Consultant works with a national group. A regular meeting takes place with counterparts from other sites for experience feedback and exchanges on working methods.

The creation of the site Engineering Department (ED) will enable treatment of problems transversely, progressively taking into account the incidence of human factors. The ED can take human factor analysis into account at the experience feedback level, which will have been carried out, either on site by Operations Manager teams or helped by the Human Factor Consultant, or by means of national experience feedback. In time SAPHIR will specifically take human factor analysis into account. Currently, it is possible to carry out a search by code for situations having a human error.

As part of the process of taking up their new post, the Operations Managers, responsible for a shift team, have been trained in in-depth analysis of incidents, which includes human factors. Issue of significant incidents reports (CRIS) are moving in this direction. The help of the newly created Human Factor Consultant is accenting this approach.

By way of example we can cite the analysis of the isolating switches for the protection of the ATWS of Unit 2 and that of the temporary lowering of the primary level below the level authorized by operating technical specifications during Unit 4 outage.

***IAEA comment on status:** (November 1994) A full and positive response to this suggestion is evident by the site appointment of a Human Factor Consultant and the examples of analysis carried out to date. It is also evident that other key staff within the organization are becoming knowledgeable and competent in event analysis which includes human factors.*

***Conclusion**: Issue resolved.*

Extensive use is made of action tracking systems and is contributing to a well managed system of quality control. However, a number of separate computer based systems are used for this task.

(5) **Suggestion:** Consideration should be given to the use of a common system across the site which would enable a more cost-effective and efficient overview to be carried out by MSQ and would result in improvement in monitoring and follow-up action completion.

***Plant response/action:** (July 1994) The setting up of a common system for monitoring actions is envisaged in two stages:*

- *Monitoring actions in coordination with the Safety Authorities: This will be effected by the RAS system (Relations with the Safety Authorities), developed by Nuclear Power Plant Operations Department and identical for all NPPs. This system will enable common monitoring at site level with mutual information at the various sites (national computer tool). An extension for monitoring actions internal to EdF (Nuclear Inspectorate, Safety Quality Team) is being analysed at Nuclear Power Plant Operations Department level.*

- *Monitoring other actions: An analysis of existing software at other sites has been carried out by the Safety Quality Team and has led to the adoption of* *the SAS application (monitoring actions on site). This software will be used to complement the RAS system and will enable monitoring to show the person responsible, the timescale and the main actions.*

Schedule:introduction of RAS system and staff training:	*first half of 1994*
training/information of users:	
use of RAS system on site together with complementary information:	*second half of 1994*
analysis of monitoring:	*second half of 1994*
setting up of SAS system:	*early 1995.*

IAEA comment on status: *(November 1994) Significant progress has been achieved in the setting up of common information and action tracking databases. To date, the RAS system is now operational to the MSQ section and will shortly be available to all operational units resulting in a common approach to recording and monitoring actions with the safety authorities. A site monitoring system is now selected and undergoing testing with a view to commissioning in 1995.*

Conclusion: *Satisfactory progress to date.*

External audits are carried out by the corporate nuclear inspection department, usually on selected specific topics, and the plant has recently benefited from a VISUREX peer review. The regulatory body also carries out inspections which include aspects of the QA programme. Managers of subunits are also involved in monitoring of quality by ad hoc plant visits. Regular reviews of work backlogs, temporary operating instructions in force, abnormal occurrences and events are also carried out and are the subject of monitoring by performance indicators.

1.4 Regulatory interface

The regulatory control applied to nuclear power plants operated by EdF in the area of technical safety takes place in three complementary fields:

(a) the establishment and application of technical rules of a general nature to ensure technical safety

(b) by a system of individual licences, issued for each installation, following in-depth technical appraisal of the technical safety provisions

(c) by systematic surveillance.

Two government ministries are responsible, Environment and Industry. They have at their disposal a department named the Nuclear Installations Safety Directorate (DSIN), which is subdivided into six divisions. In the case of Gravelines NPP, Division 2 of DSIN has responsibility for all 900 MW PWRs. Each of these divisions has primary responsibility for licensing, monitoring design, construction and operation of their establishments. The scale of the nuclear power programme has led the government to create a further regional inspection organization. The monitoring of nuclear installations has been devolved in this manner to nine specialized nuclear divisions or Regional Directorates for Industry, Research and the Environment (DRIRE) covering fourteen regions of the country. The Institute for Nuclear Safety and Protection (IPSN), which is part of the Atomic Energy Commission of France (CEA) provides technical assessment expertise for DSIN.

Surveillance of activities at the Gravelines site is the responsibility of a site inspector assigned to each twin unit group. Site inspection schedules are drawn up by DRIRE for a period of six months ahead and are approved by DSIN. The site management are informed approximately two weeks ahead of an intended inspection together with the topic to be inspected.

The site manager is responsible for nuclear safety at the Gravelines site, but communications to DRIRE, relating to a twin unit subgroup, are delegated to each twin unit subgroup manager. The corporate function specialist groups within EPN are also involved directly with DSIN on matters of a generic nature. References to regulatory requests are required to be made within certain time-scale. These are monitored by the twin unit group and MSQ and are the subject of a management performance indicator.

A copy of site inspection reports is given to twin unit subgroup managers, following inspections, and they have the opportunity to make an immediate recorded response at this time. An annual review meeting is held with the plant manager. The regulatory body does not have any formal role in the appointment of EdF key staff with safety related duties but they do inspect training records as part of their inspection duties.

The relationship between regulator and plant management appears to be frank, open and yet formal in nature. EdF provide the regulatory authority with access to their incident and event file. The event file relates to any event which occurs on safety re1ated equipment and meets certain defined reporting criteria.

1.5 Document control and records management

Documents are well written to a defined standard and are adequate in detail for tasks to be performed without direct supervision. Management technical control procedures are verified and approved at the appropriate level in the station organization before issue. Management and control procedures are subject to a review process at specified intervals and this is the subject of a monitoring and reminder system. Technical specifications and procedures are modified as and when required. A full revision history of each document is retained. The documentation identification system is well structured and well indexed. Temporary operating procedures and instructions are issued for a minimum period of two months and are checked on a regular basis.

On the Gravelines site there are documentation control centres in each of the five subgroups, each location has its own archive store. Each documentation centre operates a computerized management system common to all documents. Documents are not removed from the documentation centres, and to ensure the work teams within sub-groups have ready access, satellite sets of documentation are situated throughout each sub-group. Control procedures are in place to ensure that all document sets are updated in a timely manner when revisions or new documents are issued. All records arising from reactor outage inspections are retained in a separate archive built specifically for this purpose.

The rooms allocated for archival storage of documents are of variable standard. The store in the management building is of doubtful standard from the point of view of securing the contents from risk of fire. Most of the contents are paper records, (some of which, it appeared, did not need to be retained in this area); no humidity control or rodent control was evident. The SUT storage area was of a higher standard but again most of the records were on paper; no humidity or rodent control was visible and the fire protection system was water spray which would adversely effect the contents on discharge. Records that are identified by the regulatory bodies or by the operating organization for lifetime retention should be retained in a manner which meets appropriate standards.

(1) **Recommendation:** A review of the items retained in the management building (SUG), twill unit sub-group 3/4 (SUC) and the Technical Support Group (SUT) archives should be carried out to ensure that these contain only the necessary records required for lifetime storage.

Plant response/action: *(July 1994) The review of stored documents has been performed. The list of documents for lifelong storage has been updated. These documents are now stored in accordance with regulations.*

IAEA comment on status: *(November 1994) The review of documents has been completed as stated and those documents required for permanent storage are now stored in the appropriate archives.*

Conclusion: *Issue resolved.*

(2) **Recommendation:** A risk assessment on the management building (SUG), twin unit sub-group 3/4 (SUC) and Technical Support Group (SUT) archive storage areas should be conducted to determine whether these meet the appropriate standards required.

Plant response/action: *(July 1994) After a risk analysis of archive storage areas, the site has upgraded them to the required standards. In pa11icular, documents requiring lifelong storage have been separated from the others and stored in certified areas.*

IAEA comment on status: *(November 1994) The archives on units 3/4 have been upgraded to provide better security, fire protection, temperature and humidity control, and rodent exclusion. Other archives on site are also being upgraded or already have been.*

Conclusion: *Issue resolved.*

1.6 Industrial safety programme

Industrial safety within EdF is organized to comply with the requirements of law, and is also part of a general organizational framework determined by the general management of EdF. The regulatory responsibility belongs to the regional safety authority, DRIRE.

For the Gravelines site, a local Co-ordination Committee for Health, Safety and Working Conditions (CLCCHSLT) is established, chaired by the Deputy Site manager and attended by the subgroup managers. This committee meets bi-monthly and formulates site policy and annual programmes on matters common to the site.

A local policy statement relating to safety is available on site but not widely distributed to all staff. Safety policy notes on all aspects of safety are issued on site by the corporate department responsible for industrial safety matters, and these form the basis of the site specific industrial safety procedures series.

Surveillance. of industrial safety on the site is carried out by the safety and radiological protection section of each subgroup. Inspections are scheduled at regular intervals, but the work instructions and check sheets are mainly directed to inspection of fire equipment and fire risk.

Industrial safety is left to the observation of the monitor but is not prescribed or directed. Safety staff performing their duties have the authority to check any individual at work for compliance with personal safety protection policy. 7 Management inspections are ad hoc, are not co-ordinated in a systematic way to ensure total inspection of the plant and are not directed specifically to the identification of industrial safety hazards. The general arrangements relating to industrial safety appear to be biased towards post event analysis and subsequent removal of root cause rather than accident prevention.

(1) **Recommendation**: The surveillance tours should be reviewed with more attention being given to a systematic method of seeking out potential high risk injury or accident situations.

Plant response/action: *(July 1994) Industrial safety results at the beginning of 1993 were considered to be average or even bad. (January: *Frequency rate over 12 months = 8.2.)*

This fact, together with the OSART recommendations, has led to the development of an overall policy for the improvement of safety, and has given rise to a risk prevention and improved work condition programme throughout the power plant.

*For more than a year now we have noticed an improvement in the attitudes and behaviour of all EdF site workers which has resulted in a *frequency of 4.6 (end of May 1994). The corporate objective is to achieve a frequency of less than 5 before 1996.*

This improvement is also noticeable with our contractors where the figure has moved from 40 to 28 in less than a year.

$$\text{*Frequency} = \frac{\text{No. of accidents involve absence from work} \times 10^6}{\text{No. of hours worked}}$$

The reasons for these improved results are numerous:

- *Management Committee members and team supervisors carry out routine safety visits to installations not only for fire prevention inspections [see item 1.6(1)] but also for radiation protection, nuclear safety and industrial safety aspects. These worksite visits are organized by sub-unit management and enable visits to be made to all installations for the detection and correction of any anomalies or risks observed. The visits are the subject of report and follow up action; the reports are available in each sub-unit and are centralized by the Radiation Protection and Industrial Safety Section [see item 1.6(3)].*

- *Training, prevention and communication have also affected this improvement.*

TRAINING

- *periodic retraining (3 years) of site staff in risk prevention*
- *making contractors aware of industrial safety. This action, led by the Dunkerque Chamber of Commerce and Industry and by those in authority in the Dunkerque area, enables contractors to carry out their work while respecting the rules laid down by the Industrial and Nuclear Maintenance Club.*

PREVEN'TION

- *Introducing specific training courses (e.g. ways to prevent back injury).*

COMMUNICATION

- *Weekly publication of an article on industrial safety in the '6 à la une '.*

IAEA comment on status: *(November 1994) Inspection tours by management have been regularized and effort has been directed to raising the awareness of staff to accident prevention by team briefings, training and weekly publications. Although the accident frequency rate at Gravelines NPP has improved, the current level is still considered by the OSART Follow-up team to be high. Further work could be done in the analysis of data related to accidents in order to target improvement of industrial safety in specific plant areas, to groups of workers or to elimination of types of injury. The organizational changes that are envisaged will bring all groups of staff involved with industrial safety and radiological protection together to provide a whole site service co-ordinated in these disciplines. This initiative should provide the opportunity for further development of expertise in the area of industrial safety leading to a more systematic approach to the prevention of accidents and continuous improvements in all aspects of industrial safety.*

Conclusion: *Satisfactory progress to date.*

The current routine for plant tours concentrates on the examination of fire systems and does not necessarily ensure that high safety risk areas are examined.

(2) **Suggestion:** Consideration should be given to training a single person within each SUC and within SUT to become the expert on identification of safety risk and accident prevention measures. This should include maintaining a high profile safety promotion programme.

***Plant response/action**: (July 1994) The work of the Radiation Protection and Industrial Safety Section is developing rapidly and at the same time their competence must also be developed. Since November 1993 the in depth study into the work of the Radiation Protection and Industrial Safety Section has identified 60 activities in 14 categories. To each category we have associated the appropriate level of competence required for its activities. Two categories are involved in 'identification of industrial safety risks and risk prevention measures'. These are: 'Accidents' and 'Fostering Industrial Safety'.*

From 1995, we will undertake study on the referential skills of the Radiation Protection and Industrial Safety Section staff by identifying the necessary training (classroom, laboratory or in the field), in particular for the two categories mentioned above. It will include:

- *Methods of analysis*
  - *root cause*
  - *cause and effect diagrams*
- *Anomaly hunting*
  - *training to enable better prevention of potential injury or accident.*

In this way staff responsible for leading these categories of activities will b e professionals in industrial safety risks and their prevention, which is not currently the case.

***IAEA comment on status:** (November 1994) The Industrial Safety and Radiation Section has done an excellent job identifying fourteen categories of industrial safety goals to focus on. Two areas to focus on will be 'Accidents' and 'Fostering Industrial Safety'. Initiatives are in progress to identify the level of competence required for personnel conducting activities in the above areas. The professiona1s leading the work for identifying and correcting industrial safety concerns will have the requisite experience and training in these areas. With the recent consolidation of the radiation protection sections and the reorganization of the radiation protection department, the team concluded that adequate planning has been accomplished to achieve industrial safety goals. Training activities and work currently being done on root cause analysis should continue on a progressive schedule, so as not to lose focus on the work already accomplished.*

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

(3) **Suggestion:** Consideration should be given to co-ordinate and regularize management safety tours to ensure that all parts of the plant are inspected by a management representative at a frequency of at least monthly. Regular team briefings by supervisors and management should include items relating to industrial safety performance.

Plant response/action: *(July 1994) Same as item 1.6(1).*

IAEA comment on status: *(November 1994) See item 1.6(1).*

Conclusion: *Satisfactory progress to date.*

The plant areas inspected in SUC 3/4 were maintained to a high standard of housekeeping, fire appliances were regularly inspected and next inspection dates were visible. Materials were well stored and the contents of storage areas were listed and were allocated to a nominated responsible person. Bulk chemicals and gases were properly secured and separated, eye wash and safety showers were suitably positioned and functional. The main stores building was well maintained and orderly but no automatic fire systems are installed. Chemical substances issued from the main store are many and varied and there is no system for identifying to users the chemical risk from inhalation, skin contact, eye contact or is flammability, other than by the manufacturer' s instructions on the package.

(4) **Suggestion:** Consideration should be given to making information available to staff on the chemical risks from inhalation, skin contact, eye contact and flammability. This could be achieved possibly at the stores counter supplemented by prominent stick on labels carrying the same information which could be attached to items.

Plant response/action: *(July 1994): Labelling of dangerous products is required by national regulations flowing from European directives (transferred into French Law by Decrees). We apply these rules. These labels carry the relevant information in coded form.*

All storemen have received training in handling and use of dangerous substances, which enables them to inform workers who come to the counter about the risks linked to the products they have ordered.

To explain the significance of these codes:

- *a notice at the main store counter reminds them of risks*
- *explanatory leaflets are distributed with the product*
- *general information which has already been promulgated to all personnel, will be repeated at the end of 1994.*

IAEA comment on status: *(November 1994) The European directives and their inclusion in French Law were in force before the 1993 OSART mission. The labels of dangerous product included information to enable the user to identify the risks* *involved in their use. The concern of the OSART team was that this information was, in some cases, given only by codes. In response, Gravelines has produced a double sided A4 sheet that contains an explanation of the codes found on the labels of chemical products. A copy of the information sheet is given to each person on withdrawing a dangerous chemical products from stores.*

Conclusion: *Issue resolved.*

A number of observations of non-compliance with site rules regarding the wearing of head protection were made. Accident statistics are meticulously collected and analysed, by type of injury, by location and by group of employees, but there was little evidence of details being widely distributed to all staff. The general level of publicity and promotional material around the site to raise staff awareness of industrial safety hazards was generally low.

Accident investigations are carried out thoroughly and remedial action to eliminate the root cause is carried out. Work instructions include precautionary measures related to industrial safety.

Good performance: Housekeeping throughout SUC 3/4 and SUT, and the orderly storage of an equipment, is commendable and was considered to be of a '.i high standard.

2. TRAINING AND QUALIFICATION

Training of personnel at Gravelines NPP and their subsequent qualification is arranged to take advantage of a predominantly centralized instructional arrangement within EdF. A combination of centrally located training centres, a Gravelines training centre, as well as Gravelines line staff 'field' trainers, provide the technical and management instructions for all plant workers. In this way, EdF is able to provide the optimum in training consistency among its 54 nuclear units and exercise independence from the line staff at Gravelines NPP, while administering the needed instruction in an efficient way. Both corporate and local training policy have been integrated to cover appropriate working methods, training initiatives, and resources involved, as well as generally allowing for Gravelines specific needs.

The Gravelines Plant Manager is ultimately responsible for training and qualification of the 1500 plant workers. Department managers within each twill unit plant are responsible for defining the needs of their people, to ensure training is given, and accreditation and qualification granted and maintained. The Twin Unit Manager approves accreditation of each of his employees, as recommended by his department managers, to ensure that his staff have the requisite job skills and can apply plant safety and plant quality rules satisfactorily.

A system of training co-ordinators within each department at Gravelines allows the department manager to integrate training needs into a plant management approved strategic plan. This arrangement allows for efficient use of multiple centralized locations and the Gravelines training centre to provide the necessary instruction. Maximum use of training centre resources are utilized in both initial and proficiency instruction.

Annual training plans for each Gravelines employee are a product of both worker and supervisor. These individualized plans exemplify the emphasis which plant management places on providing high quality instruction for its employees. Changes to this annual plan are also allowed as priorities change, further showing system flexibility and the ability to cope with individual employee needs.

Several new training initiatives are under way to address the specific needs of plant management. These include extensive and systematic task based operations and maintenance course reviews with line/training project teams, establishment of operations and maintenance training institutes, as well as installation of Gravelines plant specific simulator in the 1994/95 time frame.

However, training can be improved in some areas to further enhance the ownership which plant management has shown in the training and qualification. These include completing the project under way to change plant discipline training programmes to a task based systematic approach to training, further refining those training courses which should be in the accreditation and qualification pathway, and improving the frequency and evaluation criteria of industry events training programmes. It appears that the continuing training in each area needs more attention than the corresponding initial training. In addition, periodic senior plant management observations of training at the Gravelines and the National Training Centres are suggested and more formal on the job (OJT) training programmes in some areas and better use of actual human performance mistakes and near misses to enhance training are further recommended.

In making Gravelines even more responsive to improved training, greater authority should be granted to the site training management in their efforts to serve as a single, accountable point of contact for all training of Gravelines employees. In this way, plant management would be assured that training initiatives and problems could always be implemented with a Gravelines specific approach.

Satisfactory progress has been made on most of the OSART recommendations and suggestions. Of significant note is the development of a sound training organizational structure along with the construction of a new training facility and plant specific simulator.

The Gravelines NPP has taken an operations approach to increase individual professionalism by increasing the quality of training. To accomplish this, an organizational structure was developed that created a single department manager with the responsibility and authority to review, develop and implement the necessary training programmes in Operations, Maintenance and Technical Support. The new training centre will become operational in February 1995 and will house a full scope plant specific simulator. Maintenance and Technical Support training programmes are being revised as necessary to support a task based systematic approach to training. As a result of this initiative it is expected that there will be a greater emphasis placed on lowering the acceptable threshold for plant equipment being out of service and an increase in the quality of maintenance activities conducted in the plant. The performance of training activities will continue to be monitored on a more frequent basis by senior plant management and direct feedback on the performance of plant workers will continue to be provided by line management. This approach along with increased emphasis on task based systematic training should ensure increased confidence and proficiency among the operating crews and all plant workers.

Although considerable effort is being spent on increasing the quality of operations training, there is much work left to be done for the improvements projected in maintenance and technical support training.

Continued support is given from line management to assure effectiveness of the organizational structure being developed. In addition, senior management involvement and presence during the development and conduct of training activities is of paramount importance and should continue. The team has concluded that the initiatives taken in the area of training and qualification of plant workers have progressed satisfactorily to date and that future planned activities appear realistic and of high quality.

2.1 Organization and functions

Both initial and continuing training for Gravelines employees is provided by an organization of three entities within EdF. Professional Training Services (Paris), centralized training centres (primarily Paluel and Gurcy Le Chatel training centres), and the Gravelines Training Resource Centre and Gravelines staff field trainers are the prime players in providing the needed instruction. This arrangement allows enough freedom to make decisions, with an objective view towards consistency as well as Gravelines specific training needs. However, it was noted that continuing training for site personnel on plant procedure changes, plant modifications, job specific experience feedback, teaching files, etc. could be improved in order to maintain satisfactory job skills of all front line employees.

(1) Recommendation: Plant and training management should ensure that Gravelines human performance events are factored back into appropriate training programmes on a consistent basis.

Plant response/action: *(July 1994) The current training system in French nuclear power plants does, after a second level analysis, take into account experience feedback on events occurring within the plants. Particular importance is accorded to events which stress human factors. Rapid experience feedback in certain major cases allows experience feedback to be taken into account almost immediately. In addition, it has been decided to install a full scope simulator which should be operational in 1995.*

Plant management has taken this opportunity to greatly modify the site training system by setting up an integrated Training Department bringing together site staff and training professionals.

Furthermore, an engineer has been nominated in the area of 'human factors '. After a first level analysis with operations engineering, his mission will be, among other things, to participate in the evolution of training programmes. Action to this end has already taken place in 1994, notably training in physical phenomena and *in risks linked to work at the lower part of the RRA, following an incident at Bugey NPP.*

IAEA comment on status: *(November 1994) The nomination of a Human Factors Engineer to evaluate events and participate in the development of training programmes is considered to be excellent. Human performance issues are expected to be factored into future training on a consistent basis.*

Conclusion: *Issue resolved.*

(2) **Suggestion:** consideration should be given to making 'specific' initial and continuing training for all plant employees/shift teams a part of the accreditation pathway for plant workers.

Plant response/action: *(July 1994) The initial accreditation training pathway consists of structured training carried out in a national or local training centre and training actions carried out on site (particularly through shadow training). Training to maintain competence covers, at this stage, mainly skills proficiency courses, carried out in training centres or locally in the form of 'specific' training. This series of different training actions constitutes the PLAP (Local Professional Training programme). Within this framework, an evaluation is organized by supervisors.*

Within the framework of the operating Approach for operating staff, national and local working groups (GMF) are defining in 1994 a structured programme of training to maintain competence. The programme will be annual, and will probably be four weeks for field workers, six weeks for operators (of which two weeks will be on the full scope simulator). The composition of this programme stems from analysis of tasks and required competence by function, as well as taking into account experience feedback of site, national and international incidents. The future training department is to ensure the implementation of this programme. For first line staff such as field workers and operators, this training will of course include training on principal modifications to equipment, procedures and experience feedback.

IAEA comment on status: *(November 1994) The initial and continuing training accreditation pathway identified for all plant workers appears to be adequate. The Training Department's implementation of future training for accreditation must be prioritized to assure adequate effectiveness is achieved.*

Conclusion: *satisfactory progress to date.*

(3) **Suggestion:** Consideration should be given to increasing the frequency of operating experience feedback and plant change proficiency training sessions and also performing an evaluation to determine the retention of les sons learned.

Plant response/action: *(July 1994) Set up in the first half of 1994, Site Engineering Department (ED) is responsible for leading on all site experience feedback, in liaison with Corporate Resources Department (MCP). In particular, all site events are analysed and disseminated on site through national experience feedback. Within this framework, ED is responsible for the detection of events needing specific training. A regular process of dialogue is being instituted between, operational departments, ED and the Training Department.*

In 1994 a number of concrete actions were completed, for example training in risks linked to work at the lower part of the RRA, and to anti-dilution protection.

As far as modifications are concerned, current Nuclear Power Plant Operations Department policy is to do them in groups, starting with a trial unit and leaving time for experience feedback between the first and subsequent units. In line with this modification grouping policy, the training department, in conjunction with corporate level, will be responsible for providing the appropriate training programme to the user. The first modification lot is expected to be completed by 1995 (10th inspection of Unit 5). Evaluation of this training is included.

IAEA comment on status: *(November 1994) Continued dialogue is needed between Operational Departments, Site Engineering and the Training Department. The training session on the first group of modifications should be conducted in 1995 and an objective evaluation of this training should be conducted. Trainee performance and course evaluation from trainees should be factored into future training sessions on experience feedback.*

Conclusion: *Satisfactory progress to date.*

Large training needs are handled by the formation and use of project groups or teams. These comprise representatives from the sites, of which Gravelines is appropriately represented. The corporate training department normally controls these project groups to ensure proper balance utilizing all available EdF centralized training resources. For example, a typical project group for improving operations training would include a reactor operator, his shift supervisor, and a plant engineer as well as plant instructors.

Maximum use of multiple training facilities within EdF is utilized in training the entire Gravelines technical staff. Full time instructors, both centrally located and those stationed at the Gravelines training centre, are efficiently utilized. Additionally plant line management utilizes 'field' (part-time) instructors. These are selected plant staff management or front line personnel who provide plant specific and 'shadow' training instructor needs to supplement the instructional needs of the workers at the site.

A Gravelines training committee is in charge of the specific training policies at the site. This committee is composed of the Plant Manager, the five sub-unit managers, the Safety and Quality Team Leader and the Information Services Team Leader. This committee ensures that the three year training guidelines as well as the annual Gravelines NPP plan are properly arranged to match the strategic needs of the site.

Line management ownership of the training and qualification process normally prevents interference between production requirements and needed instructional programmes for Gravelines employees.

Site training and qualification procedures did not address under what circumstances accreditation and qualification could be withdrawn if trainee performance in training is not satisfactory.

(4) **Suggestion:** Consideration should be given to upgrade Gravelines training and qualification procedures to include how circumstances of poor performance in training/qualification over a period of lime can result in withdrawal of accreditation and job skill qualification.

Plant response/action: *(July 1994) An accreditation can be suspended at any time if a person's manager notes his lack of competence in:*

- *technical and professional areas*
- *quality assurance*
- *safety*
- *knowledge of installations adapted to his activities.*

Within this framework, poor performance of activities can result in withdrawal of accreditation after analysis by the person who granted the accreditation.

IAEA comment on status: *(November 1994) First line supervisors should continue to monitor individual poor performance and determine if training/qualification should be re-evaluated for accreditation. This process should be continued for all employees on an ongoing basis. Evaluation of an individual' s knowledge in the technical and professional areas related to job specific activities regarding poor performance should be monitored.*

Conclusion: *Satisfactory progress to date.*

The site specific Gravelines training team is under-utilized in the area of providing greater authority and direction to ensure line management's training needs are met. The process of improving Gravelines' training needs could be improved if the Site Human Resources Group was given the responsibility, authority and resources to serve as a single accountable point of contact for all site training needs.

(5) **Suggestion**: Consideration should be given to reconfiguring the training organization and process on-site to give greater authority and responsibility to a training single point of contact who could be fully responsible to the Plant Manager for all training activities, initiatives and problems

Plant response/action: *(July 1994) Profiting of the opportunity created by the introduction of a full scope simulator on site, it was decided to completely review the organization and process of training at Gravelines NPP.*

A common structure was created, made up of knowledgeable NPP staff and EdF Professional Training Department (SFP) staff with pedagogic competence. The manager of this structure is responsible to the Plant Director.

The structure' s main tasks are:

- *to define with various managers, training policy in the various areas*
- *to guide and manage all training*
- *to integrate into training courses the lessons learned from experience feedback*
- *to implement specific training corresponding as closely as possible to various needs and requests*
- *to increase the quality and quantity of training*
- *to be the contact for the Training Institutes (Operation and Maintenance) coming directly from the French Nuclear Power Plants Management Committee, in particular with a view to the development of coherent programmes adapted to the needs of site competence.*

IAEA comment on status: *(November 1994) The current and planned structure for the Training Organization is considered to be excellent. Careful consideration must be given to the selection of knowledgeable training professionals who can develop and implement training programmes that meet the goals and objectives of the Gravelines Training and Operations Department.*

Conclusion: *Satisfactory progress to date.*

Safety culture training appears to have been recently generated for employees at the site. Not all employees have been trained in the INSAG-4 principles on a consistent basis as of yet. This instruction is controlled by line management and administered between the supervisor and employees in a team and discussion fashion.

(6) **Suggestion:** Consideration should be given to making safety culture training mandatory for all employees. Safety culture should be reinforced via the continuing training programme.

Plant response/action: *(July 1994) Specific training was given in 1992 and 1993 to explain to staff in the Generating, Maintenance and Administrative Departments those principles of INSAG-4 which have an impact on activities linked to processing (storemen, IT staff, security staff and training staff). Safety culture principles are also integrated in all major national courses, on the basis of required skills and giving prominence to role play (on simulator or worksite learning), using appropriate pedagogical methods (case studies, activity methods, etc.). We envisage setting up quality safety retraining for all staff from 1995, including INSAG-4 principles and human factors aspects. A trial will be conducted in 1994, consisting of maintenance and operations personnel. Approximately 300 people per year will receive this training.*

Staff training for those changing specialization now includes INSAG-4 principles. Also, the distribution of documents or brochures such as the Operating Nuclear Safety Memo, is used to remind staff of INSAG-4 principles.

IAEA comment on status: *(November 1994) A review of the major training courses indicated that Gravelines has or will institute safety culture principles, including INSAG-4, into all national and site specific training courses. All refresher training and training in specialization jobs for new applicants should also reinforce safety culture principles.*

Conclusion: *Satisfactory progress to date.*

Line management involvement in training is evident in training plan/priority establishment as well as variable attendance at the beginning and end of new training programmes. It appears that senior management (Twin Unit Managers and above) are not periodically observing staff training. Assessment of front line personnel is important in the training area because plant management can better understand the job of the people who work for them.

(7) **Suggestion:** Consideration should be given to increase senior plant management observations of training at Gravelines and the national training centres in order to provide more effective oversight of employee training activities.

Plant response/action: *(July 1994) The distance from national training centres makes it difficult for management to be present at training courses. The introduction on site of the full scope simulator (Operational in 1995) and the creation of a common training structure directly responsible to plant management will enable this suggestion to be implemented from 1995.*

IAEA comment on status: *(November 1994) Following completion of the new training centre and the installation of the plant specific simulator, senior plant management's observation of training activities is expected. Effective oversight by senior plant management should include direct feedback to students on expectations of job performance.*

Conclusion: *Satisfactory progress to date.*

(a) **Good performance:** Knowledge of training programmes by first time supervisors and in-depth annual training plan preparation shows good initiative to improve technical skills.

(b) **Good performance:** Plant management and frontline employees are active members of training improvement project teams during the large task based operations and maintenance course upgrades underway. This ensures plant specific needs at all levels are included in the training developed and provided.

Three groups of instructors are utilized to provide training to the 1500 personnel at Gravelines NPP. Owing to the heavy centralized focus for training within EdF, corporate training instructors are utilized from the Paluel and Bugey training Centres for operation and maintenance training and also from the Gurcy le Chatel training centre for additional maintenance training. Additionally, Gravelines has technical instructors for plant specific training and for proper interface with the National Training Centres. Gravelines plant management has arranged the assignment of several personnel from each department to provide 'site training of a technical nature' and 'shadow' training tutors to supplement the Gravelines specific instructors.

The instructors at the National Training Centres are of two different types, simulator/technical instructors and theoretical instructors. The eligible pool of. instructors comes from either one of the NPPs in EdF or directly from an engineering school. Rotation of these corporate instructors between the training and the plant and vice versa increase expertise in both these areas.

"Shadow" training of newly qualifying instructors is frequently used whereby a qualified instructor qualifies another instructor by close, personal observation. In the maintenance instructor area, there are instructors at the workshop level and the classroom level. All instructors observed at both Paluel and Gravelines are eager, attentive, helpful, and appear well qualified. They all seem to take great pride in their work.

(c) **Good performance:** The 'shadow' training concept of assigning qualified employees as tutors of new trainees is an innovative way to build training realism, employee confidence and further credibility into the training/qualification process. Additionally, plant staff personnel are used as part time instructors and training coordinators.

Refresher training is not mandatory for instructors to attend. Instructors do not return to the plants periodically while stationed at the training centres. The turnover of the instructors occurs every four years or so as people are rotated back and forth between plant and training positions. A plan for the upgrading of technical proficiency for all national training centre instructors starting in 1993 is under way. This will allow in-plant proficiency in anticipation of returning to the site assigned after training duties are completed.

(8) **Suggestion:** Both site and corporate instructors should receive mandatory, systematic continuing training in both technical and teaching skills. Also, 'in-plant' time, on a yearly basis, at one or more NPPs, has been found helpful in other countries to maintain current plant specific knowledge and gain additional instructor credibility.

Plant response/action: *(July 1994)*

Instructors at Paluel Training Centre: *instructors attend pedagogic proficiency modules. Moreover, each year, there are fora which enable the exchange and experience of pedagogic practices.*

In 1993, 50% of technical instructors attended technical proficiency courses in a unit. The objective for 1994 is 100%.

Instructors al Gravelines Training Centre: *For several years recruitment of instructors was made on the basis of four years' duty with return to the unit at the end. As a result of this we do not foresee systematic technical retraining at least during this period. Exchanges with course members, participation in training working groups which include site operational staff, and documentation received from various site departments reinforce our view. However, the subject taught may require additional competence. This will be dealt with on a case by case basis.*

For the pedagogic area, every year the instructors participate in a forum to exchange views on pedagogic practice with instructors from other sites. There are certain developments leading to instructors' self improvement:

- *increasing demand for specific training*
- *development of evaluation of courses for SN accreditation*
- *incorporation of safety culture in courses using participative pedagogic methods.*

In this way the instructors at the Gravelines training centre will attend courses developed by the Professional Training Department during the period 1995 to 1997:
- *'Instruction on local training requests' (10 days) and*
- *'Evaluation of an action and its effects' (7 days) and*
- *'Practice of the suitability of active pedagogy' (5 days) or 'Group leadership' (5 days).*

Within the framework of the setting up on site of the Common Training Structure, it is proposed that each instructor will be seconded to teams for two weeks. This period will be given over to maintenance of knowledge of the installation, and to analysis, with the staff of a training project, aimed at increasing their credibility.

IAEA comment on status: *(November 1994) To date, 50% of the Gravelines technical instructors have received technical proficiency training and it is expected that by the end of 1994, 100% of the instructors will have completed this training. It is also expected that all lead instructors will attend courses over the next two years that will enhance their teaching skills.*

Conclusion: *Satisfactory progress to date.*

The training records management system at Gravelines is an integrated system. It starts with the generation of the plant training plan, which is put in place with approval by senior plant management. This plan is arranged toward meeting plant regulations, provides the proper resources to attend and carry out the training, and provides the proper computerized data base tools for use by plant management. From this overall plan a Training Plan Guide (PGF), a Standard Training Plan (PTF), and eventually an Individual Training Plan (PIF) for each person on site are generated to assist management in controlling the budgeting, scheduling and processing of required instruction.

The Individual Training Plan (PIF) is essentially a contractual agreement between an employee and his/her supervisor. It is completed based upon a face to face interview with both employee and his supervisor. These plans are consolidated for the entire plant.

The system used to do schedule the training courses is a computerized data. base linking the personnel management system with both TRAINING SYNERGY and GEMINI system databases. TRAINING SYNERGY enables the resources used of plant management to be linked to both plant training constraints as well as corporate training guidelines. Normally, all personnel are notified by national or site training organization responsible for the training about six weeks before the course starts.

(d) **Good performance:** The elaborate and detailed use of individual Training Plan (PIF), generated from the Plant Training Plan, the unit Training Plan Guide (PGF), and the Departmental Standard Training Plan (PTF), is a very structured and systematic method to ensure training needs of the plant are handled professionally. individual employee face to face 'contracts' for technical instruction is a very positive signal toward the improvement of the technical capabilities of every employee.

Records of class attendance are made satisfactorily and kept in appropriate records file at the facility where the training was given. The records generated are entered into a training retention system in real time. This data. is available as a collective update by list or in an individual update. There is a satisfactory system arranged to easily allow the plant supervision to quickly assess accreditation and qualification on a continuing basis and call people in on backshifts if needed. There is no formal or integrated process for handling all possible inputs for changes to the technical training programmes at Gravelines. Satisfaction indices are used for handling trainee comments after training, but no other inputs are formally controlled.

(9) **Suggestion:** Consideration should be given to establish a formalized training change system which is arranged to handle all inputs for change to all Gravelines training programmes.

Plant response/action: *(July 1994)*

At the national level: *Within the framework of the national training organization in the areas of maintenance and operations various GMF (Skills Training Groups) give advice on training of maintenance and operations department staff. Regular meetings of these groups guarantee the matching of training to needs.*

In addition, the national organization ensures formalized follow-up of the integration of modifications in training programmes with:

- *follow-up and conservation of training guidelines*
- *follow-up and conservation of training files*

- *a system in training centres to manage the integration of modifications*
- *a site spokesman in training centres.*

At the local level: *The setting up of the common training structure and the introduction of the full scope simulator is stimulating the development of training adapted to the various needs and its commencement. To achieve this, a system for detecting training needs must be set up with management. At the present time, training requirements are only identified by line management.*

IAEA comment on status: *(November 1994) At the national level, Skills Training Groups (GMF) meet on a regular basis to evaluate changes required to the Gravelines training programme in the area of operations and maintenance. However, at the local level, a system for detecting changes, resulting from modifications and subsequent identified training needs must be set up with management. The structure for doing this has not been formalized; this has resulted in training requirements only being identified at the line management level. It is expected that a formalized training change system will be adopted at the local level following development of the new training structure.*

Conclusion: *Little or no progress to date.*

2.2 Training facilities, equipment and material

Workshops and laboratories are well equipped with computer, maintenance, operations and chemistry equipment to ensure sufficient job realism when using these facilities. Paluel's workshops and laboratories are of modern design, and has up to date equipment, which is readily accessible to students in training, and an overall atmosphere that is professional. Great pride was shown by the Maintenance Operations, Chemistry and Computer Training personnel at both Paluel and Gravelines training centres. However, the computer based training terminals set up at the Paluel and Gravelines training centres, as well as various locations in the plant, are at plant specific and significant differences may exist in the application of knowledge acquired tram these programmes.

(1) **Suggestion:** Consideration should be given to making computer based training modules at both Paluel and Gravelines site specific for use by Gravelines workers.

Plant response/action: *(July 1994) The intention of computer assisted training is to enable maintenance of basic knowledge, and to remind staff about installation operating principles. At the present time the Gravelines training centre will make* *available and upgrade as necessary, computer assisted instruction (CAI) to plant employees. This appears to be the most efficient use of CAI.*

IAEA comment on status: *(November 1994) Consideration has been given to making computer based training modules available to Gravelines workers. Computer assisted modules for various work stations have been developed and are being used at the Gravelines Training Centre. The OSART Follow-up Team agrees with Gravelines that the purpose and structure of the Paluel Training Centre is different from that of training developed at the local level and therefore site specific computer assisted modules do not appear workable at the Paluel Training Centre.*

Conclusion: *Issue resolved.*

The simulator facility at Paluel houses both 900 MW(e) and 1300 MW(e) simulators for the various plant sites it serves. The 900 MW(e) simulator is based on Gravelines Unit 1. These simulators are used from 06:30 to 20:00 each day from September to mid June of each academic year. The simulators maintain a high degree of training availability (> 99 %). Remote Emergency Shutdown Panel simulators are available for each associated control room simulator. Plans are in place for a simulator to be installed at Gravelines by 1995.

Various functional simulators are in use at both Gravelines and Paluel training centres where individual manipulations by control room operator candidates can be practiced on a periodic basis. These simulators enhance the knowledge and skills of the operator trainee using them.

(a) **Good performance:** The 'mini-plant' simulator at Paluel is an excellent training tool for use by operations personnel to learn the operating principles behind PWR operation and integrated plant response.

(b) **Good performance:** The use of functional simulators to the extent and frequency with which they are used at both the Gravelines and Paluel training centres has a positive impact on overall site training. The steam generator tube rupture event simulator normally located at Gravelines is movable from site to site for specialized use at each unit.

Training materials at the training centres are well maintained and are properly utilized by the trainees in the classroom, laboratories, workshops and simulators. Materials in the centre are updated as needed for operator and technician use.

Facilities are maintained in a high degree of readiness with minimal down time. However, a formal testing process for simulator maintenance in the Gravelines simulator at Paluel would improve training credibility when modifications are installed or maintenance work is performed. Although modifications are installed in a timely manner at the Gravelines specific simulator, it appears that the plant management have no say in what should be modified on the simulator or how quickly modifications should be installed. No QA check of these changes made in the simulator is performed. Operator aids posted on the Unit 1 Gravelines control room panels should be mimicked as closely as possible in the Paluel training centre simulator.

(2) **Recommendation:** Paluel training centre management should ensure that Gravelines generating department management is involved in approving the modifications and the schedule for the modifications before they are installed in the Paluel training centre simulator and that all Gravelines Unit 1 control room panel operating aids are mimicked as nearly as possible.

Plant response/action: *(July 1994) The CP1 simulator at Paluel is representative of all CP1 units at French nuclear power plants. It was modelled after a 'reference' unit (Gravelines 1). It has developed at the same rate as all CP1 units and not only Gravelines 1. Certain differences can exist between the simulator and each unit in French nuclear power plants; these differences of configuration are managed by Paluel.*

No modification can be implemented unless validated by the corporate Generating Department (DXP). It is only done if it is in the simulation area and if there is a pedagogic benefit. Each modification requires pedagogic work to manage differences of configuration. This organization will be applied to the simulator being developed at Gravelines.

The Operations Department management is involved in the approval and scheduling of modifications to its units. It cannot be the same for the simulator because of the need for homogeneity with French nuclear power plants and the success of a national approach.

Following the expert's comment during the 1993 OSART, an analysis was performed, showing that the various labels and documents 'stuck' to the panels in the control room of Unit 1 should not have been there. Consequently steps were taken to remove them. The Paluel simulator (in future, the Gravelines simulator) now has the same status as the Gravelines unit.

IAEA comment on status: *(November 1994) The success of a national approach to training, representing all CP1 units at French nuclear power plants, is* *understood. The Follow-up Team agrees that modifications to the simulator at Paluel can be adequately controlled under its current structure. Since this original recommendation was made, the Gravelines training personnel have carefully reviewed the differences between the simulator at Paluel and the Gravelines Unit 1 operating aids and taken corrective action to assure similarity. This recommendation will be fully incorporated through the configuration control management system that will be developed for the full scope Gravelines simulator.*

Conclusion: *Issue resolved.*

(3) **Suggestion:** Consideration should be given at the Paluel training centre to implement a periodic test programme of integrated plant systems and malfunctions on the Gravelines Unit 1 specific simulator. This would ensure that fidelity checks are done on actual Gravelines plant transients and normal operations on a periodic basis.

Plant response/action: *(July 1994) There are no periodic tests of integrated plant systems where a malfunction has not been shown in the correct behaviour of the simulator. On the other hand, after integration of modifications, checks are carried out to ensure that there is no simulator drift. As modifications are integrated in lots, the concrete result is that these checks for simulator drift are equivalent to periodic tests. Consequently, annual tests are being conducted to include fidelity checks of normal operations and plant transients.*

IAEA comment on status: *(November 1994) While there are no 'scheduled' periodic tests being conducted for transient and normal operations at the Gravelines simulator in Paluel, there appears to be sufficient validation of physical and functional fidelity requirements through checks being conducted following the integration of modifications. As for periodic testing of the full scope simulator being constructed at Gravelines, consideration should be given to review the physical and functional fidelity requirements on a more frequent basis. Instrument tolerance frames and real time transient analysis should be tested on a periodic basis. Guidance for periodic testing can be found in the recently revised American Nuclear Standard document (ANS.3.5).*

Conclusion: *Satisfactory progress to date.*

(4) **Suggestion:** Consideration should be given to have the Gravelines Safety and Quality Team (MSQ) perform an independent check of the adequacy of simulator modifications at the Paluel simulator after they are installed. This would ensure that no negative training would exist when software and/or hardware are reconfigured.

Plant response/action: *(July 1994) The Safety Authorities and the public hold each plant responsible for the operation of its facilities. To fulfil this responsibility, each plant organizes itself as required and sets up monitoring structures. However, it is not necessary for each plant to have a structure for monitoring the common resources of the whole Nuclear Plant System.*

Each plant has its own quality organization and associated checking methods for its particular activities. The Corporate Nuclear Inspectorate is empowered by the Corporate Manager to carry out external audits. The Safety Authorities are naturally responsible for monitoring safety.

As far as training is concerned, the Professional Training Departments, Corporate Resources and the plants are autonomous as regards quality assurance. Each structure has a Quality Assurance Manual. Each structure does a self-audit but does not audit the other structures, with the exception of the Corporate Resources who monitor the Professional Training Departments. The plants rely on the Quality Assurance of Corporate Resources and the Professional Training Departments to fulfil their responsibilities. They do not monitor the Professional Training Departments and Corporate Resources directly.

On the other hand, a system of quality assurance integrating the requirements of the NPP and the EdF Professional Training Department (SFP) will be instituted within the framework of setting up the common training structure. This organization will include independent checks by the MSQ.

IAEA comment on status: *(November 1994) The common training structure being developed at Gravelines NPP should assure that independent checks by the Safety and Quality Team (MSQ) are incorporated as part of the full scope simulator configuration control requirements. This will assure that software and hardware required to be reconfigured, as a result of plant modifications, will be done properly.*

Conclusion: *Satisfactory progress to date.*

2.3 Control room operators and shift supervisors

Control Room Operators and Shift Supervisor candidates receive their initial training based on a Standard Training Plan approved by the Department Head of the Generating Department. The path for a candidate in the control operator pipeline is dependent upon whether he/she enters the programme with a field technician diploma or whether the person is an experienced field operator. Some twelve weeks in the simulator at the National Training Centre in Paluel is provided. Ten weeks in classroom, also at the National Training Centre, is part of the entire programme. OJT plays an important role in the programme completion, but it appears that the formality and structure of this OJT programme is in need of improvement. Recent efforts by EdF have upgraded this programme to change the control room operator training programme using a systematic task based approach.

Some specific and site technical training is not in the accreditation pathway for this position. This should be reconsidered to determine the true necessity of making this additional training part of nuclear accreditation for the control room operator.

The transition from Control Room Operator to Shift Supervisor is one where stiff competition is faced when one attempts to qualify for this higher level job. One must pass an entry examination consisting of oral and written areas as well as successfully interviewed by the Department Head of the Generating Department. Initial training consists of appropriate simulator training, classroom instruction in design basis and operational safety training, as well as OJT. Within the past few months the Shift Supervisor position in four out of six shifts has been converted to an Operations Supervisor. The training programme for the Operations Supervisor is very extensive and lasts approximately 18 to 23 weeks. The training programmes of both Shift and Operations Supervisors have recently been upgraded and is now based on a systematic job task analysis. In addition, there are some segments of these training programmes in the area of site specific operator training, which are not part of the accreditation pathway.

Good performance: Use of the AEC test reactor at the Grenoble location is a very positive way to teach the effects of reactivity to initial operator candidates.

Gravelines continuing training for Control Room Operators and Shift/Operations Supervisors consists of three distinct segments of instruction:

- o Refresher training
- o Specific training in actual plant events, industry experience, operational safety, etc.
- o Site training of technical nature.

The total hours and mix of training to keep operator skills and abilities refreshed and current is appropriate. However, this instruction is not linked to a clearly defined task based training arrangement.

(1) Recommendation: The continuing operator training programme should be upgraded by applying a task based systematic approach to training, which ensures the appropriate tasks, skills, and knowledge are covered and that they are evaluated on a yearly basis in the training. The numbers of simulator training hours each operator receives per year should be re-examined to ensure that all necessary tasks/transients are included.

Plant response/action: *(July 1994) Gravelines NPP has set up an Operations Approach aimed in particular at the improvement of safety by depending on staff professionalism. This action depends on an increase and improvement of the quality of training given to operating teams and, in particular, to operators.*

A list of required training has been developed for each specialization. In liaison with a national group, a local working group makes proposals for maintenance of competence and proficiency. This has led to operators having completed the definition of initial training, maintenance of competence and proficiency. Specific training flowing from these definitions is being developed.

Monitoring of incidents and procedures studied by the operators is carried out by the training centre during use of the full-scope simulator. Moreover, to increase the scope of operator training, a full scope simulator is being constructed on site, to be operational by 1995.

IAEA comment on status: *(November 1994) The training being developed for operators, on the full scope Gravelines simulator is aimed at increasing staff professionalism through team training. Emphasis should be placed on adequate management oversight of this training to assure that the actions of all operating crews are consistent with management expectations and are being consistently applied.*

Conclusion: *Satisfactory progress to date.*

Evaluation of continuing training is only done for the refresher training course. This evaluation is subjective and is not linked to Gravelines specific criteria for operator tasks and expectations. The Generating Department manager attends refresher training each year with one of his operating crews so that he can experience what the operator has received at Paluel training centre. It is also noted that extensive critical analysis of simulator sessions takes place upon completion of refresher training at Paluel. The simulator reports which are sent from Paluel Training Centre to the generating department managers concerning their operators appear to be somewhat generic and shallow.

(2) **Recommendation:** Paluel training centre management should ensure that all summary reports on Gravelines operating shift team performance on the simulator are provided on a yearly basis and are appropriately specific to indicate strengths and weaknesses in the performance of the crews and individual abilities.

Plant response/action: *(July 1994) Evaluation of individual performance of shift staff under training on the simulator is being set up for initial training. It is operational in particular for a training module relating to incidents. In addition, the training programme is validated during role play sessions set up to verify team behaviour. Furthermore, a team debriefing session is held at the end of each training sessions. The construction of the simulator at Gravelines NPP will enable shift team management to observe performance on site.*

IAEA comment on status: *(November 1994) Feedback on shift performance during team training exercises is of paramount importance during both initial and refresher training. International experience has proven that weaknesses in command, control and communications among the shift, during actual plant transients has resulted in operator error and degradation of plant safety systems. Evaluation of operator and crew performance on a full scope simulator should be conducted on a regular basis. Guidance on an objective evaluation methodology can be found in the U. S. Nuclear Regulatory Commission's Operator Licensing Examiner Standards (NUREG-1021).*

Conclusion: *Satisfactory progress to date.*

2.4 Field operators

Field operators can be mechanics, operations technicians, or operating type personnel working to support the control room staff outside the control room. Norma1ly there are seven people assigned to each shift as field operator personnel. The programme for field operators initial training has been recently revised in the last two months with pilot sites implementing this programme first and project teams of corporate instructors and field operator combining to complete development of upgraded training specifications.

The initial training programme consists of 58 weeks spread out over about 15 months with 13 weeks at centralized training centre classroom and functional simulator environment as well as some 45 weeks on site with both classroom and OJT being utilized to complete the programme.

As the project teams have just completed upgrading this course material, it is apparent that the field operator training is built upon a task based systematic approach to training. The scope of the 58 week programme does appear to be quite comprehensive.

Good use is made of functional simulators and the mini reactor plant to provide the necessary operating principles to the field operator.

The proficiency or continuing training programme for the field operating personnel has recently been upgraded to include topics and theory based material areas such as I&C principles, chemical effluent principles, electrical principles, simulator hands-on, and job proficiency signoffs. These tasks and topics are part of a recently completed task-based approach. This new task based arrangement is not expected to start until sometime after September 1993. About three weeks of training per year will be taken by each field operator after that time.

As of the present, training for the field operator is a five week course conducted at least once during the year on various operator topics, theory and tasks. However, it appears that this present instruction is not task based for Gravelines specifics, nor is it formally evaluated. The present field operator training system is some ten years old and not tota1ly applicable to task needs of presently qualified field operators; at present this training is not mandatory.

(1) **Recommendation:** The completion and implementation of a systematic task-based upgrade of the proficiency training for the appropriate tasks of a field operator should be expedited. This should include the upgrading to a more formalized evaluation scheme for all operators.

Plant response/action: *(July 1994) The GMF (Training Group) 'Fieldwork Specializations' met in February 1994 to complete the existing specialization referential and to determine which competencies should be developed to carry out a field worker's task. At the end of this seminar, each site was required to develop training specifications where they did not currently exist or where they did not correctly fulfill the needs. From these definitions, the common training structure was responsible for initiating corresponding training adapted to site needs.*

In time these provisions should lead to having four weeks' training per year per person for proficiency and maintenance of competence. This training should include a means of evaluation of each field worker, depending also on line management monitoring by the Operations Manager/Technical Supervisor.

IAEA comment on status: *(November 1994) Training specifications that were developed for field operators in 1994 should provide the structure of the anticipated four weeks of training per year. Emphasis should be placed on management expectations of professionalism and safety principles during the conduct of this training.*

Conclusion: *Satisfactory progress to date.*

2.5 Maintenance personnel

Maintenance craftsmen and technician personnel at Gravelines fall under the organization of the Support Services Department. The designation of personnel include mechanics, electricians, general services craftsmen, instrumentation and control (I&C) technicians, engineering section work planners, foremen and engineers.

Each maintenance position has the appropriate accreditation and qualification pathway as well as associated courses about nuclear safety, industrial safety and operating principles. In addition, every maintenance staff member has a pathway defined leading to accreditation which includes limits of work, category of work, etc. Accreditation is good for one year for all maintenance personnel.

Typically, time in a maintenance position working as a team member, as well as knowledge of a specific skill, is enough to achieve accreditation. However, a task based approach is not taken toward qualifying craftsmen and technicians. Rather, greater reliance is placed on skills and logical thinking rather than a systematic approach to the training programme. A structured approach to OJT is not taken in this programme either since newly hired craftsmen are qualified by being a helper or part of a team.

(1) **Recommendation:** A structured OJT programme should be implemented for all maintenance personnel in the electrical, mechanical and I&C areas. This on the job task, knowledge, skill training should be co-ordinated with the upgraded task based classroom and laboratory training recommended above.

Plant response/action: *(July 1994) As for other staff, the training for maintenance personnel to acquire the necessary competence consists of:*

- *safety training*
- *quality assurance training*
- *technical on knowledge of the installation*
- *technical and professional training.*

This last training can be OJT, done with the aid of a tutor. This training, which can be taken into account by management within the framework of the issuing of formalized equivalence for accreditation, is subject to evaluation.

We believe that this is insufficiently developed and action is in hand which aims to improve this process between now and the end of 1996. Coordination. with specific classroom training is to be set up within the framework of the site common training structure.

IAEA comment on status: *(November 1994) It is expected that the formation of a structured OJT programme for maintenance disciplines will be in place by the end of 1996. Between now and 1996 the training structure should focus on upgrading the training skills of maintenance instructors and the development of training modules that integrate the operational interface aspects of maintenance tasks.*

Conclusion: *Satisfactory progress to date.*

(2) **Suggestion:** Consideration should be given to implement task based training programmes for the proficiency training of electrical, mechanical and I&C personnel. This approach should include proper evaluation methods for training given.

Plant response/action: *(July 1994) Studies in hand on site development and on maintenance specialization development have led to analysis of activities and to clarification of the necessary competence:*

- *technical and professional competence*
- *competence in quality assurance*
- *knowledge of installation adapted to activities*
- *competence in safety.*

Within the framework of the development of specializations, linked to site development, a study will be carried out on the development of training to acquire competence and knowledge, as well as on formalization and associated evaluations.

These studies are included in the framework of setting up the site common training structure.

IAEA comment on status: *(November 1994) See comment for item 2.5(1).*

Conclusion: *Satisfactory progress to date. 1*

Needs analysis for training specific to Gravelines is compiled by the Maintenance Department management; non-specific or general EdF courses are utilized but many of these courses do not take into account specific maintenance procedures at Gravelines. Safety culture training is being given to all maintenance personnel by designated trainers in the Maintenance Department. It appears that specific training in the initial pathway such as new equipment modifications and safety culture training is not part of the accreditation pathway, although they would clearly be meeting the criteria for nuclear accreditation sign off.

Maintenance contractor personnel are given a five-day course in site familiarity, safety culture, and QA principles. This course is normally attended at the start by a department head manager and is taught by local educators contracted by EdF.

Refresher training for electrical, mechanical and I&C personnel involve plant changes, safety training, and industry events training. On the average, this training last two to three weeks for each individual. In addition, new training as job responsibilities dictate, such as safety culture and job rotation is also given on an annual basis. In some parts of the maintenance departments, weekly meetings are held to communicate modes, station status, industry experience etc.

2.6 Technical support personnel

People in the technical support positions at Gravelines include engineers, planners, and technicians in the Technical Support (SUT) Group, the Generating Department, the Safety and Quality Team (MSQ), the Support Services Group and the Administration Support Group.

Section head management plays an active role in ensuring that their staff have the proper annual plan for their training. Training is based on broad job description guidelines and no task analysis is done to ensure all needed skills are given. EdF favours logical thinking and an overview of safety culture rather than specific task coverage.

Each support job has a defined level of accreditation and qualification and the basic initial training in all disciplines is in industrial and nuclear safety, risk prevention, and operating principles of Gravelines. Corporate and site training organizations provide the needed classroom, simulator, and laboratory training.

The MSQ team specifically employs both engineers and former Operations personnel. Although some MSQ courses are being developed, basic QA common training is satisfactory for needed skills overview.

Generally, initial programmes for technical support personnel take anywhere from several months to several years depending on experience. Plant adaptation programmes (PLAPs) are used in these areas for specific skills, but they are informal and not documented well to ensure proper job/task retention.

An individual professional project plan is under way in the SUT group to better utilize staff and arrange career development more formally. Also, the PLAP being upgraded in the Testing Section of the Generating Department is well written and extremely detailed.

(1) **Suggestion:** Consideration should be given to performing a task based analysis of each technical area to ensure that the instruction is centred at the procedure level where true tasks, and not just topic reviews, can be taught in the initial training programmes.

Plant response/action: *(July 1994) We are developing training from a list of required training for each specialization. These do not describe the basic tasks done, but define the competence which enables the activity for a given specialization to be carried out and to develop a studied approach (particularly the cautious and inquisitive attitude as defined in the INSAG-4 report).*

We believe that reduction to task level would not produce this studied approach as well as the desired professionalism for staff involved.

IAEA comment on status: *(November 1994) The team understands that a task competence approach is being defined in initial training for Technical Support personnel. While this approach is not reduced to the task level, the desired outcome should ensure that each activity for a given specialization is performance based.*

Conclusion: *Satisfactory progress to date.*

(2) **Suggestion:** Consideration should be given to providing periodic refresher training in teaching skills to in-plant trainers.

Plant response/action: *(July 1994) Site part-time trainers participate in internal departmental training and occasionally in certain training moduels carried out in the site training centre. We believe that their knowledge of the staff and of the area of training, together with their management skills are sufficient to make them credible and to enable them to pass on the necessary message.*

As a general rule, part-time trainers giving basic training are accompanied by a permanent instructor. After their session a debriefing essentially aimed at training methods is carried out. Moreover, in principle the person responsible for a training sessions chooses the most competent trainer (technical and pedagogically).

IAEA comment on status: *(November 1994) The Gravelines training organization has scheduled training for project managers, which includes teaching skills. Site part-time trainers received training on instructional methodology on an as needed basis.*

Conclusion: *Satisfactory progress to date.*

(3) **Suggestion:** Consideration should be given to upgrading the plant adaptation programmes in the technical support area to the level of the one that has recently been improved in the Testing Section of the Generating Department.

Plant response/action: (July 1994) The improvements to the local professional training programme in Twin Unit Group 3/4 have been taken into account by all site test sections. A common instruction has been issued defining the local professional training programmes for these sections.

In time, modifications will be made to integrate studies currently in hand at national level:

- *splitting up by activity*
- *ability to be achieved*
- *evaluation.*

IAEA comment on status: *(November 1994) None.*

Conclusion: *Satisfactory progress to date.*

Good performance: The PLAP in the Testing Section of the Generating Department is a good mechanism in that its objectives, tasks and evaluation scheme solidly support the training of the 10 technicians in this area. It is clearly the best PLAP seen in all the programmes reviewed.

Proficiency instruction for technical support personnel is about two to four weeks/year in length. This training emphasizes safety and quality, plant changes, some industry event discussions, as well as job post/station rotation. However, because of all the PLAPs are not to the same level of detail as regards continuing training, personnel are not always trained to the level of the procedures in many cases. A more structured specific continuing training programme is needed which is tailored to the needs of the support people in each group on the site. In addition, industry events training, when given, is not always formal and not normally evaluated for retention of lessons learned.

(4) **Suggestion:** Consideration should be given by Technical Support management to improve and upgrade the proficiency training of their staff by doing a task based upgrade of training materials. This should include periodic training on plant changes, industry events, etc.

Plant response/action: *(July 1994) The training of technical support personnel for them to acquire the necessary competence consists of:*

- *technical and professional competence*
- *competence in quality assurance*
- *knowledge of installation adapted to activities*
- *competence in safety.*

Within this framework, training must include training on modifications and experience feedback.

IAEA comment on status: *(November 1994) See comment for item 2.6. (1).*

Conclusion: *Satisfactory progress to date.*

2.7 Radiation protection personnel

The initial training programme of radiation protection personnel is based upon accreditation at a basic and an advanced level of radiation protection qualification. Job descriptions and the training plan guides are utilized to construct the initial training for the personnel.

Courses such as safety/quality, risk prevention and maintenance safety/operating principles are part of the accreditation pathway of all radiation protection personnel. At the more advanced stages of qualification, radiation protection personnel take courses on preventing radiation risks and using measuring devices.

Qualification of all new personnel is effectively evaluated by appropriate written and oral examinations. However, it appears that the initial training is not based upon a task based, structured system. Also, the OJT programme is not as structured and formalized as it should be.

(1) Recommendation: Industrial Safety and Radiation Protection Section (SRP) management should pursue task based training of personnel to ensure appropriate radiation protection duties and specific responsibilities are able to be carried out more effectively.

Plant response/action: *(July 1994) Radiation Protection and industrial Safety Section skills are developing rapidly;. with these the associated competence must also develop. The plant success Tests on a strong Radiation Protection and industrial Safety Section, recognized by users whose major requirements are:*

- *dose reduction within the framework of publication of CIPR-60*
- *reduction of accidents at work and their consequences.*

The tasks of this new Radiation Protection and industrial Safety Section must be to:
- *develop an 'industrial safety mentality' in the workforce*
- *impose respect for rules, policy and safety instructions*
- *listen to users, advise them on safety equipment and its use*
- *be in the field to see that safety rules are respected at the worksite and to decide on any necessary corrective action.*

Gravelines NPP has since November 1993 undertaken a study in depth of Radiation Protection and industrial Safety Section skills by studying their activities. This study was carried out on 60 activities in 14 categories:
- *Accidents*
- *Reception*
- *Leadership*
- *Outages*
- *Fuel*
- *Monitoring safety and radiation protection equipment*
- *Dosimetry*
- *Training*
- *Firefighting*
- *Rooms and exteriors*
- *Planning*
- *Service contracts*
- *Regulations*
- *Transport of contaminated material*

For each of these activities, a study is based on the 'do it' or the 'have it done' in such a way as to increase the professionalism of the Radiation Protection and industrial Safety Section staff; to each category has been associated the function concerned and the level of competence required to carry out the activities.

Thus in 1995 the setting up of the Radiation Protection and industrial Safety Section referential will being, which will set out:
- *technical and professional competence*
- *competence in quality assurance*
- *knowledge of installation adapted to activities*
- *competence in safety.*

The associated training (classroom, laboratory or in the field) must be developed [Item 2.7(2)] which is:
- *analysis methods*
  - *root cause*
  - *cause/effect diagrams*

- *communication methods*
- *IT specific training which is:*
  . *DTR (real time dosimetry)*
  . *Dosinat (national dosimetry)*
  . *Dosiana (analytical dosimetry)*
- *leading prevention action*
- *audit techniques*
- *knowledge of measurement techniques*
- *management of ALARA approach*
- *knowledge of regulations.*

From that point on, when initial knowledge has been acquired and checked [See item 2.7(1)], an accreditation will be given and will be obligatory for that function. Knowledge will be maintained and checked by periodic re-training [See item 2.7(3)]. Setting up the common training structure should enable this training to be achieved.

IAEA comment on status: *(November 1994) The Radiation Protection and industrial Safety Section has taken an aggressive approach to task review of individual job duties. A study was conducted in 1993-1994 to identify the skills required for the activities relating to the associated competence required for radiation protection staff personnel. Task based training will be developed for 60 activities in 14 categories. Continued effort to assure completion of the training activities within a reasonable time period is encouraged.*

Conclusion: *Satisfactory progress to date.*

(2) **Recommendation:** Industrial Safety and Radiation Protection (SRP) Section management should upgrade the present radiation protection on the job training (OJT) to ensure that all appropriate tasks and knowledge are included with specific objectives and evaluation schemes.

Plant response/action: *July 1994) See response given under item 2.7(1)*

IAEA comment on status: *(November 1994) The IAEA comment to item 2.7.1 applies to the completion of this recommendation. In addition, an evaluation scheme to measure the effectiveness of the training received by each individual should be incorporated into the systematic approach being used to provide feedback for upgrading all On-the-Job (OJT) training activities.*

Conclusion: *Satisfactory progress to date.*

The yearly refresher training programme for SRP Section personnel involves about four hours each month for modifications, procedure changes and industry events, as well as annual fire fighting training and other need based radiation protection proficiency training. Total time is about two weeks/year. The monthly radiation protection refresher training on industry events, etc. is led by the section supervisor and is conducted through out the year except during outage periods.

The continuing training is not truly based upon a task based process. Also, the industry events and mods training given for 3-4 hours each month is never evaluated as to lessons learned. SRP Section trainees are not given refresher training in pedagogical skills periodically.

(3) **Recommendation:** Industrial Safety Radiation Protection Section (SRP) management should perform a task-based analysis to improve the quality of the continuing training programme.

Plant response/action: *(July 1994) See response given under item 2.7(1).*

IAEA comment on status: *(November 1994) Set IAEA comments to items 2.7(1) and 2.7(2).*

Conclusion: *Satisfactory progress to date.*

2.8 Chemistry training

Chemistry technicians at Gravelines are trained to acquire theoretical and practical knowledge as well as keeping a critical, reflective attitude towards all results achieved. As in other plant training programmes, the training plan guide leads to an individual training plan (PIF) for all chemistry technicians and skilled workers. Initial qualification for skilled workers and technicians takes 18-24 months and involves about 12-15 weeks of classroom training at the site or at national raining centres. In addition, the site specific adaptation programme takes about 14-16 months.

The sequence for entry level qualification is skilled worker to junior chemistry technician to senior chemistry and then to lead chemistry technician foreman. The SUT group also has several chemistry technicians and they follow the same programme as the unit chemistry skilled workers and technicians.

Overall, the programme appears to cover the right material and it does have a proper task based systematic approach to training of the chemistry technician. The programme also relies heavily on the Plant Adaptation Programme (PLAP) and in-plant training for all the task instruction.

(a) **Good performance:** The one month in-plant training programme on fuel 'sipping' tests is very useful to provide initial skills for the advanced chemistry technician. The in-plant training and sign offs in this area are well organized.

(b) **Good performance:** The initial chemistry technician PLAP is controlled closely by the Chemistry Department supervisor. Assurance of mandatory performance of items, as opposed to simply discussing job responsibilities, ensures that a 'hands-on' approach is taken toward qualifying the unit chemistry personnel.

Proficiency training for chemistry technicians is centred around rotation between the different work stations within the Chemistry Department. Some courses listed in the optional portion of the initial training programme, such as new radiochemistry techniques and chemistry measuring apparatus are included in the 'shadow' training. Post accident sampling system (PASS) training occurs formally (two to three days/year), which is good. Specific training sometimes consists of technicians giving presentations to their peers on such things as new instrumentation, advanced radiochemistry ideas, etc. However, the structure of continuing training is not really based upon an analysis of the tasks which a junior or senior chemistry technician is expected to keep a good knowledge of on a periodic basis.

In addition, no evidence could be found of chemistry industry experience training or plant modifications and the resulting discussion of Gravelines specific lessons learned from this material. It is not clear just how industry experience/events and changes to chemistry procedures and laboratory equipment are received by 12 chemistry workers in the Generating Department and the chemistry technicians in the SUT group. However, job rotation of Chemistry technicians in the two groups does occur on occasions allowing experience to move back and forth.

(1) **Recommendation:** Chemistry Department management should set up systematic continuing training for 'all chemistry personnel, including the SUT group chemistry technicians, to ensure periodic coverage of those tasks, and their associated procedures, which are difficult or infrequently performed. Additionally plant experience from events and plant changes should be covered.

Plant response/action: *(July 1994) In the Chemistry Section, standard training plans have been defined. A large part of the training involves shadow training with evaluation. Taking experience feedback into account has been formalized; a general instruction states the organization of the Chemistry Section for starting and monitoring experience feedback action.*

Continuation training, which consists of integrating new knowledge necessary to carry out a chemist's task (new procedures, new equipment etc.), is carried out locally, if necessary with the help of external bodies (manufacturers).

IAEA comment on status: *(November 1994) The Chemistry section has formalized the process for providing experience feedback into the continuing training programme. Consideration should be given to systematically providing the training organization with the required integration of new training activities. The training department should also consider providing experienced chemists with the opportunity to present their areas of specialization during future training programmes being conducted for operations and maintenance personnel.*

Conclusion: *Satisfactory progress to date.*

(c) **Good performance:** The use of presentations by chemistry technicians on assigned projects to all peers as a training exercise is of good use in building more consistent expertise and team work within the Chemistry Department.

2.9 Management personnel

Senior plant management, with assistance from the corporate training departments, take an active role in defining the Standard Training Plan (PTF) and individual training plans (PIF) for each manager/supervisor in the unit. Gravelines has a management philosophy laid out for nuclear/industrial safety and nuclear plant cost-effectiveness which is to encourage and enable all managers/supervisors to fulfil themselves and their staff by taking on as much responsibility as possible.

In September 1990, the Units 3 and 4 Twin Manager took action to address issues of mid management dissatisfaction and accountability as well as to improve confidence in decision making processes. Communications, how 10 evaluate personnel, and responsibility delegation were given priority for training of section head level managers in 1991.

In 1992 the initial training programme for management was targeted at the foreman level with the aim of improving the section head and foreman interface: A course similar to that given to section heads in 1991 was given to foremen with different practical exercises. All foremen and section heads, who arrived since 1992 have taken this training as required by the twin unit management. Staff at the level of section head and above have courses at the national training centres, but these courses are only given when need is established.

Technical training for management is provided in subjects such as engineering and operations when certain department heads and section heads participate in simulator and operator systems/principles instruction. The new Operations Supervisor and Technical Manager on-shift positions are examples of this commitment to improving technical skills.

Management proficiency instruction takes place periodically in both the supervisory and technical skills required on-the-job. Department head and section head managers periodically attend specific technical instruction in their areas of expertise with their people. In 1992, proficiency training for Gravelines management in improved teaching skills and communications included a significant number of section heads and foremen (120 total).

(a) **Good performance:** The development of the new four day initial training programme for section heads and foremen by the Twin Unit Manager targeted at exactly the right level in the organization to effect management change and improve the operating culture of better communications, responsibility and safety awareness at the plant.

(b) **Good performance:** By giving teaching skills training to section heads and foremen, greater credibility in teaching the front line people is gained because management has better tools with which to motivate and emphasize their expectations.

The senior management initiative in holding site management training and information sessions is seen as a positive way to reinforce EdF and Gravelines management vision, forthcoming changes, and communicate and exchange ideas among all levels of supervision.

Emergency planning organization and tasks training for management numbers of the emergency planning team is given in overview fashion, but not; truly specific in its content of actual tasks to be accomplished by the different managers of the team.

Safety culture training initiatives for management training are being taken, but there is no mandatory plan to include safety culture for all foreman and above proficiency training. This should be included to ensure consistency across Gravelines units.

2.10 General employee training

Newly hired EdF and contractors' employees are required to take several general employee level training courses shortly after coming on-site and receiving a site access badge. The present initial programme includes risk prevention training, first aid, fire fighting, industrial safety, QA principles and basic radiation protection information. This training is completed normally within the first six months of hiring. First level risk prevention training is ten days long and is seen as the true strength of the whole general employee training (GET) programme. Emergency plan duties and responsibilities are not included in the present programme.

(1) **Recommendation:** Plant management should ensure that emergency plan duties and responsibilities are added to the present and upcoming general employee training (GET) programme revision expected in July 1993. This training should be accompanied by some sort of evaluation method as well.

Plant response/action: *(July 1994) On the first course attended by a new employee (new recruit reception) two hours are spent presenting the emergency plan, its organization and everyone' s role in case of emergency.*

At the time the nomination is proposed, the officer in charge of PCx staff on call trains the employee in his emergency role, referring to training document PUI (D5130/NA/CN 24-01-15)

A new exercise programme has been set up which includes in particular internal and external communications.

IAEA comment on status: *(November 1994) The IAEA comment is fully reflected in item 8.9(1).*

Conclusion: *Satisfactory progress to date.*

(a) **Good performance:** There is a ten day risk prevention programme within the first six months of new hire date. This is a good commitment to provide the expectations of site management.

(b) **Good performance:** Face to face introduction to site rules with the head of the industrial Safety and Radiation Protection Section (SRP) is a valuable tool to ensure all new employees know the importance of their site safety and work responsibilities.

(c) **Good performance:** Present general employee training (GET) course curriculum provides accident officer courses of 23 hours for a majority of the shift workers on-site. This course is mandatory for at least 50% of shift workers. Gravelines has trained more than 75% of their shift personnel in this course. This is more conservative than EdF national guidelines.

This GET programme is being upgraded presently with a new revision planned for July 1993. This revision is good initiative based upon feedback that people did not know how to communicate well enough and as a way to incorporating the new philosophy of reflection. Also risk prevention training will be split into two sections, one for all site workers and one for those who are work group supervisors and above. In addition, a three day professional adaptation for new employees is to be added where the plant manager talks directly with all new hire employees. Methods of evaluating the effectiveness of the GET programme could be improved.

(2) **Suggestion:** Consideration should be given by the Industrial Safety and Radiation Protection Section (SRP) to examine all of the present and proposed initial GET courses to check that evaluation/testing methods ensuring proper retention are in place and functioning with proper pass/fail criteria.

Plant response/action: *(July 1994) Initial industrial safety training courses are:*
- *Risk prevention*
- *First Aid*
- *Firefighting*

Obligatory training for staff working in the controlled area is:
- *Risk prevention*
- *Firefighting*

and an evaluation is envisaged as per item 2.10(3).

After this training, the training staff send an evaluation grid of the course member's knowledge and behaviour to line management who decides on his accreditation.

Local first-aid/instruction, aimed at promoting sale behaviour, practice of emergency situations and use of the correct methods of first-aid, is given by a site first-aid instructor assisted as necessary by another instructor. An obligatory check is made at the end of training by the works doctor on the aptitude for first-aid. Staff passing this test receive an EdF works first-aid certificate.
N.B. EdF has been officially recognized by the Prefecture as being competent to train and re-train its staff in first-aid.

Retraining of staff covers:

- *Risk prevention,*
- *Fire-fighting*

and each re-training course is followed by formal evaluation of the trainee; his line management then decides on his accreditation [See item 2.10(2) and 2.10(3)].

Re-training is given in first-aid and competence, is checked by the works doctor or delegated nurse, in order to verify maintenance of standards and to validate the EdF works first-aid certificate, on which are shown the dates of retraining and validations [See items 2.10(2) and 2. 1 0 (3)].

IAEA comment on status: *(November 1994) The industrial Safety and Radiation Protection Section has done a satisfactory job in identifying the required initial training and re-training courses for general employee training. A pass/failure criteria has been established for first-aid and fire fighting training and a formal evaluation of each trainee is provided to line management who then determine accreditation. In addition to the evaluation methodology provided during re-training activities a systematic method of evaluating each individual' s performance on-the-job should be established and provided to the training organization for future improvements in training.*

Conclusion: *Satisfactory progress to date.*

Refresher training for general employee responsibilities is properly structured to have proficiency version of all initial courses given. These courses, however, do not have evaluation of knowledge/skill retention associated with them. Risk prevention, first aid, fire fighting are all taught on a periodic basis. First aid for catastrophes is also included for shift workers and a large part of the site staff.

Lessons learned from industry experience is generally included in all of these refresher courses. Periodic sessions held by section heads or foremen with their people also reinforce industry experience and Gravelines policy changes.

As indicated above on initial training, the upgrading of the entire GET programme is set for July 1993. The refresher courses will also be modifie4 and the hours will be increased to improve proficiency.

(3) **Suggestion:** Consideration should be given by the industrial Safety and Radiation Protection Section (SRP) to add specific evaluation methods to all refresher GET proficiency courses for risk prevention, first aid, and fire fighting.

Plant response/action: *(July 1994) See response to item 2.10(2).*

IAEA comment on status: *(November 1994) See IAEA comment for item 2.10(2).*

Conclusion: *Satisfactory progress to date.*

3. OPERATIONS

The operational review of Units 3 and 4 of Gravelines NPP, was based on the review of the operating documentation and records, observations of the conduct of operations in the control room and in the field, and interviews with managers and key personnel in the operation organization.

The operating group although in a transition phase is adequately staffed, trained and well supported. The operating management demonstrates a clear commitment to safety and quality.

The average plant availability during the last year was above of the French and international average in spite of the recent ten year outage. Nevertheless an increase in 1992 of the number of scrams caused by human errors was noticed. As a result, an in depth analysis to identify latent weaknesses in the system was recommended.

The operations in the control room are conducted in a effective manner. During programmed power variations procedures were used and communications were well established.

The operating procedures and supporting documentation for normal operation developed by EdF is excellent. The system to control emergency conditions using event oriented procedures and to supervise the event using the symptom based procedures is well established and understood by the operators. However, it was observed that the system to keep the emergency procedures locked in a cabinet the control room might be cumbersome in the case of an emergency.

During the plant wa1kdowns it was observed that the field operators know the plant and understand the recently implemented computerized system for logging of field readings. This system was identified in the report as a good performance. Nevertheless it was noticed that some deficiencies and abnormalities were not reported by the field operators. During a walkdown, it was observed that the lighting was poor in certain areas of the plant and that the identification of equipment and piping was not adequate compared to good international practice.

The work planning and authorization process is comprehensive and well supported by computerized systems. The thoroughness of the requalification programme should be commendable. However, the use of deficiency tags was suggested as an enhancement to the system in place.

The work and administrative isolation process is thorough and no weaknesses were found in the whole process. The equipment isolation in the field is professionally conducted. It was noticed that only Deputy Shift Supervisors, Technical Supervisor and Senior Foremen are authorized to operate high voltage equipment. It was considered to be a good performance and indicates a commitment to safety.

The process to control temporary modifications is extensive and adequately documented and supported by a computer programme. However it was observed that the forms used in the control room to control temporary modifications were not filled in by the operators. As an improvement of the system it was suggested to include the commencement and termination dates of the temporary modification on the temporary modification tags placed on the equipment.

During the review it was noticed that the plant is thoroughly prepared for beyond design accidents and provisions are made to minimize the consequences in the case of a severe accident. The application of probabilistic studies and research work in the field of severe accident analysis for 900 MW(e) plants should be highlighted and it is recognized to be a good performance.

The fire protection programme is well organized. Responsibilities are well understood within the plant and fire fighting personnel are well qualified and retrained periodically. The local fire brigade station is well equipped with modem equipment including fire trucks, ambulances and radiological and chemical surveillance vehicles. Nevertheless, it was noticed during the visit to the local fire brigade that provision to maintain a fire truck within specified areas on a permanent basis to support fire emergencies in Gravelines NPP was neither documented nor understood by the local station fire chief. In addition, the establishment of direct communications with the local fire brigade from the control room was suggested.

Most of the concerns in the Operations area from the 1993 OSART mission have been adequately addressed by Gravelines NPP. Because of the large number of 900W units in France, EdF has a deliberate policy of grouping modifications with the object of keeping all units at the same reference state. The suggestion to maintain two qualified individuals present in the control room at all times was reviewed. The present policy relating to control room staffing was found to be adequate. The concerns relating to inadequate lighting in some plant areas are being addressed.

Gravelines NPP has initiated a programme to improve the performance of field operators by conducting training seminars in safety culture principles which stress the need to develop a questioning attitude and improve accountability.

The suggestion to use deficiency identification tags has been considered and plans are underway to develop a deficiency tagging system. There is also a programme to improve equipment identification. Improvements have also been made in the procedures, which define the activities, responsibilities for and verification of temporary modifications to plant equipment and procedures.

3.1 Organization and functions

The Generating Department in Gravelines NPP Units 3 and 4 comprises nine sections and is headed by a department manager who manages administrative, personnel and organizational matters and a deputy who mainly manages the technical issues.

As a result of the progressive implementation of the post of "Operations Manager", currently there are four shift teams each one headed by an Operations Manager and two shifts each one headed by a Shift Supervisor. Every shift team is a section of the Generating Department. The remaining three sections are Generating Planning, Testing and Chemistry. The three sections are managed by the Performance Team Leader. The new shift structure is scheduled to be implemented by the second half of 1994.

The purpose of this change in the shift organization is to enhance the position of the Shift Supervisor to Operations Manager. In this new organization the Operations Manager will supervise the evolution of the plant during an accident, until the arrival of the Safety Engineer.

The new shift structure is composed of a minimum of four control room operators, two per control room and one Senior Shift Foreman for tagging who report to the Technical Supervisor. The whole team is managed by the Operations Manager. The old structure is composed of a minimum of four control room operators who report to the Shift Supervisor. Two Deputy Shift Supervisors support the Shift Supervisor in the operation of the control room and in the work control and equipment isolation.

The Testing Section is responsible among other functions, for accomplishing the surveillance procedures applicable to operations. The Chemistry Section is responsible for carrying out the necessary sampling and analysis to support the safe operation of the plant.

Good practice: Electricité de France (EdF) have developed a series of information documents (practical Guides) to complement the operating procedures. These Practical Guides contain practical information about different aspects of operation of the plant ego shift turnover, handling of gaseous and liquid releases, temporary modifications. These guides are developed by experienced professionals such as Shift Supervisors or Foremen in a user friendly style. This self teaching information helps the operators to understand in depth several crucial aspects of the operation of the plant.

The authorization process in the generating department is thorough and well understood. In the case of an Operations Manager there is a requirement to have two years of experience as a Safety Engineer and three months training in management. To be appointed to the post of Safety Engineer it is necessary to complete an 18 month training course (for university degree engineers). In the case of non-engineers there are two ways to attain to the position of the Operation Manager after passing and evaluation test in the EdF headquarters. The first is to attend a training course of eighteen months. The second is to attend a six month training course to become a Safety Engineer, to work as a Safety Engineer for two years and finally to attend a six month training course.

The Shift Supervisor or Operations Manager supervises the safe operation of the units assisted by the Safety Engineer. However, he is not authorized to initiate the emergency plan in case of an accident. The Shift Supervisor or Operations Manager is authorized to start up the plant subsequent to a reactor shutdown, after an evaluation of the causes of the incident is made and the necessary prerequisites are fulfilled. This responsibility is shared with the Safety Engineer.

The Generating Department Manager visits the control room twice a day, performs a walkdown of the plant once a week for three hours and spends a week each year carrying out refresher training on a simulator in the role of a Safety Engineer, as part of his supervisory responsibilities. The Generating Department Deputy Manager also performs a walkdown of the plant once a week for three hours. The Operations Manager and the Shift Supervisor perform walkdowns twice a week for two hours. In addition three Generating Engineers support the shift in technical matters and substitute for the Generating Department Manager out of normal hours. This management supervision demonstrates a commitment to nuclear safety.

3.2 Operation facilities and operation aids

The control room is spacious, clean and quiet. Desks and panels are well designed for the operation and control of the plant and the operating procedures are well identified and located. Control room panels and component labelling were noted to be complete and in good condition. The alarm system is designed with four different colours that assist the operator in alarm analysis. The schematic mimic displays above alarm panels are clear and effective and provide the operator with a good overview of the main plant status. The process computers comprising the KIT and KPS systems provide additional aid in real time by means of core control process monitoring, data processing, accident analysis, thermal power measurement and plant history. The high speed of these computers enables analysis of transient and scrams. This is an effective tool for the operators.

(a) **Good practice:** Emergency operations procedures are suitably located and well identified near the control board in a glass cabinet. The alarms in the control room indicates when the emergency procedures should be used. This identification of procedures assists the operator during emergencies, and enhances the man-machine interface.

(b) **Good practice:** A system is used to guide the operators in the acknowledgement of important alarms with emergency alarms that indicate the procedure to be followed. Every alarm has an associated flowchart which displays the required actions.

The emergency shutdown panel is designed to maintain hot shutdown conditions and is located inside the electrical building. The instruments are clearly identified and the procedures are well located. A periodic exercise is conducted once a year at the annual refuelling outage when going from hot to cold shutdown condition.

There is another auxiliary control room for waste treatment, well equipped with one KIT computer screen and good instrumentation. Its design appears not to have taken human factor considerations fully into account.

3.3 Operating rules and procedures

The control room personnel carry out a very important portion of the drafting and review of operating procedures. This involvement is noteworthy and should assist training and familiarization with the procedures. The three Generating Engineers reporting to the Generating Department Deputy Manager, support the shift personnel in this task. The revision criteria established is two and five years for safety and non-safety related documents respectively unless an error is found or a modification is implemented.

Temporary modifications to operating procedures can be requested by Maintenance, Operations or even contractors but the proposal must be verified by the Generating Department Manager or his deputy and approved by the Shift Supervisor. The maximum allowable time for any temporary modification is two months.

Generic emergency operating procedures have been developed by EdF incorporating experience feedback from similar plants. Subsequently these procedures have been validated in the simulator and approved by the regulator (DSIN). Based on these generic procedures, specific procedures were developed at Gravelines NPP.

The general procedures for the primary system, include eleven holdpoints. The purpose of the holdpoints is to confirm that items such as Operational Limits and Conditions (Technical Specifications), administrative lock outs, requalification of systems, conditions of the reactor coolant systems, status of systems and line ups, are successfully completed before proceeding to the next stage.

Four controls by the safety committee and a list of systems that must be operational before changing the operating mode have been established. The purpose of these controls is to ensure that the Operational Limits and Conditions are met at every stage. These controls are documented and authorized by the Units 3 and 4 Manager and the Safety Engineer and the holdpoints by the Operator, Shift Supervisor and Safety Engineer.

Adequate alarm response procedures, surveillance procedures and logic diagrams are filed in the control room. There are no provisions to review flow sheets or wiring diagrams unless a modification or change is implemented.

At Gravelines two approaches to manage accident conditions are used, one event based approach used by the operating crew and another symptom based approach used by the Safety Engineer to supervise the operators as a redundancy for safe operation. Should the operators fail to select the appropriate procedure, the Safety Engineer will assume the control of the emergency using his symptom based procedures. Studies are being carried out at EdF to implement only symptom based procedures on the 900 MW(e) plants from 1995 onwards.

The procedures are clearly written in a flow chart format. Unless a modification is made the procedures in the control room are reviewed every three months. The emergency procedures are kept in a locked cabinet in the control room. The key for this cabinet is sealed in a glass box. It is necessary to break the glass in an emergency situation. The purpose of this seal is to control the quality of the emergency procedures.

(1) **Suggestion:** Consideration should be given to substituting the locking system by an administrative sealing of the cabinet contains the emergency operating procedures, which could be easily broken in case of an emergency. This system would maintain the integrity of the procedures and would facilitate the accessibility to these documents in cases of emergency.

Plant response/action: *(July 1994) We have been asked to simplify the locking system to reduce the number of actions in case of emergency.*

The following solution has been adopted by the site:

- *the cupboard will be secured by a lead/wire seal instead of being locked*
- *the seal is applied by a delegated shift member or by a member of the operating technical secretariat*
- *a monthly check is carried out of the cupboard's contents*
- *the instructions are still in sealed transparent plastic pockets.*

IAEA comment on status: *(November 1994) The plant response is accepted.*

Conclusion: *Issue resolved.*

There are seven accident procedures which are event based, according to seven postulated accidents and one general procedure to be used following safety injection.

The operational limits and conditions system was formulated by EdF at its headquarters in Paris. The whole system is very comprehensive and clearly defined. Limits and conditions are strictly followed in accordance with 'checklists' developed for this purpose. Any waivers are prepared in accordance with the guidelines and approved by the national safety authorities. A list of all such waivers is compiled annually and this forms a basis for consideration of changes to limits and conditions.

Sixteen events have occurred during the last five years, when the limits and conditions were exceeded. All such transgressions are considered as safety significant and rated as level 1 (French severity scale). The rules governing the application of limits and conditions and reporting any transgressions are closely adhered to. Limits and conditions applicable during outage periods are specified in detail.

Good performance: Equipment unavailability (relating to operational limits and conditions) is displayed on a special visible board in the control room. This board is immediately updated after any change, reflecting permanently the configuration of the safety related equipment.

3.4 Operating history

Gravelines NPP Unit 3 was commissioned in 1982 and Unit 4 in 1983. The average plant availability during the last three years is 74.1 % for Unit 3 and 80.45 % for Unit 4 in spite of the recent ten year outage in early 1993 (three months). These results rank high among French and international nuclear power plants.

Abnormal events are classified on the French severity scale and copies of the reports sent to EdF Headquarters in Paris and the nuclear regulatory authority. EdF Headquarters conduct an evaluation of the incident taking into consideration human factors. During this evaluation contacts are maintained with plant personnel directly involved in the incident.

During 1992 the number of scrams and safety related events caused by human errors increased significantly above international values. Control room operators, field operators and I&C technicians were involved in these events. Personnel at the plant and at EdF headquarters carried out analyses and evaluations of technical and human factors during the operating period reviewed.

(1) **Recommendation:** The analysis of the common root cause(s) of the events resulting from human errors should be carried out in greater depth for Gravelines Units 3 and 4 in order to determine latent weaknesses in the system. Self-confidence when operating for long periods of time could lead to relaxation of operating behaviour and this might be one factor to take into consideration.

Plant response/action: *(July 1994) See response to 1.3(4)*

IAEA Comment on Status: *(November 1994) The IAEA comment is fully reflected in item 1.3(4).*

Conclusion: *Issue resolved.*

Two turbine trips within nine months were caused by the same fault. The necessary corrective action was agreed following the second turbine trip in November 1992 but has not as yet been implemented. Modifications within EdF are studied and disseminated to similar plants. As a result, the interval from the modification acceptance to the implementation is longer than international practices and undue delays such as this may occur.

(2) **Suggestion:** Consideration should be given to reducing the implementation period for permanent modifications. This would in certain situations minimize the period in which a temporary modification is in effect.

Plant response/action: *(July 1994) The decision taken at corporate level is to introduce a policy of grouping modifications into lots with the object being better control of installations' reference states leading to an improvement in operating safety. The achievement of this grouping policy will be in stages:*

- *a study phase*
- *a preparatory phase across all French NPPs with the collaboration of the plant having the lead unit, at the end of which phase the contents of the group will be decided*
- *a phase lasting at least 4 months during which the lead site will adapt and confirm the appropriateness before work starts on the lead unit*
- *a work phase followed by experience feedback on the lot in this unit before release to all other French NPPs*
- *finally, the general modification phase on all units.*

However, certain safety related modifications which are urgent will be the subject of special programming outside the modification grouping system.

IAEA comment on status: *(November 1994) The EdF policy has always been to try to keep all nuclear units of the same series (CP0, CP1, CP2, etc.) at the same reference state. Because of the large number of 900 MW units, i.e. 34, it is difficult to have all units at the same level at any one point in time. Some modifications can only be made during 10 year outages. The plant response is accepted. The turbine trip incident referred to during the 1993 OSART was felt to be an isolated incident.*

Conclusion: *Issue resolved.*

3.5 Conduct of operations

Operating procedures, alarm sequences, logbooks, static and dynamic checklists, drawings and visual diagrams are commonly used and followed. The operators fill out checklists for post trip recovery and also for authorizations for changes in the operating mode. The shift supervisor and safety engineer sign the checklists. The operators use special logic tree charts for alarm priority evaluation. Small pocket guides have been produced. They contain extracts from 'limits and conditions', operating procedures, safety culture approach, etc.

(a) **Good practice:** The field operators are provided with small pocket guides. These guides include useful data and important items such as extracts from limits and conditions, plant wa1kdown tips, safety devices, fire protection equipment, valve line ups, tag out information, etc. The purpose of this pocket guide is to support the field operators during plant tours.

Three systems of keys are employed. These are emergency keys (keys for cabinets with operators emergency aids) and equipment keys which are kept in the Shift

Supervisor's office and I&C keys which are kept in the control room. Field operators also carry keys. The same keys are used for Unit 3 and Unit 4 equipment. There is no key register.

Shift turnovers are carried out in a professional manner. Operators are paid 15 minutes overtime to perform the band over without hurry. If, because of the plant status, this turnover period is extended this additional time is also compensated.

A shift team meeting is held jointly by the operators of Units 3 and 4 in the small room (with glass walls) situated between both control rooms after shift turnover. Both units control rooms are unmanned during this meeting, which can last for 15 minutes. However, alarms and phones can still be heard in the room and the control panels are visible. During outages two meetings are held separately because of the complexity of the tasks of the unit under outage.

While following the conduct of the operators in the control room it was observed that occasionally one of the control room operators left the control room for a few minutes, to make xerox copies or to go to the toilet. Further investigations also revealed that an operator was permitted to leave the control room to eat a snack.

(1) **Suggestion:** Consideration should be given to replacing the operator by a Technical Supervisor or a Senior Shift Foreman in the new structure or by a Deputy Shift Supervisor in the present structure should the operator need to leave the control room. Such permanent assistance by two experts in the control room would ensure complete awareness in case of incidents or accidents and more reliable operation of the plant.

Plant response/action: *(July 1994) The shift team which is present at the 19 metre level (Control Room, Technical Supervisor's and Isolation Supervisor's Office) is composed at the least of :*

- *an Operations Manager*
- *a Technical Supervisor*
- *an Isolation Supervisor (CPHC or OP 2/3)*
- *four operators of which one is on supplementary training (water/steam)*

In the event of an incident or accident the operator who is in the Control Room does not have any immediate operating action to carry out. He checks that the automatic actions are proceeding correctly and calls the Operations Manager, the Technical Supervisor and the Safety Engineer. Within a few minutes, the second operator is present in the Control Room.

To manage the incident or accident the operator uses incident or accident procedures. These require, after ensuring that automatic actions are proceeding correctly, the presence of 3 distinct people:

- *the coordinator*
- *the reactor operator*
- *the steam/water operator*

While awaiting the arrival of the Technical Supervisor or the Isolation Supervisor (CPHC) , the role of co-ordinator will be filled by the reactor operator. The two operators are present at the 19 metre level. The co-ordinator can be contacted immediately and can be in the control room within a time period compatible with the implementation of incident or accident instructions.

IAEA comment on status: *(November 1994) The plant response is accepted.*

Conclusion: *Issue resolved.*

Four technicians and three field workers per pair of units carry out field operations on Gravelines Units 3 and 4. The process of selection, training and accreditation is extensive and it takes 15 months to prepare a field operator for the first level.

The field operator walkdowns are supported by a band held computer system (SERVIR). This system is on trial in Gravelines Units 3 and 4. The system incorporates minimum and maximum values of field instrument and equipment parameters, keeps less important data for a period covering seven walkdowns and more important data for one year. The system is effective for the trending of data and can be used for predictive maintenance analysis.

(b) **Good performance:** The computerized system (SERVIR) in place at Gravelines Units 3 and 4 is an effective tool to record field data, to support the operators (providing maximum ~d minimum values) and for parameter trending when analysing equipment performance and equipment failures.

The field walkdowns are organized in such a way that all rooms and buildings are visited once a day. Readings are broken down over two days, although readings on safety related equipment are collected once per shift. During walkdowns it was noticed that some deficiencies and abnormalities were not reported, some because the field operator was already aware of them and others because the problems were not understood. Poor lighting was noticed in some rooms in the turbine hall, auxiliary building and in the water intake structure.

(2) **Recommendation:** In order to facilitate the supervisory activities carried out by the field operators, to improve the quality of their work and to minimize the risks of accidents, the lighting in the plant should be inspected and improved. Design changes should be made if necessary to achieve an adequate lighting standard in all the plant.

Plant response/action: *(July 1994) Unit 3/4 has carried out a general study and improvement of its lighting. The study was to strictly define the standards to be achieved. Unit 3/4 has specified for its installations those lights to be moved or to be increased in power.*

The other units are using the standards defined by Unit 3/4 and are checking which areas need to be better lit. This work will be completed by the end of 1994. The details for the whole site will then enable maintenance contracts to be negotiated and decisions to be made on priorities (in 1995) for bringing the lighting up to standard.

IAEA comment on status: *(November 1994) The survey on Units 3/4 identified 10 f areas where lighting should be improved. Work requests to mate design changes are being prepared.*

Conclusion: *Satisfactory progress to date.*

(3) **Suggestion:** Consideration should be given to Instructing the field operators on what to report, how to conduct more effective wa1kdowns and to communicate them the need to develop a questioning attitude during daily routine activities.

Plant response/action: *(July 1994) A working group (transverse across the plant) has developed a questioning method relative to the field operators' activities (roundsmen and operating technicians). This group was led by an Operations Manager and Technical Supervisor in 1993. Seventy-eight people, mainly roundsmen and technicians, were involved in the Study which was coordinated by the Operating Committee.*

A small booklet was produced by this group in the form of prompt sheets which was issued to all operations staff. Its issue was accompanied by an explanation by management who carry out random checks.

IAEA comment on status: *(November 1994) The safety culture booklet is intended to be a guide to field operators to assist them in the performance of their jobs. The intention is to develop a more questioning attitude and to mate personnel accountable for their actions. Seminars are also being conducted to have input* *from field operators as to how they can improve their job performance and make a better contribution to overall safety. The effectiveness of these courses of action should be proven before the issue can be considered as resolved.*

Conclusion: *Satisfactory progress to date.*

3.6 Work authorization

The work planning and authorization process at Gravelines NPP is comprehensive and reliable. It is supported by two computer programmes, one to manage work orders and the second for handling work authorizations.

Deficiencies in the field are not identified after being reported. There is, therefore, a possibility that the same defect will be reported more than once. There may be a failure to report at all because the assumption is made that the defect has already been reported. This is especially applicable for items scheduled to be repaired during refueling or planned outages.

(1) **Suggestion:** Given the current potential to originate deficiency tags in the SYGMA computer system, consideration should be given to attaching identification tags in the field to the faulty component detected, and removing them as soon as the equipment is requalified after maintenance intervention. This identification would enhance the reporting process and the supervisory activities.

Plant response/action: *(July 1994) Any leak detected in controlled or uncontrolled areas is subject to a work request filed under the name Extemal Leak. This work request includes a noxiousness analysis by its author, or by his management.*

A working group within the Gravelines NPP will be created at the beginning of 1995 to define the organization for the identification of defective components. This working group will be composed of Generating and Maintenance staff members and led by an Operations engineer. The terms of reference of this working group will include, at a minimum, the following points :

- *Definition of the field of application of deficiency tags. The types of defects which result in labelling must be specified. Only defects which can be visually observed should be considered.*

- *Definition of labelling methods and materials. Analysis of different methods and definition of the following :*

* *define the information which should be displayed on a defect identification tag*
* *define how the link between the defect identification tag and the Work Request in SYGMA which takes it into account, will be made*
* *define, for external leaks, how the noxiousness analysis of the defect is performed*
* *define the mode of production considered for the labelling*

- *Definition of the organization for labelling.*

- *Define "What, Who, Where, When, How, Why " for the application and removal of defect tags*

- *Definition of a strategy for implementing the organization selected. Define :*
  . *implementation strategy : experience gained on a pair of units with an experience feedback phase or a general trial throughout the site.*
  . *training information action to be taken with Operations and Maintenance staff*
  . *management follow-up of the organization and validation of the options chosen.*

IAEA comment on status: *(November 1994) Improvements have already been made in that a new category of deficiencies, i.e. equipment leaks, has been established in the SYGMA system. The plant agrees with the need for deficiency identification tags but has still not resolved the design of these tags or the procedures relative to their application. Experience with deficiency tagging systems in other NPPs in other countries should be reviewed as one source of input.*

Conclusion: *satisfactory progress to date.*

The work authorization process is established in three stages, preparation for work, work initiation approval 'and Operations approval. The following documents are issued if required: special permit for work involving fire hazards, permit to work in radiation areas and the requalification tests after maintenance. This equipment or system requalification, specifies the required testing to confirm the operability of the system or equipment according to the Operational Limits and Conditions.

A working meeting is held daily (early in the morning), to control the work activities. This meeting is chaired during normal operation by the Shift Supervisor or Technical Supervisor and during outages by the Generating Department Outage Engineer. Representatives responsible for the two unit group attend this meeting. These include members from Chemistry, Testing, Instrumentation, Maintenance, Health Physics, Generating Engineers and the Generating and Maintenance Department Managers or their deputies.

A thorough equipment isolation process (computer assisted) is used at Gravelines. The responsibilities for equipment isolation rest with the Operations Section, although the person responsible for carrying out the work is also responsible for confirming that the equipment isolations have been carried out properly.

During the walkdowns around the plant it was observed that the equipment identification labels were small and a few were missing. Tags or identification signs were not satisfactorily located to avoid identification errors. Steam lines were not identified, some lines were painted in two colours (connection to the auxiliary feedwater tank), some fire protection lines were not painted in red colour and flow directions were not indicated on the lines.

(2) Recommendation: An equipment identification programme should be established to identify weaknesses and to correct them in the short/medium term, taking into consideration operators and technicians suggestions. Equipment identification checks after maintenance intervention should be strengthened, confirming proper restoration of labels and adequate equipment identification after painting. This practice would support the good quality of operations and would minimize the potential for human errors.

Plant response/action:: *(July 1994)*
- *in 1994 : units 2, 5, 3*
- *in 1995 : units 1, 4, 6*

An accurate identification of valves and equipment will be carried out in all rooms.

- *Labels will be refurbished*
- *Identification of all equipment by room (electrical supply, hoists, air supply, lighting, telephone)*
- *Installation of diagrams showing the location of equipment in rooms at each level of the Reactor Building*

This identification will be carried out on the whole installation of a unit. All data will be entered into a computer database. SYGMA will also be updated.

IAEA comment on status: *(November 1994) The plant has embarked on a major scheme to label all plant equipment with its functional identity. The scheme also includes the requirement to improve lighting, to mark out floor areas where* *equipment and facilities are to be laid down during outages or special tests and to identify and document access requirements (e.g. scaffolding) for work on valves or thermal insulation, none of which were findings of the OSART mission.*

The scheme for labelling is being carried out in four principal stages:

-Identifying needs of each department
-Survey equipment
-Decide actions to be taken
-Carry out the work.

Steps 1 to 3 have been carried out for Units 2, 3 and 5 except for rooms that were locked at the rime of the surveys. (These will be surveyed in 1995). Step 4 will be carried out for Units 2, 3 and 5 in 1995. Steps 1 to 4 for Units 1, 4 and 6 will be carried out one year later than the other units.

Conclusion: *Satisfactory progress to date.*

Electricians are authorized to work on energized equipment on low voltage systems (48 V). Work authorization is needed to work on such equipment under these conditions as a normal practice in nuclear power plants. For high voltage equipment (6.6 Kv or higher) only the Deputy Shift Supervisor (senior operator) or the Shift Supervisor are permitted to operate the equipment.

Good performance: In Gravelines NPP only the Deputy Shift Supervisor (senior operator) or the Shift Supervisor are authorized to operate high voltage equipment (6.6 kV or higher). Given the personnel and equipment implications when operating high risk equipment, this is considered to be a good performance, and clearly indicates a commitment to safety.

The process to control temporary modifications is extensive and is adequately documented. Authorization by the responsible engineers, originator, supervisor and staff carrying out the work are indicated in the SYGMA computer system. A work authorization is required to implement a temporary modification, which enables the Shift Supervisor to know the status of the configuration of the plant. Two kinds of tags are issued to clearly identify temporary modifications in force, one by the organization performing the work and the second by the owner of the equipment. However, it was observed that the tags did not record the commencement and completion dates of the work. Whenever possible, orange paint is applied to the equipment to reinforce the identification of temporary modifications. When a temporary modification is initiated in the control room, a form is filled in and filled by the operator. By procedure, these forms must be checked for validity once a week during refuelling outages and once a year during normal operation. It was observed that forms were filled out in the control room but the operators did not sign then.

(3) **Suggestion:** Consideration should be given to determining the reason why the operators do not sign the temporary modification forms. Such forms should be signed as soon as the temporary modification is authorized for implementation or removal. The current situation may lead to a complacent attitude in the control room staff when the approved procedures are bypassed.

Plant response/action: *(July 1994)*

Systematic temporary devices and measures (DMP) during unit outage.

These DMPs are subject to prior risk studies. An Isolation Supervisor, available for the duration of the outage, is appointed to follow up progress in the placing and withdrawal of DMPs.

Corrective temporary devices and measures(DMP) (during unit operation or outage).

Each temporary modification must first be requested by the maintenance section and must be granted by the Operations Manager (for a unit in operation) or the outage section (for an outage -with a second level verification by the Operations Manager). A form is issued, signed by the Operations Manager. These forms are filed and available to operators until the DMP is withdrawn. This file is checked each week by an Operations Manager.

In both cases, DMPs being related to safety, security and/or availability are subject to temporary operating instructions which are taken into account by the operators (necessitating the signing of a register). The Operations Manager, assisted by the site engineering staff, is responsible for safety analysis.

IAEA comment on status: *(November 1994) The plant response is accepted. The modification forms are reviewed by all control room operators and a log sheet or register in a binder in the control room is signed. The shift supervisor con easily check who has signed the register.*

Conclusion: *Issue resolved.*

(4) **Suggestion:** Consideration should be given to including Implementation and termination dates on the identification tags, so as to enable any responsible person to determine whether a temporary modification is within the authorized period and for how long it has been implemented.

Plant response/action: *(July 1994) All temporary modification tags now carry work start and end dates.*

Departments concerned are :
- *I & C departments*
- *Maintenance departments*
- *Testing sections*

__IAEA comment on status:__ (November 1994) The plant response is accepted. The design of the temporary modification tags should however be standardized.

Conclusion: *Issue resolved.*

3.7 Accident management

EdF head office has developed a thorough programme for the 900 MW(e) reactors, to control or at least to minimize the impact of beyond design and severe accidents, based on research, probabilistic studies and experience feedback. As a result several features have been progressively incorporated into this type of plant.

Procedures have been developed to provide the link into the standard emergency procedures for accidents beyond the design basis such as, total loss of heat sink at power operation and at cold shutdown, total loss of feedwater, total loss of emergency power supply, loss of low pressure safety injection or containment spray systems, containment leaktightness failure, loss of low pressure safety injection and loss of containment spray systems.

Good performance: Credit should be given to Gravelines NPP and EdF, for the comprehensive application of the outcome of investigations of beyond design basis accidents into the development of procedures to handle these accidents in the most effective manner. The training of Operations personnel in those procedures in the classroom and on the full scope simulator should be also be highlighted.

The equipment related to beyond design basis accidents is maintained and tested on site as any other safety related equipment. The accident scenarios, such as the recirculation to the refuelling water storage tank in case of the complete loss of heat sink is tested during the commissioning of the plant. The efficiency of the containment filters, is tested during the tell year outages. The results are disseminated to all 900 MW(e) units in EdF.

The Operations personnel most familiar with this type of unexpected scenarios are the Safety Engineers on shift, who, on arriving at this situation would take the lead in conducting the control room operations. The operators receive training in the classroom and on simulators in using the beyond design and severe accident procedures as part of the yearly refresher training.

3.8 Fire fighting programme

Codes and standards for fire protection developed by EdF are followed in the preparation of the fire protection programme in Gravelines. The fire detection system is comprehensively spread over the two units. The central alarm system is located between the control rooms of both units. The responsibility of this system rests with the control room operators. When an alarm is actuated, the field operator is sent to check the origin of the alarm, who then informs the control room staff of his assessment. Checklists are used to guide fire fighting actions.

The Technical Supervisor is responsible for conducting fire fighting in the field and for coordinating the municipal fire brigade. The immediate action is provided by the shift crew (three persons from the shift, two persons for security and an additional six persons from the other four units). It is an established practice that municipal fire brigade personnel be accompanied by an operator.

Automatic fire suppression is only implemented in the areas of the reactor coolant pumps, high pressure safety injection pumps and transformers. The remaining fire fighting systems are manually operated. Surveillance tests are carried out on these manual systems such as fire fighting pumps, dampers, sprinklers, etc. The plant is divided into fire zones each of which has a local panel. Fire fighting surveillance is included in the regular walkdowns of the operators.

The municipal fire brigade normally has eleven fire fighters but never less than seven. It is available on-site within ten minutes of the alarm actuation. Communications during fire events are held between the control room, security headquarters (in the plant) and the Fire Protection Centre in Dunkerque. Common fire fighting drills are conducted at least once a year, led by the Plant Manager or his deputy. The municipal fire brigade is well equipped with fire trucks, ambulances and vans for radiological and chemical measurement.

During the review of the local municipal fire brigade, which is located 1½km form the plant, it was observed that there were no provisions to maintain at least one fire truck on permanent basis to support Gravelines NPP. It was also noticed that the fire chief was not aware of this item. Other fire brigades near the plant might take between 20 and 30 minutes to arrive. Fire alarms are communicated from the control room to the on-site Security Headquarters. Security Headquarters are responsible for establishing communications with the Fire Protection Centre in Dunkerque. The Fire Protection Centre communicates the emergency to the local fire brigade located in the town of Gravelines. This is an extended chain of communication. Direct communication between the control room and the local municipal fire brigade headquarters would be better.

(1) Recommendation: As the local fire brigade of the town of Gravelines is directly involved in the fire fighting programme of Gravelines NPP, at least one fire truck with its specified crew, should be available on a permanent basis to manage any fire emergency in a short period of time. The fire chief should be instructed in the assignment of priorities.

Plant response/action: *(July 1994) After analysing the recommendation, Gravelines NPP believe that the organization of the external emergency services in case of fire answers the question raised.*

In fact an agreement signed by the NPP and the Prefecture for the area (which has authority over all the professional firemen in the area) provides a precise list of the requirements which must be satisfied by the two parties in case of fire (availability of emergency services, means of communication).

From a practical point of view, the implementation of this agreement is carried out, for the Prefecture, by the Dunkerque Fire Protection Centre, which is responsible for the Gravelines and Mardyck centres.

The results obtained from all the exercises and from real fires have shown that this system is perfectly efficient:

- *arrival of the first emergency services at the actual place of the accident: between 5 and 7 minutes*
- *arrival of reinforcements from Dunkerque and Mardyck: between 12 and 20 minutes.*

IAEA comment on status: *(November 1994) The formal arrangements with the Prefecture together with actual results achieved to date confirm that the response time for External Fire Service is satisfactory. Adequate provision exists within the site plan to achieve proper decision and direction of external services on arrival on site.*

Conclusion: *Issue resolved.*

(2) **Suggestion:** Consideration should be given to establish direct communications between the Control Room and the local fire brigade in order to minimize the delays in the communication links between the Control Room, Security Headquarters, the Fire Protection Centre in Dunkerque and the local fire brigade in the town of Gravelines.

Plant response/action: *(July 1994) After analysing the suggestion in detail, Gravelines NPP is convinced that the present organization of communications between the site and the outside emergency services provided for in case of fire is the most efficient for all situations and particularly for serious situations.*

In fact, the time taken for the call to go through to the fire brigade which will take action is already very short (direct lines between the control room and the site protection post (PCP), between the PCP and the Dunkerque Fire Protection Centre, between this centre and the Gravelines centre and does not have very much effect on the total time needed for the fire brigade to arrive and be operational.

Indeed, going through the PCP enables the site to very quickly organize the reception of the emergency services and to guide them to the exact location of the accident (opening the entrances/gates, turnstiles, giving out portable dosimeters, setting out highly visible guiding markers at frequent intervals ..).

There have been several exercises with the fire brigades during 1993 and 1994, aimed at improving the times to reach the affected once the brigade has arrived on site. These exercises will be continued. Actual situations where a fire has broken out (or involving injured people) have shown the same times.

IAEA comment on status: *(November 1994) It is considered that the current arrangements reflect the right balance to achieve appropriate controls consistent application and speed of response. This is demonstrated by actual results obtained from responses to simulated and real situations.*

Conclusion: *Issue resolved.*

4. MAINTENANCE

The maintenance activities at Gravelines NPP are performed by several departments in the plant, and are based on a spirit of cooperation between the Twin Unit Groups and the Site Technical Support Group to achieve the common goals and objectives for the implementation of the maintenance programme during operation and outages. The responsibilities of the various departments and maintenance staff are clearly defined in procedures. Maintenance activities are carried out by qualified personnel.

The plant is well supported by the Electricité de France (EdF) corporate organization, who 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 of plant maintenance to ensure high quality maintenance which focuses on plant safety and availability. Plant operation and management policies influence contribution of the maintenance staff to safety. In this regard, the Quality Safety Plan approach to maintenance, the Maintenance Committee, work coordination meetings and detailed work procedures are good examples which enhance safety culture. Preventive and predictive maintenance programmes are well established and use a comprehensive computerized maintenance management system. Maintenance management systematically checks work reports, outage summaries and event reports to ensure that the maintenance programme is carried out in an effective manner.

The overall condition of plant equipment and systems is generally good, but some suggestions for improvement were offered during plant tours. More rime should be spent by management touring the plant. Storage areas, workshops and document archives were found to be in order and provide good retrievability. However, some concern was noted relating to the improper storage of flammable materials. The in-service inspection (ISI) programme is well organized and inspections are rigorously performed by qualified personnel. The outage planning process, outage programme implementation and outage follow-up are very well managed.

The positive response of Gravelines NPP to the findings of the 1993 OSART mission in the maintenance review area should lead to an enhancement of operational safety. Acceptable solutions have been found for the issues: in each case the issue is already fully resolved or progressing satisfactorily to a conclusion. These include the formal system of plant tours by managers and supervisors which, in part, is aimed at improving safety awareness of workers, calibration certification of local gauges used on safety related equipment, ensuring that the SYGMA system is able to call up only valid worksheets and the appropriate storage of inflammable materials in the stores area.

A challenge to plant staff still exists for devising an effective system for defect tagging of leaks. However, a system for the timely repair of leaks is being established.
The need for operators to be more insistent on the timely repair of defective equipment is being addressed through training.

4.1 Maintenance organization and functions

The maintenance activities at Gravelines NPP are performed by Support Services Departments of three Twin Unit Groups (SUC) and the Site Technical Support Group (SUT). SUC is responsible for the availability and safety of the plant facilities and decides on the maintenance activities to be carried out. It is also responsible for the maintenance budgets of their corresponding Twin Unit Groups. SUT has the responsibility for the maintenance activities of electrical, mechanical, valves, piping and welding during outages of all units, acting as a prime contractor delegated by the three Twin Unit Groups. It is also responsible for maintenance activities on electrical and mechanical equipment during operation when requested by SUC. The Support Services Department of SUC is responsible for maintenance activities on all I&C equipment during both operations and outages and for the maintenance activities on electrical and mechanical equipment according to the priority of maintenance work requests during operation.

The Nuclear Power Plant Operations Division in EdF corporate organization provides the site maintenance with national maintenance policy, strategy, personnel resources and material resources which are necessary to conduct the maintenance programmes. Additional services include technical advice and support, including performance of in-depth analyses and reviews of outstanding incidents, anomalies and non-conformities and operating experience feedback.

A Maintenance Committee was established in September 1992 .to aid cooperation between SUC and SUT in the maintenance field with the manager of SUT being the chairman, nominated by the Plant Manager. Bach group is responsible for implementing the decisions reached by the committee.

Good practice: The Maintenance Committee that was established to assist communication between the two maintenance groups is very useful to promote experience feedback, optimize maintenance resources and to validate major technical solutions.

Maintenance staff of the plant are generally competent and their work is of high standard, leading to a good level of nuclear safety. A programme for the qualification of the plant personnel exists for each position and a refresher training programme for each person takes place periodically.

The plant operational policy, management policy and example set by management contributes to the good work practices of the maintenance staff. In this connection, the Quality Safety Plan approach to maintenance, Maintenance Committee, work procedures and work co-ordinating meetings are good examples that enhance safety culture. The safety awareness of the maintenance staff during maintenance activities was found to be generally good. However, during plant tours, there was evidence that improvements could be made to overall safety awareness.

(1) **Recommendation:** More attention should be paid by management in the field to ensure that safety awareness of workers is maintained and improved. This could be achieved by establishing a format system of plant tours by managers and supervisors.

Plant response/action: *(July 1994) Safety culture is a question of professionalism and of discipline linked to individual behaviour which develops when requirements are imposed from higher levels.*

"When errors are made, they are considered Jess as errors than as a source of education which can be of value. Individuals will be encouraged to identify, indicate and correct imperfections in their work in order to help others as well as themselves to prevent future problems. Whenever necessary assistance is given to improve subsequent performance. "

Management must make it clear that they are concerned about safety.

They must -verify in the field that staff are taking safety into account and intervene to create improvements.

Periodic and formalized safety visits exist (or will exist) in each Twin Unit Group, particularly to maintenance work areas. The team is made up of:
- *A Departmental Manager,*
- *A Section Manager or an Engineer*

possibly accompanied by an SRP representative and/or a member of the CHSCT. These visits are (will be) used to carry out checks in the safety quality approach, particularly on safety related equipment (IPS) like :
- *checking SN and RN authorization,*
- *checking the quality plan monitoring*
- *checking worker INSAG4 behaviour.*

Within the framework of work linked with outages, these visits will contribute to the diffusion of safety culture to our contractors.

IAEA comment on status: *(November 1994) The IAEA comment is fully reflected in item 1.2(3).*

Conclusion: *Issue resolved.*

4.2 Maintenance programme

The maintenance programme of Gravelines NPP covers the functions and tasks of plant maintenance to ensure high quality maintenance according to the importance of equipment and plant availability. It is based on the national maintenance programme, which is established by the Corporate Maintenance Department of EdF.

Maintenance management systematically checks work reports, outage summaries and event reports to ensure that the maintenance programme is carried out in an effective manner, taking into account the development of maintenance policy and regulations. The event analyses evaluated by the plant are sent to the Corporate Maintenance Department of EdF for consideration along with those from other EdF nuclear plants. They are incorporated in the development of the national maintenance programme.

4.3 Material conditions, facilities and equipment

The overall equipment conditions and plant housekeeping were generally good in most areas of the plant. However, several steam and water leaks were found in the turbine building and in the pump house and were not identified; with deficiency tags to demonstrate that work requests had been initiated. Some labels on equipment such as valves and instrumentation were missing.

(1) **Recommendation:** Evaluation and rectification to equipment leaks in the controlled and uncontrolled areas should be performed quickly from a point of view of the plant reliability and worker safety. Such leaks should be identified by deficiency tags to indicate that a work request has been filed.

Plant response/action: *(July 1994) See response to item 3.6(1).*

IAEA comment on status: *(November 1994) Refer to comments for item 3.6(1). Deficiency tags are presently not in use and a study is being performed as to how to implement the tagging of equipment to indicate that a work request has been* *filed. Changes have been made to the SYGMA system to have a special category of equipment leaks designated. An inspection of Units 3/4 indicated that there were some equipment leaks but work was in progress to rectify them. The plant policy is to place high priority on the rectification of equipment leaks and there was evidence that this policy is effective.*

Conclusion: *Satisfactory progress to date.*

An instrumentation calibration programme is included in the plant preventive maintenance programme, but local gauges on systems important to safety on which calibration certification labels are not indicated were found. SUC for Units 3 and 4 started a provisiona1 local gauge calibration programme in November 1992 and a group was established in March 1993 in the Safety and Quality Team (MSQ) to develop local gauge calibration criteria and a calibration programme for Gravelines NPP.

(2) **Suggestion:** Consideration should be given to applying calibration certification labels to local gauges used on safety related equipment and notifying the plant Operations staff of the calibration criteria.

Plant response/action: *(July 1994) Maintenance policy for local gauges at Gravelines NPP (defined in April 1993) is based on the following principles:*

- *the purpose of this equipment is to detect any deviation from the physical measurement (its basic function is the measurement of the size concerned)*
- *local gauges should not be used to check performance*
- *any measurement outside RGE criteria must be validated by test instrumentation.*

The preventive maintenance chosen will ensure that local gauges used to monitor safety parameters for periodic tests (RGE) will be checked using equipment of a higher standard which has been previously calibrated. The criteria for scrapping a gauge will be failure to meet its standard of precision. Each local gauge will be checked every four years. All such site gauges will have been checked after the 1994 series of outages (December 1994).

IAEA comment on status: *(November 1994) The suggestion has been addressed adequately. The managers of each twin unit have agreed to meet the requirements of the suggestion by the end of 1994.*

Conclusion: *Satisfactory progress to date.*

Maintenance is supported by specialized workshops for SUC and SUT respectively. Material conditions and housekeeping in workshops were found to be generally good. Each workshop was well equipped for maintenance work during operation and outages, including a steam generator mock up in the SUT hot workshop.

Good performance: The full sized lower part steam generator mock-up facility in the SUT hot workshop provides workers with a good opportunity to improve their ski1ls and contributes to the reduction of radiation exposure (ALARA).

Remote controlled tools are widely used in the plant. A large amount of special equipment and tools to support maintenance activities has been purchased by EdF taking into account plant maintenance experience feedback.

4.4 Procedures, records and history

Gravelines NPP introduced a comprehensive computerized maintenance management system (SYGMA) in 1989, which is used in all maintenance activities from work request issuance to work completion. By using the SYGMA system procedures used in preventive, predictive and corrective maintenance activities are promptly prepared. Each maintenance procedure (work sheet) is registered in the SYGMA system by the procedure code, the activity description, the revision number, etc. This system is very effective and therefore well accepted by all personnel.

Maintenance procedures are developed and updated by an editor who has been accredited by a department manager, checked by the supervisor and approved by the department manager. Once a procedure has been approved, it is sent to the documentation section and in case of modification the former procedure is deleted. However, it was found that during the review a procedure number in the SYGMA system had not been updated.

(1) **Suggestion:** Consideration should be given to applying more formalized checks when updating input data in the SYGMA system to ensure a high level of quality in this system.

Plant response/action: *(July 1994) The updating of data in SYGMA is the responsibility of the 'Methods' technicians. For example, when a worksheet is replaced and its number consequently changed, the technician must correct the number in all the OIS in which it is used. This updating was difficult to perform when the A22 doc application worksheet number was used (called number A22).*

Since March 1993, if has been decided to use only the chronologically derived worksheet number created by SYGMA (called number BMO) which now avoids any possibility of inconsistency.

In the current, interim state of affairs, the verification of consistency between the worksheet used in job files and those referenced in SYGMA is performed by two actions :

- *the documentation ensuring the setting up of outage job files corrects the worksheet number in the file and provides the applicable worksheet.*

- *furthermore, the work co-ordinator verifies in an A22 List of applicable worksheets that the file contains the right worksheet al the right index number before approving it for action.*

In a few months time, when the balance of old numbers has decreased as a result of progressive updating, a single operation will permanently cancel all the old A22 numbers.

IAEA comment on status: *(November 1994) Gravelines NPP staff carried out an investigation of the scale of the problem identified by the 1993 OSART. They found that SYGMA was unable to check the validity of worksheets (gammes) that were referenced by an A22 number. However, they found that manual quality checks, routinely carried out before the issue of a work package, did include such checks and had correctly amended the A22 reference. The situation has, therefore, always been under control. Nevertheless, Gravelines is taking action to delete old A22 references and allowing SYGMA to assign its own references. The SYGMA system does check the validity of worksheet references it has assigned (i.e. worksheet bearing a SYGMA reference.)*

Conclusion: *Issue resolved.*

The technical documentation relating to maintenance activities is properly stored in accordance with good administrative procedures and was found to be updated correctly by the document sections in the main archives and in the satellite archives. The material history records are readily accessible and pro vide valuable information for maintenance activities. The plant is provided with technical information from all other similar plants operated by EdF. The maintenance staff extensively use this feedback for plant improvement.

4.5 Conduct and control of maintenance work

The overall impression of maintenance work was good. Maintenance is carried out by qualified personnel according to approved work procedures. Some shortcomings were found in the field, such as a defective padlock and a chain of a hoist hanging across stainless steel instrumentation piping. Plant tours to be performed by SUC management are described in a document which was formalized in March 1993. These are intended to ensure adherence to plant policies and procedures and to observe maintenance activities.

The auxiliary diesel generator preventive maintenance was checked as an example of equipment important to safety. The workers and their supervisor performed the maintenance in an efficient manner and the job file including the quality plan was properly signed and checked in accordance with work procedures. The equipment was isolated properly by the tagging system, which is authorized by using the SYGMA system and the computerized tagging system (AIC).

(a) **Good practice:** Evaluation and comparison between the predicted and actual job times are an effective means to improve future maintenance scheduling.

The maintenance work control system is entirely computerized and all maintenance activities are very well controlled by the SYGMA computer system. Any plant staff member having access to the computer can enter observed deficiencies into the SYGMA system. Every morning the new work requests are discussed at a work request meeting between the Operations Department and Support Services Department. During an outage in addition to these participants, the Safety Engineer, a Revision Engineer, an Outage Engineer and a Unit Operating Engineer are present. This meeting was found to be very effective for coordination of work and for informing the different departments about the work to be done in the plant.

(b) **Good performance:** The work request meeting between different departments and the work request agreement meeting in each department is a good method to prioritize work orders promptly and to obtain interdepartmental consensus.

Gravelines NPP has implemented a Quality Safety Plan approach to maintenance, which is intended to limit the human factors risk for work on safety related equipment. This approach specifies the required conditions during the activity, the risk foreseen, the monitoring points identified in the risk analysis and the necessary documents to be compiled into the job file.

(c) **Good practice:** The Quality Safety Plan approach to maintenance based on risk analysis relating to human factors provides effective independent quality control and contributes to plant nuclear and personnel safety.

4.6 Preventive maintenance (PM), predictive and corrective maintenance

The Gravelines NPP preventive maintenance programme is highly developed, taking into account the manufacturer's material specifications, maintenance doctrines and the basic preventive maintenance programmes developed by the Maintenance Department of EdF, which include local and national experience feedback.

For preventive maintenance during outages, the outage preparation documents are developed by planners who manage all maintenance activities taking into account the corrective maintenance work requests issued before the outage. Checking of maintenance work, evaluation and analysis of the results obtained during the execution of the preventive maintenance programme are well defined and properly performed.

Condition monitoring techniques are widely used to optimize preventive maintenance activities at Gravelines NPP. The predictive maintenance programme covers equipment important for safety and availability and makes use of a portable data collector and fixed instrumentation. Monitoring of parameters such as temperature, vibration, oil viscosity, pressure, conductivity, etc., monitoring intervals, monitoring equipment and points are clearly defined. The evaluation and analysis of monitoring records are correctly carried out and utilized at the national level together with the results from other nuclear plants operated by EdF.

Good performance: Using a portable data collector enables maintenance staff to record equipment conditions on the spot and to take countermeasures quickly, if required.

Corrective maintenance activities at Gravelines NPP are initiated by work requests using the SYGMA system. The new work requests are normally discussed every day at a work request morning meeting attended by representatives from the Operations Department including the Chemistry Section, the Test Section, the Safety and Radiological Protection Section and the Support Services Department. One of four levels of work priority is assigned to each work request. Urgent corrective maintenance identified during a night or weekend is provided with necessary action by on-call maintenance staff. Corrective maintenance work is performed utilizing an extensive well constructed job file. The impact of not performing corrective maintenance on non-safety related systems and on unit availability is considered and there may be a deferment to the next outage. This work would then be included with the preventive maintenance programme. After completion of corrective maintenance the completed job file goes back to the planner for the first analysis. If the analysis indicates more activities are necessary an experience feedback document is drawn up and either used locally and/or sent to the

Maintenance Department of EdF. This experience feedback enables other plants to deal with similar faults identified on the same equipment.

4.7 In-service inspection (ISI)

The Gravelines NPP in-service inspection (ISI) programme is based on the national programme. This programme is prepared and updated by the Corporate Maintenance Department of EdF and is based on legal requirements and experience feedback.

Safety related equipment inspected by the ISI programme is classified in three safety classes depending on their levels of importance to nuclear safety. The local ISI programme at Gravelines NPP is prepared taking into account local and national experience feedback and if necessary, specific inspections to follow up a recent event as required by the regional safety authority. The ISI programme is included in the initial outage file and sent to the safety authorities for approval two months before the outage. Results of the ISI programme are evaluated, documented and sent to the safety authorities two weeks before the plant restart. A meeting between the plant and the authorities is held to review the results prior to unit restart. The ISI programme, including an evaluation of indications, experience feedback and qualification requirements of technicians is well structured.

In-service inspection at Gravelines NPP is carried out by the Chemical and Metallurgical Laboratory (GDL) staff, EdF subcontractors and GDL subcontractors. For the management of the plant ISI programme, GDL assists in the detailed programme preparation, non-destructive testing specifications, supervising or performing the inspection, writing examination reports for each piece of equipment and presentation of the results to the safety authorities prior to plant startup. Certification of subcontractors is performed and performer qualification requirements of GDL and subcontractors are examined and tracked periodically by GDL. This system is clearly documented and was found to be well controlled.

There is a good fire protected archive for non-destructive test records in the plant. GDL has the responsibility for management of this archive and good record keeping procedures and good retrievability of ISI records were noted.

4.8 Stores and warehouses

The Stock Management and Provisions Section of the Site Administrative Support Group is responsible for procurement, storage and issuing materials, and spare parts.

The plant storage procedure is clearly defined in the Gravelines NPP Stock Management Document authorized by the Plant Safety and Technical Committee, and is in accordance with the EdF National Quality Organization Manual.

The Technical Support Unit of EdF is responsible for the procurement of safety related spare parts at the national level. The procedure gives a clear definition of the classifications of plant spare parts and materials.

In order to track and control inventory in tool storage rooms, a bar code system for controlling the issuing of tools is used. This is a very effective method of material and tool control.

Good performance: Use of the bar code system for the control, issue and inventory of tools is a very effective system.

Gravelines NPP has five warehouses. The storage equipment and facilities were found to be very clean. All certified spare parts are clearly identified by a stock code check sheet which has a special colour according to the safety classification of the spare parts. Plant storage requirements are well described in procedures. The shelf life programme for O-rings and other materials with special storage requirements was found to be in order. A working group was established in May 1992 and has been developing an action plan for the preventive maintenance for equipment in stores. In the main spare parts warehouse concern was noted relating to the improper storage of flammable materials. Stainless steel and carbon steel were properly separated and satisfactory protection was used to separate stainless steel from carbon steel.

(1) **Recommendation:** Proper storage for flammable materials and chemicals should be provided in the stores and warehouses. Appropriate fire risk analyses should be performed.

Plant response/action: *(July 1994) After further analysis of fire risk such materials are now stored in safety cupboards which have ;been specially designed for storage of inflammable liquids and solids as well as dangerous substances.*

IAEA comment on status: *(November 1994) A comprehensive risk analysis was carried out and the simple expedient of storing inflammable chemical products in fire proof cupboards was adopted. The cupboards are designed to isolate the contents should the temperature rise above a pre-set, adjustable level; doors would automatically close and seals inflate under heat to isolate the contents. Twenty such cupboards have been purchased and are in use.*

Conclusion: *Issue resolved.*

4.9 Outage management

Outage work planning and scheduling at Gravelines NPP are prepared by using a computerized scheduling system and is based on a long term national outage schedule, which includes all EdF nuclear power plants. This plan is coordinated in order to schedule contractors with specific abilities, national specific tools, fuel management and the electrical generation situation on the national level.

Outage work preparation is started 16 weeks prior to the beginning of an outage. A Revision Engineer is responsible for controlling the timescale and cost of the outage. An outage preparation summary document is prepared 14 weeks before the outage. This document defines the outage activities and establishes the critical path for outage.

After approval of the critical path for the outage, more detailed schedules for each of the outage activities is built up two weeks before the outage. Coloured outage schedule charts are produced to show clearly the conditions of main equipment during the outage according to the requirements of the Technical Specifications.

Good performance: The coloured outage schedule charts for main equipment enable plant staff to recognize clearly that this equipment must be kept in operation to satisfy the Technical Specifications.

Outage management is the responsibility of the Outage Structure organization, which is controlled by the management staff and includes a Revision Engineer, a Unit Operating Engineer, a Safety Engineer and an Outage Engineer. It is composed of staff from all technical departments of the plant having responsibility for the execution of tasks during the outage. The tasks and responsibilities of each staff member are clearly defined in a document authorized by the Plant Manager. The Outage Structure is organized 16 weeks before the beginning of an outage and functions until the plant reaches full power following the outage. The first daily outage meeting starts two days before the outage. Good communications are ensured through daily meetings.

The follow-up to an outage is very effective. The Revision Engineer is responsible for writing an outage report, which includes the technical, financial and administrative aspects of the outage. This is submitted to the site management and EdF headquarters.

5. TECHNICAL SUPPORT

The technical support functions at Gravelines are provided by a number of plant and corporate departments. The tasks and responsibilities belonging to the various departments are clearly defined. The directives from the corporate organization provide a framework of responsibilities for the local organization.

The overall surveillance test programme is extensive and of high quality. It includes not only the technical operating specifications but also recommendations from designers and suppliers of equipment. The execution of surveillance tests was found to be acceptable. However, some improvements could be made in the administrative control of surveillance tests in order to fulfil the technical operating specifications.

Both the plant. modification and the corporate modification programmes are of. high quality. The use of a project leader with well defined responsibilities demonstrates good performance in dealing with plant modifications. These designated persons are responsible for the safe and well documented progress of work.

The experience feedback programme is also of good quality. However, improvements could be made in the area of event analysis, particularly in the area of human factor related events. The decision to appoint a Co-ordinating Engineer in each twin unit plant is a positive step to improve experience feedback at the plant level.

The functions of reactor engineering and fuel handling were observed to be well managed by professional and conscientious staff. There are good relationships with and good support from the corporate organizations.

The preventive and corrective maintenance of process computers is managed in the plant and the plant must install new software and database revisions provided by the corporate organization. Other computer applications are developed at corporate level but it is the responsibility of the plant to implement and monitor the correct performance of these applications. At the plant level it is possible to implement local applications with the Plant Manager's authorization.

Gravelines NPP has adequately addressed the recommendations and suggestions made in the area of Technical Support during the OSART in March 1993. An external reorganization of technical and engineering resources is in progress which will centralize these resources on site and allow for better review of operational experience feedback, root cause analysis and resolution of technical problems on site. This reorganization should improve accountability of site technical personnel.

Improvements have been made in the administrative control of surveillance test procedures and a review of the technical adequacy of test procedure is in progress.

A permanent outage management organization is now in place which provides improved control of unit outages

A review of existing computer applications on site has indicated that there is no need at present for additional local applications. Additional national information. Systems such as a chemistry database are under development.

5.1 Organization and functions

Technical support at Gravelines is not, generally, specified as a single department, but the responsibilities for this area are shared by a number of groups, strongly influenced by the corporate departments.

The Nuclear Generating Division (EPN) and the Plant Engineering and Construction Division (DE) provide sites with support assistance and expert evaluation. The corporate organization provides doctrine, directives and guidelines but it is the site responsibility to implement these policies. Safety guidelines are provided by the Nuclear Safety Department (DSN) and implementation is carried out at plant level by the Plant Manager.

The operational Experience Feedback Group (GAREX) has the responsibility for in-depth analysis of specific events and for recommending actions to prevent the recurrence of future similar events. Outage experience feedback is carried out by the Corporate Technical Support Group (UTO).

For plant modifications UTO carries out the assessment of plant modification requests with design being performed by DE. A final date for the initial meeting in order to obtain plant consent with members of UTO, the Twin Unit Manager and the Technical Support Group plant (SUT) Manager, must take place at least two months before the start of the outage.

Technical Operating Specifications as well as the periodic test rules are prepared by DE. From these inputs: WN develops the General Operating Rules, which describe in summary tables the nature of the tests to be performed, the acceptance criteria and the frequency. Periodic tests for the twin units are based on reference test procedures that have been validated in a pilot plant of the same series.

In the corporate organization, the Nuclear Fuel Group (GCN) from the Nuclear Operations Department, is responsible for the carrying out of core management which is verified by fuel suppliers. GCN prepares and provides the SUC/SUT with the reloading pattern, safety evaluation of the reload and important physical parameters for plant operation such as critical boron concentration, rod worths, reactivity coefficients, flux maps and core physics tests for startup.

Process computer support at the corporate level is provided by UTO. At the plant level, supervision of software or hardware for national applications is provided by the Electronics and Computer Management Systems Section (GSEI) but they can develop their own local applications in agreement with the Plant manager.

5.2 Surveillance test programme

A comprehensive programme for surveillance testing has been established at Gravelines NPP to demonstrate that systems and equipment, both safety related and non-safety related, are within acceptable limits to perform their functions, as required by Technical Operating Specifications.

Technical Operating Specifications as well as periodic test rules are provided by DE. These documents have evolved over the years to include experience feedback and Plant situations not analysed In the Original design basis. The application of these new more restrictive documents has increased the number of significant events being reported to the safety authorities. From these inputs the Nuclear Safety Department (DSN) has prepared the General Operating Rules, which describe in sun~ tables the nature of surveillance tests to be performed, acceptance criteria and test frequency.

A good policy has been established during outages based on experience feedback. This policy includes hold points that require verification of the state of the systems by means of a cheek list as well as approval by a special safety committee that meets at least four times during the Outage. One of the aspects included in this policy is the control of surveillance tests taking into account the fact that many other groups besides Operations are performing surveillance tests during the outage. Periodic tests for the twin units are based on reference test procedures that have been validated in a pilot plant of the same series. Some complex surveillance tests to test specific design features that are common practices in other NPPs are not performed in EU plants, because of the high amount of standardization. Some of these tests are only performed in some of these plants during the ten year outage. Once validated in one NPP, and in agreement with the regulatory authorities, the tests are not performed systematically in the other plants of the same design.

An important aspect of nuclear safety is the control of Technical Operating Specifications and surveillance test requirements provided by the Safety and Radioprotection Engineer (ISR), who belongs to the Safety and Quality Team (MSQ) in the plant. The ISR is responsible for drafting and/or management of and updating of the surveillance test list provided by DSN. In addition, he is the normal contact with DSN for additional information related to surveillance testing, which may be required by any group in the plant.

Some weaknesses were observed in the overall administrative control of surveillance tests taking into account the large number of groups involved. During power operation, the ISR controls surveillance tests, acceptance criteria and test frequency in accordance with a corporate directive. During outages the ISR carries out the last verification in the hold checklist so that he is in a position to permit a change in the state of the plant in agreement with Shift Supervisor. The Shift Supervisor is responsible for verifying that systems are available when they are needed. The ISR does not have any specific mandate that allows him to carry out overall control and sometimes he must impose additional controls or checks, depending on the plant, systems and equipment status.

(1) **Suggestion:** Consideration should be given to improving the administrative control of surveillance testing. This could be achieved by creating a single data base which contains all the surveillance test requirements for every group. This database could include: the tests, the groups responsible, the frequency, the maximum time allowable, and all the plant conditions or states under which these tests must be performed in order to guarantee the availability of the system as required. In order to facilitate management by the ISR, consideration should be given to add an administrative control sheet that would be filled in by the person responsible for each group involved in surveillance tests. This sheet would then be sent back for processing once the test has been successfully completed by the required date. The database would then be updated. In this way it would be easy to have a complete picture of surveillance tests for all the groups in any state of the plant with minimum amount of work.

Plant Response/Action: *(July 1994) Currently, the Maintenance Department manages surveillance tests through the SYGMA system. It is responsible for programming the tests in liaison with the Generation Department who carries them out. The two departments hold a programme meeting. A schedule of work related to safety and availability is issued every week following a multidepartmental liaison meeting. This schedule is issued to all involved staff, especially the shift teams.*

The Operations Department ensures by various means that programming of all systems tests is done. It is also responsible for an overview of surveillance testing *using the instruction which lists all criteria of Chapter 9 of the RGE (General Operating Rules), the division Of responsibility between sections and references of working documents.*

For outages, start-up testing is included directly into the scheduling. The various sections concerned liaise in the Preparation Of this Programme. The current site outage Project will enable this to be further improved .

IAEA Comment on Status: *(November 1994) There have been considerable changes made in the administrative control and procedures relating to surveillance tests. Although a single database is not in use, these changes achieve the same end results. The plant response is accepted.*

Conclusion: *Issue resolved.*

Good performance: The in-depth analysis performed by DSN for the various outage states, which is reflected in the Technical Operating Specifications; the Plant implementation of this policy which includes additional surveillance test requirements; and the role of the ISR are an improvement on the standard practices seen in most NPPs.

Administrative controls have been established to deal with any changes in test procedures generated by design changes. If a test is delayed beyond the maximum allowable time, a significant event report is submitted and the operating status of the unit changed, if necessary.

Equipment requalification subsequent to preventive or corrective maintenance is performed by tests to verify adequate performance. These tests are performed independent of the normal schedule for the surveillance tests and thus maintains the same periodicity in spite of the requalification.

Scheduling of surveillance tests is carried out on a weekly basis but with different approaches depending on the group involved. The Operating Engineer supervises surveillance tests to be carried out during the next week. He can modify, add or cancel some tests in order to balance the work load within reason.

The tests witnessed were carried out in a professional manner with good test equipment being available. Good administrative controls on work approvals were followed by the technicians responsible for the tests. Insufficient control was observed in some of the test procedures in that they did not clearly specify the return of the system to its normal configuration once the test had been performed.

(2) **Recommendation:** The test procedures should be reviewed relative to returning systems to the normal state in order to ensure the correct line-up of the system once the tests have been performed. This could be achieved by extending the checklist to indicate explicitly the steps necessary to return to the normal state.

Plant Response/Action: *(July 1994) Writing test procedures for most of the elementary systems is shared among the French nuclear power plants by EdF headquarters using the principle of 'reference units'. Each site, therefore, writes reference test procedures attributed to it, which are then taken into use by the other sites, possibly after modification to meet purely local differences. This arrangement, made possible by standardization of the French nuclear power plants, avoids each power station having to study each modification to the documentation. Furthermore, the writing of test procedures is consistent over all sites by rules defined at corporate level. This structure enables a good level of quality to be guaranteed and enables experience feedback to be taken into account.*

Analysis of incidents after use Of test procedures has shown that almost all errors when returning to the normal state after surveillance test, stem from special devices and measures (temporary) (DMP), which have not been correctly included in the test procedures. In 'classic' use of the test procedures, staff professionalism is good enough to ensure correct returning to the normal state. It is not appropriate to introduce cumbersome systems for these.

At local level, taking this recommendation into account is in accordance with Directive No. 74 of 26.11.93 Definition and organization principles for the management of DMP. For each surveillance test where a DMP is in use, this requires its formalized and explicit removal.

A first stage carried out by Twin Unit Group 516 had verified about 60 tests out of 300 per unit by the end of 1993. In these 60 it has been noticed that in some, the return to normal state was not sufficiently explicit. A more complete check will be carried out on, all surveillance tests during outages on units 6 and 5 during 1994. This will allow the definition of the test list to be clarified. The aim is to have finalized a list by the end of 1994.

IAEA Comment on Status: *(November 1994) The plant response is accepted. The review of surveillance tests to determine if there is sufficient information listed to ensure that equipment is returned to its normal state should be completed as soon as possible.*

Conclusion: *Satisfactory progress to date.*

Generally speaking there is no policy at the plant for the performance of historical or trend analysis of test results. This is left to the individual work groups to decide. Only when an anomaly is repetitive is a trend analysis started.

(3) **Suggestion:** Consideration should be given to the establishment of a general policy at Gravelines for the performance of a first level analysis of the results and data from surveillance tests as a matter of routine. This could improve in-house experience feedback and could predict possible future actions when measured parameters begin to differ significantly from normal values.

Plant Response/Action: *(July 1994) The surveillance tests done by Operations enable verification that equipment and systems comply with safety requirements. Trend analysis is not done systematically. However research into trends is carried out depending on the importance of equipment (e.g. chemical and volume control pumps) or its proximity to threshold levels.*

One of the principal duties of the Operations Manager is to decide how much monitoring to undertake. He carries out a first level functional analysis. An Organization instruction defines the responsibilities of the executant of the surveillance test, the 'checker' (the Operations Manager), and the 'verifier' the (safety engineer) in the sense of the 1984 Quality Decree. Setting up instrumentation can be requested of the Test/Inspection Sections.

On the other hand, a certain amount of equipment is monitored within the framework of condition monitoring by the maintenance departments. Therefore trend analysis does exist, which can give rise to further work or monitoring.

Within this framework, study of regrouping maintenance into one group, as well as the Operations Approach Project should permit the following improvements:

- *set up a policy of surveillance test, trend analysis by the off-shift structure.*
- *permit better liaison between analyses carried out by Maintenance and by Operations off-shift structure.*

IAEA Comment on Status: *(November 1994) The general policy relative to first level analysis of surveillance test results is now in place. The plan, however, is to go beyond the original suggestion and perform long term trend analysis by the new Operations Planning section. Priorities will be established as to which equipment is to be analysed in greater detail.*

Conclusion: *Issue resolved*

Information related to surveillance testing, number of tests and anomalies found during the evaluation of safety related equipment performance are sent to DSIN every two years. SUT and SUC also make a standard report after each outage that refers to the surveillance tests performed by these sections during outages.

5.3 Operational experience feedback

Operational experience feedback at Gravelines is the responsibility of the Safety and Quality Team (MSQ), which has two groups, one for Maintenance and one for Operations. The Safety Engineers on shift belong to MSQ.

MSQ is responsible for the detection and analysis of incidents during the in-service and outage phases and controls the feedback of information on-site. The Shift Supervisor and the Safety Engineer on shift initiate significant event reports and the initial event analysis is carried out by them. However, the initiation can be made by other departments with the support of MSQ.

Significant event reports may be initiated according to ten criteria. For such events operational experience feedback files will be started based on the decision of a Twin Unit Manager, at the request of the regulator or based on other requirements from corporate or on-site organizations. The Twin Unit Management Committee appoints the person to reply or to take action, defines completion dates and reviews the status of files beyond completion date. In 1992, 55 files were opened for Units 3 and 4 and in response 145 actions were initiated, e.g. responses to the requesting organization, procedure modifications, etc.

The first analysis of events will be performed on site and second analysis of the event is carried out by the Nuclear Generation Division Operational Experience Feedback Group (GAREX). In GAREX there will be a responsible person assigned as a so called 'pilot' to perform the analysis.

Experience feedback analysis on-site is split in two levels. The first level must be completed in four days. The second level must be performed in at least in two months. The monitoring of the actions following a significant incident report (CRIS) in the first stage is the responsibility of the twin unit management and overall control is provided by MSQ. Follow-up is monitored by a computerized system. However, there are no event reports prior to 1986 in the computer database. Therefore, it is not possible to assess what actions were taken. The event reports from 1991 are all closed.

(1) **Suggestion:** Consideration should be given to have event reports before 1986 implemented into the database in order to allow a better analysis and follow up of recommended actions.

Plant response/action: *(July 1994) Significant event reports before 1986 were the subject of a study, which was completed in July 1994. A summary shows for each incidents:*

- *the cause*
- *the origin, which could be a technical or human failure*
- *the type of incident as defined in Directive No. 19*
- *the fact that the incident could be linked to refuelling*
- *if it is an incident or a deviation by IAEA definitions.*

IAEA comment on status: *(November i994) Re suggestion has been implemented as described.*

Conclusion: *Issue resolved*

In March 1993, only three of the 13 significant event report files from 1992 were still open. The same eagerness can be seen in the experience feedback files of Units 3 and 4 in that there were only four out of 145 actions from 1992 not closed out.

Off-site, the assessment of significant events is performed by GAREX. Implementation of corrective actions is carried out by the corporate organization, either by the Nuclear Plant Coordination Group (GCP) or by the Corporate Technical Support Department (UTO). If corrective actions are assigned to different departments, a so called 'Affaire Parc' file will be initiated. GCP sends this file directly to the manager of the nuclear power plant. At the plant, a Co-ordinating Engineer (ICI) is in charge of identifying and analysing event files. The ICI may also carry out in-depth analysis of site events and reports this analysis to the corporate experience feedback departments.

The Twin Unit Safety, Committee (GTS) usually has a meeting once a month to review events and status of corrective actions or an immediate meeting if a safety related event occurs. Twice a week the Twin Unit Management Committee have a short technical conference and once a week a deliberation to solve and discuss administrative problems is held.

MSQ is in charge of the control and implementation of the appropriate corrective actions. The Twin Unit Manager is responsible for ensuring establishment and monitoring of the follow-up actions.

For external events (both EdF and non-EdF) experience feedback information is sent from GAREX to the plant. At the site many different organizations have access to experience feedback information. The recent establishment of the Co-ordinating Engineer was an important step in clarifying the experience feedback process in the twin units, but this has not been extended to the whole site. For external events there is a computer data base which lists all events that have occurred in EdF NPPs. Staff who are involved with incident analysis or in follow-up actions have a coded access to this data base.

(2) **Recommendation:** To emphasize experience feedback there should be an on-site organization which is responsible for the distribution and control of all off-site and on-site event reports. This would provide better site co-ordination and better assignment of human resources.

Plant response/action: *(July 1994) Within the framework of a study into site organization, one of the five priorities covers this recommendation. The Engineering Project will enable grouping of all engineering staff under one head. The Engineering Department (ED) is made up of three main parts:*

- *The first part groups about 20 people to cover long term analysis. There are four specializations: operations, I & C, electromechanical and specific transverse studies. These people lead site responsibility work with the aim of improving safety, unit availability with optimal management. The main subjects dealt with are: analysis of basic maintenance programmes, analysis of operational surveillance testing, processing experience feedback, analysis of particularly complex technical files, guiding national enquiries etc.*

- *The second part is made up of people in the operational departments who maintain the link between work, immediate first level analysis, and in depth analysis in liaison with the first part of ED.*

- *The third part is made up of a representative sample from various site departments, dealing with the technical priorities to set up from elements prepared by ED. It deals mainly with long term trends, analysis of major technical matters.*

Technical correspondence is centralized for study and analysis before possibly being sent out to the sub-units. National experience feedback is thus analysed by one person, depending on specialization. The SAPHIR system (system of analysis of records for experience feedback) will enable analysis and monitoring of both local and national experience feedback.

Events which happen in a site unit are subject to departmental analysis. Joint study by the Generation and Work departments enables detection of potentially large problems. Subjects to be dealt with at site level are then sent to ED for discussion. A 'Case' is then created for analysis with a single site person responsible (either ED, or in the sub-unit).

One person in Engineering is responsible for overall monitoring of experience feedback whether local or national.

IAEA comment on status: *(November 1994) There has been an extensive reorganization of engineering and technical support resources on site since the OSART mission in 1993. This reorganization goes well beyond the OSART recommendation and should lead to a much greater sense of ownership by site technical personnel.*

Conclusion: *Issue resolved*

In order to emphasize experience feedback during outages, there is an on-site experience feedback programme to analyse outages. Meetings are held to exchange the different SUT and SUC experience consisting of dedicated staff from both departments and an expert from UTO.

At the corporate level (UTO) several engineers are working to assess outage experience feedback. For one to two days per week the UTO engineer responsible for the station is on-site. UTO has developed a handbook which was tested during an outage at Blayais NPI) in 1992 and will be distributed to all sites in March 1993.

In order to reinforce outage experience feedback and to shorten the duration of outages there should be an on-site control process established by MSQ.

(3) **Suggestion:** Consideration should be given to using an experienced operations engineer or shift supervisor in the outage scheduling Organization in order to improve the liaison between SUC and SUT.

Plant response/action: *(July 1994) The new outage organization, in place since Unit 4's outage in 1994, is organized on a Project basis. Its principles are set out in D5130 NA/CN 00 02 03 and its main aim is to group all outage staff under one manager. The outage manager in the Generation department is part of this team and is responsible for supervision of all generation outage activities.*

IAEA comment on status: *(November 1994) There is now a permanent outage management organization in Place which is responsible for planning outages,* *organizing equipment tagging and isolation, scheduling tests, liaison with operational shifts, monitoring unit shutdown and startup, preparing requalification tests, and designating equipment line-ups. Refuelling outages at Gravelines are scheduled to take place in the period from March to October and average 33 to 35 days in duration except for the recent outage on Unit 1 in which new steam generators were installed.*

Conclusion: *Issue resolved.*

There is a group in the corporate organization consisting of engineers, scientists, ergonomists and sociologists, who are responsible for human factor analysis. The results are reported in an annual report. Human factor analysis is conducted only on significant event incidents. In 1992, 366 significant events were reported from Gravelines and 69% of them had a human factor cause.

(4) **Suggestion:** Consideration should be given to improve the site capability to analyse root cause of events. The use of resident human factor experts and guidelines should be emphasized. Human factors analysis at the site level should take into consideration in addition to the significant event reports all events which affect availability.

Plant response/action: *(July 1994) See response to 1. 3 (4)*

IAEA Comment on Status: *(November 1994) See item 1.3(4)*

Conclusion: *Issue resolved.*

5.4 Plant modifications

Modification requests can either come from the plant or from corporate departments. The assessment of these requests is performed by the Modification Managerial Committee of the Engineering and Construction Division (DE) and the Nuclear Generating Division (EPN). Following preparation, feasibility studies are performed and the proposals come back to the Modification Managerial Committee for acceptance or rejection. If a modification is approved, a Modification Engineering Leader will be appointed. GAREX examines the request and approves the required documents for action. After GAREX has given its agreement, the EPN Corporate Technical Support Department (UTO) is requested to start the annual planning for the installation of this modification. UTO requires the plant to agree to the modifications at least two months before the start of the outage.

Monitoring and control of the modification Process is performed on-site by the OMNIS computer program and at the corporate level by the CHAMOIS and GESMOD Programs. The safety authorities have access to the latter computer program. Modification Management on-site is Provided by the Modification Common Structure Department (SCOM) along with a quality assurance engineer from, the Quality Department of DE. SCOM is a department of the General Engineering Centre (CIG) in Marseilles. SCOM Provides Project management for modifications and new construction work.

Both the Corporate Technical Support Department (UTO) and the Studies Unit (LTCE) of DE can initiate field Work dossiers for modifications. The dossiers are verified, registered and classified by SCOM. Safety analysis is carried out by the Plant Safety Committee.

The contractors are monitored by the technical department of SCOM which can be supported by the local Construction Quality Control Department (SQR) engineer for non-destructive testing. Monitoring before starting the Work includes a review of the quality assurance programme of the contractor and listing of applicable documents. Upon completion of the work, SCOM verifies that the modification is in accordance with design and updates the mechanical drawings.

SCOM is in charge of the modification, but the work is performed by the on-site organizations depending on the area of responsibility. The division of work between the departments is well documented and controlled including the updating of the affected documents. The documents are updated in a period of one month after the conclusion of work.

In order to improve the engineering and updating of documents after the completion of modifications, Gravelines has started to transfer facilitators from SUC to SUT. For approval of modifications to I&C equipment all necessary documents must be included in the work package. Work cannot be started without valid requalification Procedures. In such cases the operating engineers use existing surveillance tests or they must establish new tests. Requalification is done in accordance with strict procedures and follow exact sequences. All required endorsements and independent checks must be completed before the modification can be accepted into service.

The updating of documents which are affected by a modification and are not I&C related starts with the approval of the modification programme. After the completion of the modification work the verification for conformity is first done by SCOM and the second inspection is performed by SUC. The validation of the modified documents follows immediately with updating of the computer data base, distribution of the new documents and cancellation of the invalid ones.

The status of modifications, which are carried out during an outage, must be presented to the safety authority for their approval for beginning of the startup phase. The essential documentation changes for normal plant operation must be completed at least in a draft version and all changes indicated.

Although there is a procedure which describes and formalizes temporary modifications at the plant there is no procedure for temporary sampling facilities or measurements on systems, which are in service.

(1) **Suggestion:** Consideration should be given, in the existing temporary modification procedure, to include a procedure which indicates the necessary approvals and provides written information for the shift staff.

Plant response/action: *(July 1994) See item 3.6(3)*

IAEA comment on status: *(November 1994) Refer to comment for item 3.6(3).*

Conclusion: *Issue resolved.*

Good performance: The modification programme at the corporate and site level is an example of thoroughness and is clear and strictly structured, even though different departments are involved. In particular the requirement that work cannot be started without a requalification procedure is exemplary.

5.5 Reactor engineering

Reactor engineering tasks at Gravelines NPP are performed by the Generating Department (PN) of the twin unit.

In the corporate organization, the Nuclear Fuel Group (GCN), is responsible for core management and this is verified by the fuel supplier. GCN carries out and furnishes the reloading pattern to the SUT and the safety evaluation of the reload, theoretical parameters for plant operation: critical boron concentration, rod worths, reactivit) coefficients, flux maps and the core physics tests required for startup to the SUC. This data is supplied approximately one month before the station needs it. In order to make this analysis for the next cycle, GCN follows up on the necessary on-line data.

EdF does not have a zero fuel leakage policy. In the case of significant leakage, above the limits, a decision relative to reinsertion or repair of the fuel is taken by the Twin Unit Manager with the technical support of GCN. Load following is forbidden if fuel integrity is suspect, as determined by primary system activity achieving a predetermined value, or with MOX fuel in the core.

Gravelines Units 3 and 4 use MOX fuel. Some plant modifications were implemented due to the MOX fuel as were more restrictive controls for access to the fuel buildings. Additional training has been carried in the plant for general staff and also more in-depth training for Operations, Chemistry and Radiological Protection and Fuel Handling staff.

The Testing Section from PN is provided with sufficient human resources with good levels of knowledge and experience. Their relationship with GCN is good. An exhaustive surveillance tests programme is performed by the Testing Section in particular those tests which are related to the cross incore-excore calibration every 90 effective full power days. No trend analysis of test results is carried out at the plant level.

Shutdown margin calculations after a reactor trip are carried out by three persons, two from the Operating Team and one from the MSQ using two different methods. The calculations of all three must agree before commencing the approach to criticality.

The chemistry section from PN follows up on cladding integrity by analysis of primary circuit activity during the cycle as well as by analysis of sipping tests during outages. The criteria for maximum activity are specified in the Technical Operating Specifications, and the criteria to carry out qualitative or quantitative sipping analysis are specified in a directive from the corporate organization. Despite these criteria it is up to the plant to carry out analysis and if necessary repair fuel assemblies. Even if the specified action levels are not reached, analysis is sometimes carried out because of the desire to reduce primary circuit activity (ALARA).

Good practice: Sipping test analysis, which is carried out by the chemists when they suspect a problem with fuel cladding integrity, is performed even though the associated action levels have not been exceeded. This good practice should be encouraged and extended as much as possible.

5.6 Fuel handling and management

Fuel management, handling and supervision of fuel loading for the six units has been carried out by the General Service Section (SG) of SUT since September 1991. This new organization in Gravelines concentrates responsibilities, retains an expert team and optimizes human resources. The staff of the SG/SUT section are sufficient to carry out all the fuel handling tasks for the six units, including loading, unloading, change of fuel inserts, new fuel reception, spent fuel removal and checking and repair of assemblies.

The fuel management team is responsible for external relationships: i.e. liaison with the corporate organization, fuel supplier, fuel reproccesor, and official national and international authorities. They also perform nuclear material accounting.

Control and surveillance of radiation protection aspects is always performed as required by procedures. Special controlled access to the fuel building is established in cases of reception of new MOX fuel because of the security and radiological protection requirements.

A spent fuel handling operation was observed on Unit 3. The work was done in a professional manner by highly experienced persons who showed a good degree of knowledge in all skills necessary to do this work. Material and water chemistry conditions in the spent fuel pool were good. The spent fuel pool has all the necessary equipment and tools to carry out fuel handling operations and inspections such as quantitative sipping tests and visual inspection.

SG/SUT use redundant controls: i.e. procedures, core and pool mapping and fuel position identification panels to check that all the fuel assemblies and inserts are in the correct positions in fuel building as well as in the reactor during a refuelling operation.

During loading operations reactivity control by means of boron concentration and source range channel counts is monitored in parallel by SG/SUT and the operators in the control room. Careful control on fuel assembly deformation when unloading the core is carried out, in order to prevent and avoid problems when loading a new core. Special procedures are used in order to deal with problems related to damaged fuel or reduced water level in the pools.

5.7 Computer capabilities

Gravelines NPP has one of the largest computer networks in French NPPs. The corporate organization is responsible for applications that have single source software on a national scale basis. The decision to develop new applications is taken at a high level in EdF.

The Electronics and Computers Management Systems (GSEI) at the plant is responsible for the operation of networks and communications, front-end processors,the department systems, work stations and for the preventive and corrective maintenance of personnel computers. GSEI is also responsible for the development of local applications, but it is up to the Plant Manager to decide whether or not to implement a new application based on a proposal of a data processing committee.

The maintenance of large systems, including IBM, Bull, Datapoint, networks and communications, front-end processors, and the department systems is carried out by the respective manufacturers on the basis of nationally negotiated contracts.

The number of persons working in GSEI seems to be low for the large number of users at Gravelines NPP. So far, only a small number of local computer applications have been developed.

(1) **Suggestion:** Consideration should be given by Gravelines to implement more local computer applications.

Plant response/action: *(July 1994) A survey of existing local applications and their functions is planned for the end of 1994. The validation of the local applications which are to be retained and their rendering consistent with the site information system will take place from June 1995 to September 1996. The Gravelines NPP will not implement any more local computer applications.*

This wish to limit implementation of local applications to a minimum is based on:

- *standardization of French nuclear power plants' information system(consistency between local and national levels),*
- *an increase in the quality level of this information system,*
- *the normalization necessary for their use on the work.*

Nevertheless, for more efficiency in the area of the use of this information, a personalizd information presentation system has been developed.

IAEA comment on status: *(November 1994) All computers, at Gravelines are installed on local area networks or are interconnected with the national system. Software is strictly controlled and any changes for new applications require extensive reviews and approvals in order to avoid the possibility of adverse impact on other software, i.e. bugs. As stated, there are already several databases in use and more national information systems are under development, e.g. chemistry database. The OSART Follow-up team agrees with this approach.*

Conclusion: *Issue resolved.*

Software for the process computers, KIT and KPS, has been developed by a subcontractor. Software and data base maintenance and verification as well as modification requests and experience feedback are the responsibility of UTO. At the plant level the I&C Section is responsible for preventive and corrective maintenance for process computer hardware only.

Annual maintenance of the process computers is only performed in periods when the fuel is removed from the core, because of the extensive use of computers by Operations. The I&C Section is also responsible for the installation of the new software and data base revisions supplied by UTO.

The process computers are connected to an interplant network and real time data from these computers can be obtained at the corporate level and by some other external organizations.

A large number of national computer applications are installed at Gravelines NPP. The most significant national applications are: the SYGMA program for work order processing and work assessment; AIC for work permits and tagouts; and GALILEE for collection of predictive maintenance related data. A small number of local applications have been developed, one of the most significant being that used for outage scheduling, which uses a personal computer.

6. RADIATION PROTECTION

The fundamental rule with respect to radiation protection at Gravelines NPP is that it is the concern of all workers. Thus, the primary task of the Radiation Protection Organization is to provide advice and support within the plant. This is performed in a professional way by the sections involved.

The ALARA concept has been introduced and considerable efforts are being made to integrate it into the operation of the plant. It is considered that this initiative should be effective in reducing the upward trend in dose rates.

The ventilation equipment used for reducing the risk of airborne radioactivity during outage work in the primary system and the software for assessment of the impact of releases during an accident have been recognized to be good practices.

A number of suggestions for improving radiation protection were made. These included combining the existing five sections concerned with radiation protection into one, reducing the level of silver-110 in the primary system, speeding up access to dose result data by introducing an updated computer system and monitoring of releases from all rooms or buildings where radioactive material is handled. The general impression is that radiation protection at Gravelines NPP is considered to be a matter of the utmost importance by all employees and accordingly it is carried out to a high standard.

The 1993 OSART team had made a number of specific suggestions regarding the radiation protection practices for reducing worker dose rates and for the control and monitoring of plant radiation areas. Overall, Gravelines NPP has satisfactorily addressed or resolved each area of concern and has made significant improvements to achieve and maintain a well-controlled radiation protection programme.

The team was impressed by the actions that were taken for identifying and correcting the radiation problem associated with the silver-110 accumulation from control rod wear and the installation of a new computer system for monitoring real-time dose rates. The team was also impressed by Gravelines' commitment to formulate proposals to fully embrace ICRP-60 for the protection of its plant workers.

Good progress has been made in the continuous monitoring of all radiation areas in the plant and in the posting and general guidelines for protecting workers against unnecessary radiation exposure.

Continued effort is needed in formalizing task based training programmes for continuing training for radiation protection personnel and completion of the training *programmes being developed for general employees in the area of risk prevention and Industrial Safety Practices.*

The team concluded that the improvements in the radiation protection programme at Gravelines have achieved satisfactory progress to date.

6.1 Organization and administration

Each twin unit group has a Radiation Protection Section(SRP), which provides assistance and advice to the twin unit group. The technical sub-unit also has a Radiation Protection Section, which has the duty of assisting and advising within the sub-unit and to provide support in the area of personnel dosimetry and personnel resources.

The working conditions section in the Management Sub-unit is responsible for the coordination of radiation protection matters as the administrator of the radiation protection policy. This section facilitates the necessary cooperation between the plant management, and the Industrial Safety, Radiological Protection and Environment Department. This section also acts as an advisor for the implementation of instructions and recommendations.

Each worker is responsible for his/her own radiation protection but is well supported with advice and guidance by the SRPs.

The separate radiation protection sections require additional efforts to ensure coordination and cooperation between these sections. Radiation protection work could be made more effective if it was performed within one department.

(1) **Suggestion:** Consideration should be given to combining the existing five sections concerned with radiation protection into one department in order to minimize problems with co-ordination, communication and interfaces.

Plant response/action: *(July 1994) Within the framework of an overall study of the development of maintenance, organisation and professionalism, a working group analysed the activities and associated skills in the field of radiation protection. Its findings were taken into account together with the results of a study on Engineering and Outages.*

Two important decisions were taken as a result of these studies:

- *there will be a single Radiation Protection and Industrial Safety Section for the site.*

- *during the transitory period and in order to perpetuate the arrangements made during the replacement of the steam generators in Unit 1, the Radiation Protection and Industrial Safety Section resources will be managed centrally by the Permanent Outage Structure.*

IAEA comment on status: *(November 1994) The team agrees with the conclusion of Gravelines NPP that combining the existing five radiation protection sections into one department will result in better co-ordination and communication among the staff and across departments. Care should be exercised during the transition period in order to prepetuate team work and promote specific lines of responsibility.*

Conclusion: *Issue resolved.*

Each department within the plant organization is responsible for the implementation of radiation Protection measures relating its field of activity. The radiation protection organization appears to be too strongly governed by the relevant corporate organizations within EdF. This is reflected in the way information and instructions are conveyed to the plant and the lack of discussion or feedback with site staff.

ICRP 60 has not yet been enforced by either CEC or the French authorities but some of the principles are already considered on site.

(2) **Suggestion:** Consideration should be given by EdF to formulate proposals to fully embrace ICRP 60, as it is likely to be adopted by CEC in the near future.

Plant response/action: *(July 1994) EdF has always been most careful to ensure that its nuclear power station workers are well protected. The average collective dose recorded in French power stations has until very recently been among the best in the world. But since 1989 there has been an increase in the average collective dose per unit of production. At the same time certain units are recording much lower annual average collective doses, the reasons for which need analysis. This involves being aware of the facts and additional efforts by everyone together with ambitious objectives (Radiation Protection Report).*

Corporate policy requires a reduction of the average collective dose (to 1. 6 Msv/unit/year). Gravelines NPP is involved in this through its ALARA Committee. The main areas of study in 1994 are:

- *The choice of outage work 'TARGET' on which the most exposed workers are occupied (services, valves, inspection and checking, work on steam generators or vessels).*
- *Starting an enquiry on dose rates of operations staff, particularly on work done on invert pipework.*
- *A more precise forecast of dose rates.*
- *Instituting Radiation Protection and Industrial Safety sheets.*
- *Integration of dosimetry into contracts and management contracts.*
- *Integration of an ALARA module into "Risk Prevention" courses.*
- *Daily publication of dose rates during maintenance.*
- *Development and qualification of biological protection adapted to worksites.*
- *Communication of dosimetry information.*

With respect to industrial policy, we are concentrating on our contractors, who receive 80 % of doses, along the following lines:

- *Better monitoring of staff dose rates (DOSINAT = National dosimetry system)*
- *Improved medical monitoring (Decree 92-15B of 20.02.92)*
- *Improvement of work posts*
- *Development of contractual relationships with contractors*
- *Workforce training*

Conclusion: *Issue resolved.*

The SRP-staff complement is small but are skilled and dedicated. A training plan has been set up in order to give basic and continuing training to the SRP-staff. Training in radiation protection constitutes an essential part of the training of all employees at the plant. Special emphasis has been placed on the introduction of the ALARA concept and this is embraced in the training given to all staff.

Information on the French developments in radiation protection is good and is provided by Industrial Safety Radiological Protection and Environmental Department (DSRE) and via radiation protection meetings. However, knowledge on-site of international radiation protection developments is in a somewhat limited and edited form.

(3) **Suggestion:** Consideration should be given to improving the arrangements for radiation protection staff on-site to keep abreast of developments in the international radiation protection field.

Plant response/action: *(July 1994) Gravelines NPP has taken into account, in studies on the development of radiation protection, information exchange with other countries. For this purpose there is a radiation protection database called 'ISOE' (NEA Information System on Occupational Exposure). This has three levels:*

- *Level 1: general dosimetry information*
- *Level 2: a technological database*
- *Level 3: a practical database*

There is also on site an ISOE contact who keeps in touch with the Radiation Protection, Industrial Safety and Environment Department on this subject. His task is to research best international practice and to disseminate it on the site. Only Level 3 is of interest to the site as it enables us to obtain direct from other countries information relating to good dosimetric practice for work identical to our own.

This facility is not a priority in the short term but on completion will enable further progress in the radiation protection field.

NOTE:
- *The database is written in English*
- *Few sites participate in augmenting the database.*
- *Only the planning staff are concerned.*

IAEA comment on status: *(November 1994) The Gravelines Radiation Protection Department has available on site an ISOE (NEA Information System on Occupational Exposure) contact who keeps in touch with international issues. Issues and new developments in the areas of radiation protection should be addressed at the worker level.*

Conclusion: *Issue resolved.*

SRP staff play an active role in the daily work and seem to have good contact with the plant management staff at all levels. SRP staff provide advice and guidance when necessary but are fully aware of the importance of letting the individual worker recognize and assess their responsibilities.

The ALARA concept in its true sense was introduced in 1991/92. An ALARA committee is now making progress in integrating the ALARA process in the organization. The present conditions have been analysed, objectives and goals have been set, and management contracts have been drawn up which include references to ALARA.

Good performance: The work to introduce an understandable ALARA concept and the achievement of committing all parts of the organization is excellent.

6.2 Radiation exposure/radiation work permits

In support of the policy that all staff must be responsible for their own radiation protection, there is a great need for good communications and support together with suitable training. This has been addressed by directing resources to prepare personnel for carrying out work in the controlled area.

In accordance with the policy of encouraging individual responsibility, written radiation work permits are not used. The need for special precautions regarding radiation protection is discussed by the relevant parties during the planning of the job. The SRP gives advice and may occasionally check the performance of the workers.

In order to control and minimize the doses to personnel, a classification system regarding radiation risks has been implemented. Distinct rules for authorization of entries have been laid down. The different zones are indicated with informative signs. Currently access by personnel to orange (2 mSv/h to 0.1 Sv/h) and red (> 0. 1 Sv/h) zones is controlled by means of suitable training and appropriate signs or access doors. There is no policy of locking doors in the orange zone. The red zone access doors are locked at all times and require Plant Manager approval for entry.

(1) **Suggestion:** Consideration should be given to fitting locks to the doors/gates leading to the orange zones on the plant. This would provide additional assurance that no inadvertent entry to these zones would occur. If this proves to be impractical then greater attention needs to be given to delineating the zones and controlling access.

Plant response/action: *(July 1994) The Decree of 7. 7. 77 taken in application with Article 18 of the Decree No. 75-306 of 28.4 states the thresholds and marking methods for areas which are specially controlled or forbidden. Areas in which dose equivalent level is likely to be above 2 mSv (200 mRem) per hour and at most equal to 100 mSv (10 Rem) per hour are designated 'Orange Areas'. It is noted that the number of Orange Areas does not exceed 25 during outage or 10 during normal running. Access to these areas and duration of visit are submitted to the Department of, or to personnel qualified in, radiation protection.*

We believe that we should obey the current French legislation which states:

- *each Orange Area is to be identified by a pictogram*

- *the dose rate in the area is shown at the side of this pictogram.*
- *Orange Areas are detected and monitored during periodic mapping.*

In addition, in order to improve the delineation of these areas, the Site Industrial Safety Committee approved the use of an A3 sized notice to remind staff of the risks and their obligations regarding entry. The rules have also been published in an article in the weekly site publication (6 on Page 1) and are included in the radiation protection sessions of Risk Prevention retraining courses. Further, a weekly check of the dose rate in these areas and their notification are envisaged.

IAEA comment on status: *(November 1994) The team concluded that the Gravelines improvements for delineation of orange areas is adequate. In addition, the facility has diseminated information, concerning risk prevention and information on daily dose rates, in the weekly site publication.*

Conclusion: *Issue resolved.*

There are clear ground rules laid down covering access to and exit from controlled area. For the reactor containment and the fuel handling building special rules are in force in order to control the risks. In order to reduce the risk from 'hot spots', special warning signs are used on plant system components. Moveable shielding is also available for jobs being carried out near 'hot spots'

Considerable effort has been made in obtaining detailed estimates of job doses. When the results are known, they are evaluated and the experience gained is used next time such jobs are planned. Individual and collective doses are input into two computer systems, DOSIANA and DOSINAT. These programmes are under development and should eventually assist in the recording of dose rates, predicting doses to be received for particular jobs, analysing trends, etc.

Dose rates and surface contamination surveys are performed, on a weekly basis. The measurements points are predetermined in order to trend and document the results in a 'map' for each room/area. The data is readily available where it is needed.

6.3 Internal radiation exposure

The control of personnel contamination, external as well as internal, is well provided for by a monitoring programme. External contamination is carefully checked with sensitive portal monitors at two points on the exit route from the controlled area. Internal contamination is checked by whole body counting. For contractors this is carried out at the start of the contract and again on their final day on-site. For plant personnel the monitoring is carried out every 6 months. Whole body counting is also carried out following any suspicion of an abnormal internal dose. The number of incidents of internal contaminations is low and the individual doses received resulting from these internal contaminations are also low.

Particular attention has been given to minimize the occurrence of surface and airborne contamination. Fixed and portable monitors that incorporate alarms are used to measure airborne contamination and alarm as necessary. Surveillance tests to check surface contamination. The method of handling contaminated tools, equipment and materials is well documented. Special ventilation equipment has been provided to diminish the risk of occurrence and spread of surface and airborne contamination and this is regarded as a good practice.

Good practice: Special ventilation equipment has been developed and is used during outages to decrease the number of airlocks and in doing so reduces the service time. A 'ventilation hood', arrangement is put on the reactor vessel and the water level is lowered to just beneath the steam pipes. The controlled ventilation system is used to create a slight pressure reduction and enables a reduction in airborne activity to be achieved during maintenance activities on the primary system.

6.4 Radiation protection instrumentation, equipment and facilities

A reasonable supply of fixed as well as portable instruments are provided. Instruments and protective equipment for individual use are readily accessible. The supplier of instruments is required to guarantee resources for maintenance and calibration; as a result the choice of suppliers is limited.

Instruments are checked and calibrated on-site every six months according to a given procedure. In addition, the instruments are calibrated once a year by the supplier who must be accredited by the Bureau National de Metrologie. The instruments are labelled with the date of calibration. However, some instruments were observed without calibration stickers.

6.5 Personnel dosimetry

The French regulations require that film dosimeters be used. The DSRE in EdF provides and evaluates, on the authorization of the Central Department for Production against Ionizing Radiation (SCPRI), the film dosimeters for EdF employees. Contractors have film dosimeters which are provided and evaluated by the SCPRI.

Obtaining results from film dosimeter systems is slow. A thermoluminescence dosimeter (TLD) system can be evaluated on site and provide quick results.

(1) **Suggestion:** Consideration should be given to using thermoluminiscence dosimeters (TLD) for monitoring extremity doses while carrying out special (maintenance) tasks since this system facilitates rapid evaluation of doses received.

Plant response/action: *(July 1994) EdF wishes to ensure the same level of prevention for all personnel working on the unit. EdF has a firm objective to improve dosimetric monitoring of the workforce, particularly being aware of 'extremity' doses by detailed analysis of work presenting this type of risk. Use of specially adapted dosimeters for this type of work is essential (Radiation Protection Report).*

A number of studies are in hand. For example, staff working on the secondary side of steam generators only wear film dosimeters which conforms with the policy that extremity doses are always less than 10 times the whole body dose. Questions have been posed on the values of doses at the extremities which are incorporated. In order to resolve these queries, staff at ORI - Mediterranée have worn hand films on an experimental basis to monitor dose rates during work on the secondary side of steam generators, with the following objectives:

- *to obtain in depth knowledge of dose rates for this type of work*
- *to identify the most penalising stages of this work in terms of dose.*
- *to determine policy.*
- *to propose the major lines for improvement.*

The main result from these trials carried out in 1993 is that the dose rate at the extremities is only a problem in the case of televisual inspection (ITV). It has been decided to continue for a further year monitoring extremity doses of workers exclusively concerned with the higher risk stages of ITV work in order to determine a policy.

IAEA comment on status: *(November 1994) Gravelines NPP has instituted a study to determine the feasibility of monitoring extremity dose rates using figer rings on extremities during high radiation tasks. Consideration should be given to using such monitoring on a regular basis.*

Conclusion: *Issue resolved.*

An electronic dosimeter system has been introduced as the film dosimeter system is considered to be too slow to satisfy all the needs of radiation protection. The electronic dosimeter is not only used for individual dose monitoring but also to monitor doses associated with particular jobs and has become the only tool available to survey the individual and collective dose situation. Although the system has the possibility to provide necessary integrated dose data, Gravelines NPP does not appear to have the necessary computerization to take advantage of this system. This results in an unnecessary delay in determining real time doses.

(2) **Suggestion:** Consideration should be given to the implementation of a new computer system. It is also suggested that the format and content of the dose data available as a result of the electronic dosimeter system should be designed to correspond to that of the International Information System on Occupational Exposure (ISOE).

Plant response/action: *(July 1994) Gravelines NPP is now equipped with a real time dosimetric system. Twin Unit Group 1/2 is already equipped for:*

- *monitoring staff dose rates*
- *access control*

Twin unit groups 3/4, 5/6 and the Site Technical Support Group currently only have the monitoring staff dose rates capability. For access control Twin Unit Group 3/4 will be equipped in 1994, Twin Unit Group 5/6 and the Site Technical Support Group in 1995. This system enables us strictly to ensure an improvement in the monitoring of work-site dose rates and is a valuable tool for the ALARA approach.

As to the liaison DTR - ISOE, this can only be manual, a repeat of dosimetry for worksites for basic information, which has little interest for foreign sites. This overall dosimetric data for all sites, together with information on good practices are currently centralised in the Industrial Safety, Radiation Protection and the Environment Department before being transmitted to other countries.

IAEA comment on status: *(November 1994) The team concluded that the initiative taken by Gravelines NPP regarding the installation of a real time dosimetric system is considered to be a good performance. The dosimetric system is installed in twin groups 1 and 2 and the schedule for the remaining installations in twin groups 3 and 4 and 5 and 6 is realistic.*

Conclusion: *Issue resolved.*

The individual doses, job related collective doses and total collective doses are documented and analysed in a good manner. If an anomaly occurs it is examined as quickly as possible and corrective actions are taken. If a high individual dose occurs there are clearly written procedures in effect to take care of the individual.

Since the dosimetry of neutron radiation is complicated, neutron doses have so far had to be calculated. An evaluation of a so called 'bubble' dosimeter is presently being carried out by EdF. However, neutron radiation does not occur frequently on-site.

Good performance: Due to an initiative from Gravelines NPP EdF is now evaluating a neutron dosimeter. This can be seen as a good example of awareness and active contribution at the site level.

The equipment and the facilities used facilitate the high aim of controlling the risk of internal contamination. The dose resulting from internal contamination is calculated and introduced into the dose register of the individual in an addition to the external dose. There is a procedure for handling cases of internal contamination, which includes routines for decontamination, bioassay and medical care if needed.

A procedure exists to check the status of dose received on the contractor's arrival. A special passport for workers in radiological work is currently being introduced. Individual dose records are evaluated in order to check if the worker can carry out his job without exceeding any set dose limits during his stay at the plant. If everything is in order he/she is allowed to enter the controlled zone and his/her dose is consequently surveyed daily, with a delay of 28 hours, caused by the current lack of compatible computer systems until the end of the stay.

One of the main radiation sources is silver-110 which is the main activation product in the primary system. It originates from the control rods. This appears to be a special problem related to French PWRs.

(3) **Suggestion:** Consideration should be given to addressing. the silver-110 problem and achieving a reduction in worker dose levels.

Plant response/action: *(July 1994) The presence of silver-110 in the primary circuit stems from wear of certain control rods which, following certain criteria, are reloaded into the core. This maintenance policy was modified in 1993 and recommends that rods found during the three yearly inspection to be 'pierced' should not be reloaded. The amount of wear on the control rod assembly cladding is now measured using both ultrasonic and eddy current testing in order to determine possible thinness of material in the cladding.*

Checking thresholds and criteria are specified in a note written by EdF's non-destructive testing experts, Chemical and Metallurgical Laboratories.

This change of modification policy, initiated in 1993, has enabled the suppression of source term pollution by silver-110 in the primary circuit. It is too recent for it to result in a reduction of primary radioactivity linked to this radio-element.

On the other hand, records of releases of tritium free liquid from Gravelines NPP over the last five years (1989 to 1993) show a tenfold reduction of radio-activity (from 36 GBq to 3.7 GBq). This reduction reflects the lower quantity of silver-110 in the primary circuits at Gravelines NPP and should continue in the years to come.

IAEA comment on status: *(November 1994) The team noted that the initiative taken by the Gravelines facility for resolution of the silver 110 concer was well thought out, effective and should achieve a reduction in worker radiation dose levels. The maintenance policy established as a result of this problem is expected to be applied at a national level.*

Conclusion: *Issue resolved.*

Individual and collective doses received at Gravelines are not extremely high when compared to international levels, but there has been an upward trend during the last few years. This has been duly observed and action has been and is continuing to be taken to reduce the trend.

6.6 Radioactive waste, control and monitoring of effluents and environmental monitoring

Efforts have been made to reduce solid waste. Goals and contracts have been established and resources are being applied into segregation. of waste derived from different sources in the controlled areas.

There are procedures and rules for collecting, packaging, storing and transporting the different kinds of solid waste. As in most countries the lack of a defined maximum value for release of materials from the controlled zone has an impact on the efficiency of waste handling. However, there is a fairly well specified definition of what can be considered as 'non-radioactive' in the rules of the plant.

The radwaste storage facility is a building that has no shielding walls between the different storage arrangements in the building. The dose rates can differ considerably from one radwaste package to another. Dose rates from the packages, although within the defined dose rate limits can still contribute to individual and collective doses.

(1) **Suggestion:** Consideration should be given to the installation of shielding walls or improving on the current use of empty packages as shielding. It is also suggested that workers in these areas be provided with individual dose rate meters (incorporating 'dose rate' alarms) so that they can receive early indication of high dose rates.

Plant response/action: *(July 1994) Systematic use of the least active waste drums as shielding is currently practised in the radwaste storage building. A maintenance worksheet specifies this practice for storing concrete drums containing radio-active waste. As a result, dose rates in the gangways near these drums remain very low (of the order of some tens of µSv/h) and the doses received by the staff are limited (some tens of µSv/h). In order to follow the development of dose rates in this building, periodic mapping is currently being studied in the event that drums are moved.*

For these reasons we have not proceeded with providing personnel in this area with individual dose rate meters incorporating alarms.

IAEA comment on status: *(November 1994) The team concluded that the actions taken by the Gravelines NPP to address this concern are adequate. Continuation of periodic mapping for following dose rate development is encouraged.*

Conclusion: *Issue resolved.*

Regulations concerning specifications of the different stages of waste management and the ultimate form of the waste when disposed of are provided by the National Agency for the Management of Radioactive Wastes (ANDRA).

The release of gaseous and liquid effluents is strictly governed by several decrees and directives from the authorities concerned. Detailed procedures for monitoring the releases and their impact on the environment are available.

ALARA goals have been established and clear efforts are being made to explore other options to reduce the amount of releases as well as the activity content. It was noted that the arrangements in place for obtaining authorization to release radioactive liquids and gases appear complex. The monitoring system for normal operations and accident conditions appears to be well adapted to the requirements. Some rooms/buildings such as the 'hot' chemistry laboratory and the 'hot' laundry are not ventilated to the stacks of the plant and therefore the releases are not monitored.

(2) **Suggestion:** Consideration should be given to monitoring the ventilation air flows from all radwaste areas and buildings.

Plant response/action: *(July 1994) It has been decided to extend the notion of 'buildings used for the storage of solid radioactive waste' to all radwaste areas of the site, excluding the nuclear island. The aim of this global approach is to define the monitoring means necessary to guarantee the surveillance of releases caused by the ventilation of all these areas.*

The following actions have been carried out :

- *a survey of all site areas or buildings involved,*
- *a study request lodged with the site engineering staff.*

The study which has been launched has already provided us with precise information on the characteristics of all these ventilation airflows, both in terms of worker radiation protection and environmental releases. Proposals for improvement in these two fields have been made. They will be examined by the Site Engineering Technical Committee in the very near future.

IAEA comment on status: *(November 1994) The global approach done by Gravelines NPP to study the survey and ventilation of all radwaste areas on site is excellent. Now that the data has been collected, the site Engineering and Technical Committee is encouraged to take the appropriate action to recommend and schedule the monitoring necessary to achieve worker and environmental protection.*

Conclusion: *Satisfactory progress to date.*

A comprehensive programme for monitoring the impact of all effluents from the plant on the environment has been introduced. Sampling locations and equipment as well as the sampling routines appear to cover the needs in a carefully considered manner. A large proportion of the environmental programme is performed in conjunction with the regulatory authorities concerned. Much importance is attached to keeping the public in the vicinity of the plant informed as to results and conclusions of local environmental matters.

6.7 Radiation support during emergencies

The Environment Section within the site Technical Support Group is responsible for monitoring releases during an accident and for making an assessment of the impact on the environment. The section has access to manual calculations as well as computer programs in order to make these assessments. The data used in the assessments include meteorological, on-line monitoring and data calculated on a source term basis. Two vehicles with monitoring equipment are used to survey the site and the surroundings.

> **Good practice:** The software for assessment of the impact of releases during an accident appears to be exemplary. The fact that it is commonly used within EdF contributes towards reducing the risk of confusion among the different parties involved in an emergency assessment.

7. CHEMISTRY

The personnel of the Gravelines NPP Chemistry Group , twin Units 3 and 4 are well qualified and highly motivated. Initial training is well documented through a national programme but follow-up training should be more formalized and documented.

Specifications, guidelines and procedures for plant chemistry are prepared by EdF Headquarters which also recommend equipment and instrumentation for monitoring the chemical and radiochemical parameters. The specifications take into account plant specific materials. Recommendations for equipment are the outcome of detailed and long examinations and testing. The laboratories are well equipped and kept clean but there is some shortage of space. This results in lower standards for radiation protection and fire protection. Precautions should also be taken to prevent spread of contamination. The results of the chemical and radiochemical measurements are evaluated and reported on a corporate level. Exchange of information and feedback are also performed in the plant between the different twin units and with the Technical Support Unit.

A particular feature of the twin Units 3 and 4 is the use of MOX-fuel. From a chemical point of view the follow up of this fuel has made necessary the development of specialized radiochemical measurements (e.g. alpha spectrometry). Important efforts have also been made to reduce radioactive releases into the environment.

During the 1993 OSART mission, a number of very specific suggestions were made relating to chemical treatment of plant systems. These suggestions have been reviewed by Gravelines NPP and the corporate chemistry department (GDL). Some changes in chemical specifications have been made. Additional review is required to determine if additional improvements can be attained by implementing some of these suggestions.

Improvements have been made in the trend analysis of important chemical parameters. GDL is developing a chemistry database which should provide additional improvements. Formal monthly and annual Chemistry reports are now prepared.

Fire protection and contamination control concerns in the chemistry laboratories have been resolved.

EdF is reviewing sampling techniques and the need for remote handling facilities on post accident sampling systems (PASS).

7.1 Organization and functions

The chemistry group along with the testing group are sub-units in the Technical Support Department of the Production Section.

The chemistry group is composed of two planners reporting to the performance team leader and one foreman reporting to the same team leader who is responsible for 11 technicians and a professional operator. One aspect of the planners' tasks is related to the long term. The chemistry group is mainly responsible for the performance of chemical and radiochemical surveillance of all circuits of the plant, for waste handling and treatment and for conditioning of the circuits. The chemistry group is not assigned to operational shifts but qualified members of the group are on call around the clock to ensure availability in case of any abnormal event.

A daily meeting takes place within the chemistry group to discuss the problems of the past 24 hours and to distribute the daily work. The foreman also assists at the daily planning meeting where work orders are prepared. This meeting is composed of representatives of Radiation Protection, Maintenance, Operations, and Chemistry.

In the field of radiochemistry the EdF Department for Safety, Radioprotection and Environment (DSRE) takes the lead in EU of radioactive measurements in nuclear power stations. Radiochemical specifications for the different circuits and for different operating conditions have also been issued by DSRE. This specification does not take into account waste discharges which are governed by the SCPRI guidelines.

The Headquarters Central Laboratories for Chemistry and Metallurgy (GDL) have several roles in the power plants. They provide technical support, advise in technical areas, perform tests, analyses, controls and investigations, and ensure co-ordinated actions in national and international bodies. GDL has worked out a comprehensive set of chemical specifications and a water chemistry policy. A liaison engineer who is dedicated to a group of nuclear power plants, has the role to co-ordinate exchanges between the plant and GDL, to solve specific chemical problems, to organize regular meetings, to ensure feedback from other plants when a new problem arises and to transmit new information from both EdF and foreign NPPs. The policy for chemistry and radiochemistry is determined by EdF headquarters. Implementation of the policy is performed by the chemistry group. Chemical and radiochemical measuring techniques are also developed by headquarters' laboratories. This leaves the plant chemist with more routine work. However, the new structure with two planners should result in more in-depth studies and examinations.

Good practice: The nomination of a liaison engineer from EdF headquarters to assist the plant chemist in all chemical problems upon request is a good practice.

The chemists at Gravelines have an extensive training period of almost two years. After two years of training an accreditation can be obtained which allows the professional operator to work alone and to be on-call.

The basic training consists of two main parts: corporate training courses which cover quality assurance, safety, plant descriptions and functions; and local training courses which are plant specific.

7.2 Chemical treatment, materials concept, activity buildup and corrosion

For the primary coolant a co-ordinated boron/lithium (B/Li) chemistry is used according to the GDL specifications in order to maintain a pH value of approximately 6.9 at 300°C under operating conditions. The pH recommended by EdF is somewhat lower than what is now favoured in most Plants (i.e. 7.1-7.2). At the end of the cycle the pH is increasing slightly as a minimum value for Li of 0.7 ppm is specified with a band of 0.6 to 0.85 ppm. At the recommended average value this will give a pH of 7.27 (EdF-programme).

The operating records show that in general the guidelines are strictly followed but in the lower part of the allowed spread at the end of the cycle in Unit 3 as well as in Unit 4. EdF has performed tests at pH of 7.2 in six PWRs and intends to generalize this type of operation to all plants after agreement by the safety authorities.

(1) **Suggestion:** The activity buildup in the primary circuit is influenced by pH. Consideration should be given to the implementation of a higher pH. International practice is tending towards a PH of 7.2. At the end of the cycle, operation at the upper level of the pH band should be favoured.

Plant response/action: *(July 1994) Treatment of the water of the primary circuit at a pH of 7.2 at 300°C has been inserted in Rev. 2 of the Chemical Specifications issued by the Chemical and Metallurgical Laboratories (GDL). This plan was presented in March 1994 to the Safety Authorities who requested further information before giving their approval. This information has now been provided.*

As soon as the Safety Authorities accept the plan, Rev. 2 will be applied.

IAEA comment on status: *(November 1994) As stated, the suggestion to operate the primary system at a higher PH was agreed to by EdF and approval is being sought from the Safety Authorities to implement the new specifications. Although higher pH has been noted in other countries to reduce activity build-up in primary circuits, this is not thought to be a significant problem in French PWR's at the present time.*

Conclusion: *Satisfactory progress to date.*

A rinsing procedure of new beds of ion exchangers in the primary circuit is used to avoid the pollution of the circuit and to saturate the anion exchangers with boric acid. During the rinsing, which should use a maximum of ten bed volumes, the water at the outlet of the ion exchangers is discharged to the treatment system for primary effluents.

The ALARA principle is being put into operation in order to reduce the dose-rates. If this reduction necessitates procedures which are not covered by the present specifications a working group will be established. Indeed the plant chemist is not allowed to go beyond the directives given by the headquarters laboratory. Any modifications must be discussed first on corporate level.

Gravelines, being a plant cooled with seawater, uses titanium (Ti) tubed condensers. However, small inleakages of seawater occur. Chemically they are rather easy to detect but mechanically they are difficult to localize. As a result a small modification has been made to the chemical specification, allowing the plant to operate during one month with a sodium content of 20 to 40 µg/kg and a cation conductivity below 1 µS/cm if more than 35µg/kg of Cl^- are present.

The conditioning of the secondary system is based on the all volatile treatment (AVT) with ammonia-and hydrazine to maintain a pH $\geq$ 9,7 in the feedwater. The injection of boric acid is being considered by GDL. Tests have been performed and are in a final state of evaluation. It is recognized that ensuring reducing conditions in the steam generators is important for the protection of Inconel tubing.

(2) **Suggestion:** Consideration should be given to increase the hydrazine content in feedwater to > 100 ppb since the amount of sludge removed during lancing seems relatively high. This would ensure reducing conditions in the steam generators.

Plant response/action: *(July 1994) Feedwater hydrazine concentrations will be increased for Units not having copper alloys in Rev. 2 of the Chemical Specifications, thus incorporating favourable international experience feedback. The new hydrazine specification will authorise concentrations of between 30 and 200 ppb; our objective will be above 100 ppb.*

***IAEA comment on status**: (November 1994) At the time of the OSART mission in 1993, the specification for hydrazine in the feedwater was 5-100 ppb. GDL agreed that the specification should be increased to 30-200 ppb since there is some evidence that low hydrazine concentrations can be one of the factors leading to increased amounts of sludge on steam generator tube sheets. Other factors can also cause sludge such as chemical contaminants in the feedwater system, e.g. copper. However, excessive hydrazine in the feedwater system will limit the life of ion exchange resins in the blow down demineralizers. The target hydrazine concentration is 100 ppb.*

***Conclusion:** Issue resolved.*

Strict compliance with EdF-GDL specifications is implemented. In the absence of a chemist (night shift, weekend), operators can initiate actions with the help of a system of alarm description and response cards. An on-call chemist will then come to the plant.

A tightening of chemical specifications is being taken into consideration by GDL especially for sodium. With the present specification it is theoretically possible to operate for a considerable time with relatively high sodium concentrations and no corresponding anions. However, the use of a sodium to chloride ratio as a specification, such as proposed by EPRI is not considered useful. Limitation of sodium in the make-up water is reached through the use of a non-regenerable mixed bed system with ion exchangers of nuclear quality. The chemists are conscious of problems arising from sodium hyroxide in steam generators and take prompt action in case of increase of sodium. Less attention is given to organic pollutants. Organic pollution could be the origin of corrosion problems in nuclear steam generators.

(3) **Suggestion:** Consideration should be given to periodic measurements of organic pollutant in the feedwater system. Supplementary treatment of the make up water to remove organics may become necessary.

***Plant response/action:** (July 1994) It has never been proved that organic pollution in the feedwater system can be the cause of corrosion in the steam generator tubes. Nevertheless since 1990 a mixed bed demineraliser filled with high quality macro porous resin (of nuclear quality) has been in place up-stream of each of the three site demineralised water systems. This new installation is intended to remove traces of sodium, silica and organic matter from the feedwater for the secondary circuits and the reactor cooling water.*

After some three years of functioning, the resin is systematically replaced so as to free it from release of chemical pollutants (decision taken following an experience feedback meeting on 16 December 1993 at Tricastin NPP).

Weak anionic resins from water production systems are also macro-porous in type, which confers on them the same high efficiency as those described above.

IAEA comment on status: *(November 1994) Organic pollution in the feedwater system in EdF PWR's is not a significant problem at this time since the raw water sources do not contain significant amounts of organic carbon. Mixed bed resins in the make-up water systems are also replaced every three years in order to avoid build-up of organic pollutants. Periodic measurements of total organic are made but the analysis cannot be made easily on line.*

Conclusion: *Issue resolved.*

The blow down purification ion exchangers are also of nuclear grade and not regenerable. The main chemical parameters of the secondary water are continuously monitored.

Both primary and secondary intermediate cooling circuits are conditioned with trisodiumphosphate. The concentration in the circuit is between 100 and 500 ppm of phosphate, giving a pH of 11.5. It can be expected that phosphate will soon be no longer be allowed because of environmental problems. It is also recognized that phosphate can give problems in radwaste treatment due to gel formation in the presence of boric acid sodium hydroxide and calcium hydroxide.

(4) **Suggestion:** Consideration should be given to examine alternative products to trisodiumphosphate for the conditioning of the primary and secondary intermediate cooling circuits.

Plant response/action: *(July 1994) In France the use of trisodiumphosphate is authorised for conditioning the reactor auxiliary cooling circuits and secondary circuits whilst the use of chromates is forbidden. Other products such as molybdates have been studied but have not yet proved themselves.*

To limit the possible risk of gel formation, the phosphate content in the evaporator concentrates is limited to 20 g/kg (GDL/EdF Specification). The demineralised water make-up for the main Circuits Conditioned by Phosphate is checked weekly and enables possible leaks to be detected.

On the other hand, the recommended concentration in these circuits was reduced in 1988 from > 500 ppm to a band between 1 00 and 500 ppm in order to reduce the impact on the environment but also the clogging of the effluent treatment circuit. The readings taken show a regular reduction in our consumption. We are *optimising the amount of phosphate injected to keep a minimum pH of 11. 0 at 25°C (Specification).*

IAEA comment on status: *(November 1994) The EdF corporate chemistry organisation (GDL) is reviewing the use of trisodium-phosphate in closed loop cooling circuits. At present this usage does not appear to be a problem and concentrations are not significant to cause an environmental problem.*

Conclusion: *Issue resolved.*

(a) **Good practice:** Purification during shutdown before refueling: the use of a larger volume of ion exchange resins (mixed bed) at the end of the cycle allows for better purification of the primary circuit.

(b) **Good practice:** Chemistry can have an influence on dose rates of plant equipment. The use of chemical holding points ensure that outages are carried out under optimum chemical conditions.

(c) **Good practice:** After exhaustion the resins of the steam generator blow down purification system are not regenerated which avoids ingress of regeneration chemicals.

(d) **Good practice:** The use of a mobile purification system for startups avoids delays by the chemistry group during startups.

7.3 Chemical surveillance programme and procedures

An analytical programme has been developed on the basis of technical specifications, the chemical specifications of GDL and the radiochemical specification of DSRE. The programme defines analyses to be performed daily or weekly on each of the circuits. Each chemist has a comprehensive document with the tasks to be carried out the coming month. In addition, each morning, analyses by special request are added to the routine programme. Any delay must be reported immediately to the foreman who can decide to postpone some analyses due to the unavailability of sampling lines or other reasons. Results are reviewed critically for compliance with specifications, and for trends.

When grab samples need to be taken from the circuit, a technician of the chemistry group must work in close collaboration with Operations. Documents describing the responsibilities of the different parties are available.

The aim of chemical monitoring is to have continuous measurements of some important chemical parameters in order to take corrective action rapidly in case of abnormal situations. Chart recorders for chemistry parameters are located in the control room. When specifications are exceeded, an alarm signal will be initiated and immediate action must be taken. For each alarm, a card will describe the necessary actions. A full set of these cards is available in the control room as part of the general rules for operation. The charts from the chemical parameter recorders can also be used to produce trends although this is not done systematically. Trend analysis is important to assess situations in an early state.

(1) **Suggestion:** Consideration should be given to systematically performing trend analysis of important chemical parameters so that corrective actions can be determined at an early stage.. Given the advanced information systems available at Gravelines the development of such a system for generating trend analysis should not represent a significant task.

Plant response/action: *(July 1994) Currently monitoring is carried out on several of the main chemical parameters, in particular:*

- *on steam generator blow down:*
  - *sodium .... (continuous monitoring)*
  - *cationic conductivity.................................... (continuous monitoring)*
  - *S.G. bundle leaks.(act g).............................. (continuous monitoring)*
  - *chlorides.. (one a week)*
  - *sulphates.. (once a week)*
- *on extracted condensate:*
  - *dissolved oxygen.. (continuous monitoring)*

The relevant data is subject to handwritten trend analysis. The results so obtained lead to corrective actions. This data is then included in the monthly laboratory reports. The WANO chemical index is then calculated and compared with national values. Furthermore, the development of a computerized system is under study.

IAEA comment on status: *(November 1994) Continuously monitored parameters are analysed manually on a daily basis in order to detect if they are tending to deviate from normal values so that corrective actions can be taken. GDL is developing a computerized chemical data system which should be available in about 18 months.*

Conclusion: *Satisfactory progress to date.*

Preventive maintenance and calibrations are performed by chemistry personnel. Calibration stickers are attached to each instrument after calibration, which shows the calibration date and the date of the next calibration (latest date possible). Each instrument is described in a working document and in a history file. However, there is no systematic programme for scheduling instrument recalibration.

(2) **Suggestion:** Consideration should be given to comprehensive planning of maintenance and calibration which would be useful to organize the work of the technicians of the chemistry group.

Plant response/action: *(July 1994) A basic programme of maintenance and calibration of the chemical analysers has been established by GDL. This programme has been applied and subsequent actions are scheduled. It is planned to computerize it at the same time as the trend analysis computerization [see item 7.3.1)].*

IAEA comment on status: *(November 1994) A policy document relative to maintenance and calibration of chemical analysis equipment has been prepared by GDL. Procedures have been prepared and a computer database is under development.*

Conclusion: *Satisfactory progress to date.*

It was noted that there were many manufacturers' manuals written in English and German. This could cause confusion or errors during maintenance or recalibrations.

(3) **Suggestion:** Consideration should be given to have the manufacturers deliver their monitors with manuals in French.

Plant response/action: *(July 1994) Purchasing conditions have been established and formalized; those for foreign equipment require the provision on delivery of equipment of users' manuals written in French. Since the OSART evaluation, the Chemistry Section has been vigilant in avoiding what was an isolated incident.*

IAEA comment on status: *(November 1994) Purchase orders now specify that equipment manuals are to be provided in French.*

Conclusion: *Issue resolved.*

Radiation protection monitoring equipment relating to chemistry e.g. surveillance of activity in sampling systems and N-16 measurements on steam-lines, are within the scope of the chemistry group, which is responsible for their maintenance and calibration. In order to test these monitors, approval must be received from the shift supervisor.

All measurements performed by the Chemistry Section are fully described in analysis work sheets, the chemical guides and application documents, which are available at the working station. These documents are updated on a regular basis and their use is compulsory before any field work is undertaken. The control system for the documents has the capability of ensuring that the latest version is available at the working station.

Interlaboratory comparison tests are performed on a yearly basis. However, systematic deviations in analytical methods and skills need to be screened on a more frequent basis.

(4) **Suggestion:** Consideration should be given to the introduction of individual control cards which could be a useful tool for detecting deviations in analytical procedures at an early state.

Plant response/action: *(July 1994) Maintenance of competence is ensured by:*

- *rotation of chemists to different work stations (5 posts), with a frequency high enough to prevent tasks becoming routine but low enough to maintain competence.*
- *monitoring these work stations. This enables prevention of drift of analysis resources and possible differences.*
- *work when on-call when all section activities are covered.*

Current analytic procedures have well-proven operating methods which include verification prior to chemical analysis and which therefore, do not need calling into question on a regular basis.

Those which are the most delicate because of infrequent use or which are of recent origin are the subject of specific training.

IAEA comment on status: *(November 1994) Although specific control cards are not in use, the rotation of chemists through the various job tasks, monitoring of chemical data and detailed procedures ensure that deviations will be detected at an early date. The same results are achieved as would be achieved using control cards.*

Conclusion: *Issue resolved.*

In Units 3 and 4 standard $U0_2$ and MOX-fuels have been used since April 1989 and October 1989 respectively. The loading of MOX type assemblies has dictated the implementation of new methods to discriminate the nature of failed fuel elements during operation. In steady state operation gamma spectrometry is performed on primary water. In transient operation global beta measurements are performed. If fuel leakages are detected alpha monitoring is mandatory. During shutdowns sipping tests are performed. The first test is qualitative to detect leaking elements. Afterwards a quantitative sipping test is performed on failed elements to assess the equivalent diameter of the defect. So far no defects have been found in MOX fuel. The Chemistry Department maintains the capability to perform alpha-activity measurements. The MOX related work is reported quarterly to the safety authorities.

Demineralized water is produced from raw water from a nearby canal. The raw water is pretreated with lime and ferric chloride and filtered. Demineralization is obtained by using a conventional ion exchange system with co-current regeneration with sulphuric acid and sodium hydroxide.

The effluents are neutralized before discharge. The demineralized water is polished on a non-regenerable mixed-bed system with nuclear grade resins. A supplementary system is being installed to avoid discharge of the sludge from the pretreatment section.

7.4 Operational history and recording of results

All results of chemical and radiochemical measurements are recorded. Chemistry results of routine measurements are stored in a computer based recording system. Terminals are available in the laboratory and for operational personnel. Results of chemical analyses on request with low or unknown frequency are not introduced in the data bank but archived as paper documents.

The routine analyses are transferred to the corporate laboratories (GDL) according to the chemistry application. Radiochemical routine measurements (global beta, global gamma and tritium) are also put into a computer based system and transferred to the 'Nuclear Fuel Group' (GCN). After the results have been obtained, they are transmitted to 'Operations' by paper. In case of results which are out of specification actions are undertaken immediately. Graphical trending of chemical analyses is not well developed.

(1) **Suggestion:** Consideration should be given to the development of information systems technology to improve trend analysis programmes. It was noted with satisfaction that work on this application was started during the OSART mission.

Plant response/action: *(July 1994) See response to 7.3(1).*

IAEA comment on status: *(November 1994) See comment for 7.3(1).*

Conclusion: *Satisfactory progress to date.*

Operational experience feedback is organized on a national scale by the Corporate Laboratories (GDL) for chemical measurements. This is provided by systematic reporting of results of all plants and annual meetings of all plant chemists. Radiochemistry results are reported through DSRE who defines policies for waste treatment and provide liaison with the SCPRI and the Ministry of Environment.

On-site monthly meetings are organized between chemists to discuss the plant situation and several points of interest for all units (such as pollution of make-up water, management of ion exchange resins, interlaboratory tests etc.). Results of the meetings are reported.

Systematic reporting for Units 3 and 4 includes the behaviour of the MOX-fuel. The chemistry report is then integrated in the operations report, which is sent to the SCPRI and the regulatory authorities. The Chemistry Section report includes the gamma activity of the primary circuit, alpha measurements, behaviour of the primary circuit (leakage rate) and an evaluation of fuel leakages.

Major problems are described in 'incident reports'. Although these reports are more informal, they contain considerable information which gives an overview of the lessons learned. A large distribution in the national system is guaranteed. There are no formal monthly or annual reports issued specifically by the Chemistry Section.

(2) **Suggestion:** Consideration should be given to preparing all necessary monthly and annual reports on a formal basis.

Plant response/action: *(July 1994) Chemical and radio-chemical reports are analysed and formalizd in monthly and annual reports. Each significant variation from a chemical parameter or of a significant size is explained whenever possible in order to develop experience feedback.*

The reports also deal with the standard of fuel cladding, the development and production of effluents (radio-active or not), waste (ion exchange resins, filters, evaporator concentrates). They are drawn up by a member of the Chemistry Section management and are distributed after checking, to the other site laboratories and to the operating departments. In return, GDL distributes a three monthly incident report for use by the chemists.

IAEA comment on status: *(November 1994) The plant response is satisfactory. Monthly and annual reports provide adequate information.*

Conclusion: *Issue resolved.*

All documents used in the chemistry section are indexed and filed according to a national code. The main reference documents are the National Quality Management Manual (MNOQ), the Gravelines Quality Assurance Manual (MOQ) and the Corporate Filing Code. A document control system is available at the plant. It manages the documentation and ensures the distribution of the documents.

7.5 Laboratories, equipment and instruments

The Chemistry Section works in different areas of the plant, the main places of which are the nuclear auxiliary building (NAB) and the chemical laboratory. In the NAB some measurements on the reactor coolant and the main auxiliary circuits are performed (e.g. boron and hydrogen). The furniture in this laboratory is unsuitable and should be renewed. Sampling is performed in a separate room adjacent to the laboratory. This system had been updated after the incident at Three Mile Island. It is well protected and will allow collection of representative samples even under high radiation conditions. The chemical laboratory has been integrated on the ground floor of the administrative building. It is composed of different rooms such as a laboratory for oil analysis, weighing room, preparation room counting room and the hot laboratory with physical measurement and preparation rooms. The counting room is equipped with up-to-date alpha and gamma spectrometry as well as with devices for beta-, gamma- and tritium-measurements. The laboratories are kept in clean conditions by the chemists. Showers, fire extinguishers and protective clothing are available. All procedures include safety instructions to be taken into account at each working station. An eye-wash station was not available during the visit. Due to the expiration of the validity date it had been removed the day before. It was noted that the gas bottle for calibration of H_2-measurements by gas-chromatography in the hot laboratory was not fixed to the wall in a stable manner. Corrective action was taken during the mission.

Although laboratory facilities and housekeeping were generally considered to be good, there were some industrial safety hazards, fire hazards and factors which could contribute to the spread of radioactive contamination. Suggestions were made for improvement.

(1) **Suggestion:** Consideration should be given to installing fire protection equipment (extinguisher and blanket) close to the room where oil analyses are performed.

Plant response/action: *(July 1994) Laboratory fire-fighting equipment has been installed.*

- *extinguishers are now at the entrance to the room where oil analyses are performed; an anti-fire blanket is also available in the laboratory.*

IAEA Comment on status: *(November 1994) There are adequate fire protection facilities in both the hot and cold chemistry laboratories.*

Conclusion: *Issue resolved.*

(2) **Suggestion:** Consideration should be given to installing a dose-rate meter in the preparation room close to the sample storage location since it is necessary to store some samples for later counting.

Plant response/action: *(July 1994) We consider that it is not necessary to install radiation monitoring equipment in the various hot laboratories. The arguments in favour of this statement are:*

- *The chemists go further than required by the protection rules and check dose rates of all the radio-active sources. (calibration sources, samples before going out of the area).*
- *Monthly radiation and contamination checks are carried out in the laboratories by the Radiation Protection and Industrial Safety Section.*
- *A gamma monitor would show any rapid increase in radio-activity (which is very unlikely in a laboratory).*
- *The background readings on the counting equipment installed nearby detect any radiation development coming from the preparation room.*

IAEA comment on status: *(November 1994) The plant has addressed adequately the finding of the OSART mission; the response is accepted.*

Conclusion: *Issue resolved.*

(3) **Suggestion:** Consideration should be given to take measures in order to prevent the spread of contamination and unauthorized transport of active material between the reactor auxiliary building and the laboratory in the office building.

Plant response/action: *(July 1994) The following measures have been taken to remove these risks:*

- *They are double packed when they leave the area.*
- *Radio-active flasks are transported in a leak-proof container (portable or placed on a trolley depending on their number).*
- *No unauthorised movement of radio-active materiel comes to the laboratory. Only samples taken or requested by the chemists go there.*

IAEA comment on status: *(November 1994) The plant response is accepted.*

Conclusion: *Issue resolved.*

(4) **Suggestion:** Consideration should be given to providing an automatic closing of the door between the two laboratories.

Plant response/action: *(July 1994) An automatic doorway with a portal monitor to check for contamination is in place in, the chemistry laboratory 3/4.*

IAEA comment on status: *(November 1994) The automatic door and portal monitor are now installed.*

Conclusion: *Issue resolved.*

GDL and DSRE have developed a post accident sampling system (PASS) for both liquid and gaseous samples from the reactor building. The liquid samples are obtained from the normal sampling system, which was adapted and updated after the Three Mile Island accident. Measurements performed on primary circuit water are boron, dissolved hydrogen and gamma spectrometry. Once a liquid sample has been obtained in the nuclear auxiliary building, it will be transported to another unit hot laboratory for further handling. The sample will then be degasified, to reduce, contamination risks and liquid phase activity. The gaseous phase will be analysed for hydrogen content and Xe-133 activity. With the present sampling facilities, the potential of receiving high dose rates while handling samples exists.

(5) **Suggestion:** Consideration should be given to the development of robotics in order to overcome potential problems of dose rates during dilution.

Plant response/action: *(July 1994) Studies are in hand on the need for such sampling and on possible improvements to equipment.*

IAEA comment on status: *(November 1994) There are procedures available for sampling of containment and effluents following a design based accident. Hydrogen meters are installed in EdF N4 series plants (1400 MW). EdF is evaluating the need for remote handling of samples but the preferred approach is* *not to carry out sampling and analysis until 48 hours following an accident. (i.e. allow for sufficient decay).*

Conclusion: *Little or no progress to date.*

Gaseous samples from the containment enable hydrogen, gas composition and the gamma spectrum to be measured. Reactor building air sampling is performed with a well designed system operated at distance. Once the sample is taken it will be automatically transported for further analysis by a gas chromatograph and a gamma spectrometer.

If the PASS is to be used a crew of two persons will be responsible for taking samples, one acting as an operator, the other to give instructions according to the procedure. The procedure has been written but at present does not have a section on safety and radiation protection.

(6) **Recommendation:** Although chemistry personnel are aware of potential problems, safety and radiation protection measures should be fully described in the PASS operating procedure. Frequent training in the use of the equipment and the procedures should be carried out in order to maintain the necessary skills.

Plant response/action: *(July 1994) Radiation protection and industrial safety measures are now integrated into post-accident liquid sampling procedures. Initial training is carried out on National Course A716 in the training plan for chemists who are on call for the Internal Emergency Plan (PUI). The necessary skills can be maintained as needed by the possibility of practice on another twin unit group on the site no manual measurements on a liquid sample are required by the post-accident procedures which allow the reactor to be brought to safe operating*

IAEA comment on status: *(November 1994) Initial training on post accident sampling is carried out. The present procedure requires that the chemist rehearses the sampling technique on a non-accident unit before actually taking samples from the accident unit. This is intended to satisfy ALARA concerns.*

Conclusion: *Satisfactory progress to date.*

7.6 Quality control of operational chemicals

Policy DI043 approved by the Technical Operating Committee (CTE) of EdF in March 1990, is the basis for the selection of chemicals and materials which can be used on-site. Several groups within EdF Headquarters work together to implement this policy.

The chemical specifications are set up by GDL which also makes the declaration of compliance with these specifications. Some modifications are expected in the production of boric acid, lithium and sodium phosphate to comply with the specifications. Final specifications will be issued by the end of June 1993.

The chemicals for the conditioning of the secondary system are stored in the plant stores. When needed the vessels are transported to the place of use and their contents are transferred immediately to the working stations. At present non-recyclable drums are used which could create a potential environmental hazard and waste disposal problems.

(1) **Suggestion:** Consideration should be given to the use of recyclable drums for conditioning agents such as ammonia and hydrazine.

Plant response/action: *(July 1994) Directive No. 43 (PMUC* approach) requires chemicals to be packed in 180 or 800 litre drums with an associated individual analysis sheet. Suppliers will not accept the principle of reusing 180 litre drums as they cannot guarantee their cleanliness and therefore compliance with specifications.*

A study is in hand on compliance with the PMUC rules and the reutilisation of 800 litre drums.*

* *PMUC (Products and Materials Usable in Twin Unit Groups) refers to an EdF standard which defines among other things limits for certain undesirable chemicals which could be present in products as diverse as paints, adhesives, cutting oils, solvents, strippers, soaps but also of course chemical additives, ion exchange resins.*

IAEA comment on status: *(November 1994) Empty drums are sent to a contractor who is responsible for disposing any remaining chemical contents. The plastic drums are then recycled, i. e. the plastic is melted and used for other applications. Drums are not refilled, because of the concern for chemical contaminants. The environmental concerns are thus addressed.*

Conclusion: *Issue resolved.*

The diesel fuel is of military type with strict specifications. Upon delivery, density, colour and odour are measured at the power plant. The supplier must perform a full analysis and certify the fuel.

An annual analysis is performed by a specialized laboratory to assess compliance with the specifications. Special attention is also given to bacterial growth.

7.7 Radiochemical measurements of environmental samples and of radioactive waste

Effluents are produced and managed on a twin unit basis. The Chemistry Section is responsible for the analysis, adherence to radiochemical specifications, accounting and for making recommendations to the operating team. The site Technical Support Unit (SUT) is responsible for monitoring the impact of releases into the environment as well as for reports and statistics.

Primary effluents (hydrogenated) are concentrated by evaporation to recover boron for recycling. The distillate can be recycled, depending on its tritium content. Other effluents are treated either by evaporation, by ion exchangers or by simple filtration. After treatment the solutions are stored in tanks from which a transfer is prepared to final control tanks. SUT cheek compliance with specifications before release to the environment.

In order to minimize the impact of effluents, national and local working groups have been set up. Motivation comes from co-responsibility, monthly feedback and a management contract. Action plans have been launched with one person responsible by name for each measure.

An Environmental Committee has been set up in the plant in order to promote experience feedback, harmonize practices, improve organization and methods, and to optimize the use of resources. The committee is chaired by a person appointed by the Plant Manager.

8. EMERGENCY PLANNING AND PREPAREDNESS

The overall quality of the emergency preparedness, plans, procedures, facilities and equipment of Gravelines NPP is satisfactory. To a large degree emergency planning is supported by corporate EdF since it is common to all EdF plants. A uniform approach was chosen by EdF, the Nuclear Installations Safety Directorate (DSIN), the Institute for Nuclear Safety Protection (IPSN), the Central Service for Protection Against Ionizing Radiation (SCPRI) and the Directorate of Civil Protection (DSC), which provides for good solutions for coping with accidents on the national level. The structure for dealing with radiological emergencies is complemented on the national level by the structures for managing with any kind of natural or man-made disaster. Co-ordination on the plant, regional and national level is good.

The principal recommendations relate to the enhancement of training and exercises on site. A recommendation is made for upgrading facilities at the Prefecture and for providing additional information to the public in the emergency planning zones. Suggestions relate mainly to further improving revisions and formal distribution of the documents, to clarifying policy on stable iodine prophylaxis and to continuing the enhancement of the on-line radiological emergency monitoring and assessment system. Two suggestions relate to assessing the need to relocate command centres and the on-site press centre during some classes of emergencies.

Many good practices and details were observed during the mission which confirm that Gravelines NPP is prepared to cope with a wide range of accidents which are beyond the design basis of the plant and even beyond the planning basis for emergencies.

The majority of issues raised during the OSART mission in the area of Emergency Planning and Preparedness have been satisfactorily resolved by the staff at Gravelines NPP and should contribute to improving the overall effectiveness of the Emergency arrangements. Progress has been made in formalizing the training requirements and records for all staff who have a role in the emergency plan (PUI) and this will require further development to incorporate refresher training and participation in exercises. Further consideration should be given to the criteria that determines when newly appointed staff are assigned to the emergency duty rosta and the application of assessment methods following completion of training courses should also be considered. It is pleasing to see that the frequency and content of emergency exercises and drills at Gravelines have been extended. Exercises are the principal means by which teams and individual staff can demonstrate competence and understanding of the emergency arrangements. A more formal role by the appropriate regulatory body in determining the acceptability of emergency exercises at NPPs could be a beneficial way of demonstrating an acceptable standard of emergency preparedness to the public as is the practice in some *other countries. Further consideration should be given to the adequacy of the permanent installation of radiological monitors at the site boundary and off site.*

8.1 Emergency planning and preparedness organization

Emergency planning is well organized from EdF corporate level down to the Gravelines site level. At the corporate level, the responsibility for preparing and coordinating emergency plans is delegated to the National Crisis Organization (ONC), which reports to the Nuclear Power Plant Operations Division (EPN). A common approach for emergency planning and preparedness has been adopted by EdF for all sites.

At the Gravelines NPP, the responsibility for preparing and coordinating emergency plans rests with the leader of the Safety and Quality Team (MSQ), who reports to the Deputy Manager. The leader of the MSQ is supported by one full time emergency staff member who is responsible for the emergency plan. He is solely concerned with internal emergency planning and fire protection. Responsibility for providing the actual services required by the Plan d'Urgence Interne (PUI) or site emergency plan rests with different departments of Gravelines NPP. A revision of the PUI based on the EdF "Model" emergency plan is in progress. It is planned that an updated PUI will be put into service during this year.

Revision and distribution of the PUI is subject to on-site Gravelines QA procedures. The QA procedure requires the PUI to be reviewed every year. Copies of the revised PUI are also distributed to the EdF corporate organization, ONC, but it has no review function. A copy of the revised PUI is also sent to DSIN, but is not explicitly approved. DSIN has in the past years made two inspections to review the PUI at the Gravelines site.

Not all copies of PUI on site had all the, required stamps and marks required for controlled distribution by QA and two copies of the PUI contained some chapters which had not been updated. It was also found that the originators of the PUI, the emergency plan of the prefecture (PPI) and the EdF national emergency plan and procedures, following a revision, do not receive an acknowledgement slip verifying that recipients have received and filed the new revision, and discarded the old one.

(1) **Suggestion:** Consideration should be given to formalizing a system of acknowledgement slips relating to revisions of emergency plans. Such a system should be used by those controlling the distribution of revisions to ensure that all controlled copies are correctly updated.

Plant response/action: *(July 1994) A formalized document acknowledgement system has been set up by the plant. It allows the sending of all Internal Emergency Plan (PUI) and the receipt of all Civil Emergency Plan (PPI) documents to be traced.*

It operates in the following manner:

- *the documentation department transmits, with each new issue, an ad hoc form which allows internal and external document transfer to be managed by means of pre-established document transfer grids,*
- *the receiver then returns the form to the Safety and Quality Team manager, who archives it (cf Application Note D5130 NA CN 24.01.11)*

Regarding the Safety Authority, DSIN, any update of the PUI received is recorded and incorporated in the document; the acknowledgement of receipt is sent back to the operator. Where local authorities, namely the Prefect, are concerned, the Regional Interministerial Service for Economic and Civil Affairs, Defence and Civil Protection (SIRACED PC) is responsible for controlling distribution of the Prefecture Emergency Plan (PPI)

IAEA comment on status: *(November 1994) The formalized system that has been established satisfy the full requirements of this suggestion.*

Conclusion: *Issue resolved.*

The ONC with its extensive experience at corporate level obtained from other EdF sites gives advice on planning to the Gravelines NPP. Both the ONC and Gravelines NPP staff give advice on emergency planning to the Prefect of the District (Département Nord). The relationship with the local off-site organization is good. and Gravelines NPP contributes equipment for off-site organizations. Copies of the PUI and PPI have been exchanged. There is no formal system for off-site organizations to participate in the review process of the PUI.

(2) **Suggestion:** Consideration should be given to developing means whereby relevant off-site organization could comment on any revision of PUI before it is implemented.

Plant response/action: *(July 1994) The organization created for accident management involves EdF and government authorities at national and local levels. A system for the collection of observations concerning the Internal Emergency Plan (PUI) from authorities external to the site, has been set up. It enables the observations from other EdF authorities involved (power station sites or other* *internal EdF groups) to be taken into account during any revision of the National Model Emergency Plan (involving internal W organization and interfaces with government authorities). These results, which come from experience feedback, are presented at the EdF national Internal Emergency Plan conference.*

A French regulation (Decree 63-1128 of 11.12.63 Art. 4) requires any nuclear reactor operator to submit, inter alia, the associated PUI to the nuclear Safety Authority six months before fuel loading. Presentation of an updated PUI to the Nuclear Safety Authority is also required prior to commercial operation of the reactor. Practically, the EdF corporate 'Model ' emergency plan is reviewed and approved by DSIN before it is implemented, as well as any substantial modification of it. Compliance with the local PUI, namely Gravelines, is checked through on site surveillance visits carried out by DSIN and/or DRIRE: any resulting comments have to be taken into account by the plant. Finally, adequacy of this PUI is verified through emergency exercices carried out at national level, and/or at local level; debriefing meetings of national and local organisations involved allow any comment to be formulated, reviewed and taken into account when deemed appropriate.

The collection of all the observations from external authorities is managed by the EdF national Internal Emergency Plan co-ordinator as far as the 'Model' emergency plan is concerned; regarding site specific aspects, observations are managed by the site PUI co-ordinator.

***IAEA comment on status:** (November 1994) Satisfactory arrangements now exist to ensure that any intended revisions to the PUI are subject to adequate consultations or approval by the relevant off-site organziations. In addition, the site management at Gravelines NPP has made a commitment to have a formalized annual meeting with the Regional local authorities SIRACED-PC directed to achieve a general review of emergency arrangements. The first such meeting is scheduled for December 1994.*

***Conclusion:** Issue resolved.*

The EdF Corporate organization for emergency response is very well organized and maintained. It was designed with the objectives of assisting the affected plant with all national assessment capabilities to mitigate the consequences of an accident on-site and of assisting the Prefect of the District, where the population may be threatened, in taking decisions outside the plant.

Gravelines NPP site organization for emergency response was designed with the objectives of bringing the affected unit to a safe position and to mitigate the consequences to the environment, of protecting the personnel on-site, of providing data on accident evolution and monitoring of the environment to the assessment groups on site at Gravelines, to the EdF corporate assessment group in Paris to the DSIN and to the IPSN assessment group in Paris.

At the head of the organizational structure for emergency response defined by the Gravelines PUI is the Management Control Centre (PCD). The PCD team is headed by the Plant Manager (or his representative), who is responsible for executive decision making on site, for coordinating the work of four on-site control centres, for instructing them to carry out necessary complementary actions, for the primary links with off-site organizations (the Prefect, the Management Control Centre of EdF, DSIN and SCPRI) and for information on the plant status to the media. The PCD is set up in the Administrative building, with a backup position in the Hardened Control Centre (BDS) of the site or bunker, which assures habitability during all accidents.

The Local Control Centre (PCL) team is responsible for control and nuclear safety of the unit, i.e. bringing the affected unit to a safe state, using the unit emergency procedures. It provides first aid for the injured and takes the first actions in response to a fire. It collects unit related information on the nature of the emergency for its own purposes and data requested by the Local Emergency Team (ELC). The on-duty Safety Engineer, who is on shift at the site, operates in the PCL team, using special accident monitoring procedures. The PCL is set up in the control room of the unit in which the accident has occurred.

The ELC is responsible for evaluating and assessing the nature of the emergency and its probable development in conjunction with off-site national crisis teams (of EdF and of the DSIN), using the audio conference link and other telecommunications. The ELC makes suggestions and recommendations to the PCD for enhancing the response to bring the affected unit to a safer state. The ELC provides information to the PCD and crisis teams in the DSIN and EdF. It is manned by site engineers, on-site engineers from the EdF design department, Framatome engineers and DSIN personnel. The ELC is set up in a room common to two units.

The Logistics Control Centre (PCM) team is responsible for all matters related to internal logistics: assembly of personnel at muster points, accountability, provisions of emergency care for the injured, contingent evacuation and decontamination at the off-site shelter building. It is responsible for managing the site intervention resources (relief, posting of signs, transport, repair and telecommunications).

The PCM is set up in two rooms in the administration building (not sheltered), with a backup position in the BDS bunker.

The Assessment Control Centre (PCC) is responsible for estimating the size of the release (or potential release), for estimating its consequences off site (dose estimates), for taking samples and measurements and centralizing their interpretation, and for identifying areas on the site which are contaminated or have elevated radiation levels. It is set up in one room in the administration building, with a backup position in the BDS bunker.

Co-ordination of the EdF corporate emergency response with off-site technical advisory organizations and radiological emergency response preparedness is extensive and well prepared.

8.2 Emergency plans (site/utility)

Organization, responsibilities and all activities to be implemented during an emergency are clearly documented at EdF corporate and Gravelines site level in the EdF national emergency plan and the PUI. The organization and responsibilities for preparing and maintaining the PUI is defined in the Gravelines QA manuals.

There are agreements with external organizations to support the emergency plans at the EdF corporate level such as transport by air, use of robotics, airborne surveillance, technical support from Framatome, support from EdF design departments, etc. At the site level, the Prefect, local civil and military hospitals and fire brigades provide support.

The basis for planning and classification of emergencies is standardized at the corporate level, and approved by the regulatory body, DSIN, to deal with a very broad accident spectrum. All accidents and resulting releases remain under the common envelope represented by the "upper bound accident", which is the complete meltdown of the reactor core, with the controlled venting of the containment building using a sand filter after 24 hours.

Emergency planning zones (EPZ) were established using the ICRP 40 as the international protection standard. A 5 km radius circle around all EdF sites was established for evacuation of the population and a 10 km radius circle for sheltering while the cloud passes.

The EdF national emergency plan and the Gravelines PUI define three levels of emergencies. A level 1 emergency is declared for all accidents detectable from outside the site boundary and requiring external emergency resources to be called. A level 2 emergency is declared for all events which result (or are likely to result) in a radiological accident confined to the site or in the case of radiological accident involving limited releases to the environment. A level 3 emergency is declared for an accident, the severity of which requires the use of ultimate (U) procedures (sign of worsening of the situation).

As soon as a significant disturbance occurs, the shift team will start using the required incident and accident procedures on which they have been trained on the simulator. The shift supervisor immediately calls the on-duty Safety Engineer.

The Safety Engineer uses the accident monitoring procedures. He assumes the responsibility for the unit only during accident conditions not covered by I (incident), A (accident) or H (beyond design) operating procedures. An order from the Management Control Centre (PCD) is required before the safety engineer can use the ultimate (U) procedures.

In cases where the preventive measures taken by the team prove to be inadequate to control the situation, the shift supervisor immediately alerts the on-call duty manager. When there is appropriate justification, the on-call duty manager will take the decision to implement the PUI. In the case of a Level 2 or Level 3 emergency, the plant security office (PCP) triggers the national emergency management system of EdF, DSIN, the Prefect and SCPRI. In the case where procedures so require, the shift supervisor immediately orders the alert through the PCP.

Protective measures at the plant level are well thought out and include provisions for:

- alarms transmitted by different systems (loudspeakers, personal pagers, conventional alarms, unit alarms and site alarm;
- evacuation routes (marked safety exits, staircases);
- muster points, i.e. rooms with exits which can be rapidly closed to offer sufficient protection against radiation fall out, equipped with dedicated safety telephone, and instructions;
- checking, that all personnel are assembled at muster points;
- searching for missing personnel;
- any necessary body contamination monitoring by mobile equipment at muster points; and
- ensuring that personnel are evacuated from the accident area.

Assessment of accident consequences is done generically at EdF corporate level for all 900 MW units, and documented in several reports available to the site personnel involved in emergency planning.

Two units on site use mixed oxide fuel. The source term estimation does not specifically address this situation.

(1) **Suggestion:** Consideration should be given to repeating the source term estimation to take into account the case of mixed oxide fuel.

Plant response/action: *(July 1994) When MOX_fuel was first loaded into a French PWR, accident studies, among others, were revised taking into account this particular feature; based on expert review and advice, DSIN granted authorisation for operating plants with this type of fuel. As a result of these studies, the estimated source term considered for PUI is not significantly different from the source term with UOX fuel as safety margins are included to cover a selection of possible sequences.*

IAEA comment on status: *(November 1994) The appropriate studies were carried out and these confirm that no changes to the PUI is required.*

Conclusion: *Issue resolved.*

It is common in some countries, to have iodine tablets for radioprotective prophylaxis stored at the muster point areas, so that distribution, if so required and decided, can be done without delay, (even before evacuation from the site).

Plant response/action: *(July 1994) The storing of iodine tablets has been implemented. The tablets are located inside lead sealed containers which are enclosed in the casings of security telephones. These are installed at each muster point.*

Distribution of iodine tablets is subject to the decision of the head of the Management Command Post (PCD), following medical advice. Furthermore, instructions to personnel, for use by the designated muster point officer, are contained inside the lead sealed containers.

Verification by appointed Resources Command Post staff (PCM) is carried out every 6 months. The renewal of iodine tablets, ensured by the medical service, is carried out every 5 years if necessary.

IAEA comment on status: *(November 1994) Gravelines NPP has responded positively to this suggestion. Satisfactory arrangements are now in Place for the location and distribution of potassium iodine tablets. Further consideration should be given to the delegation of authority to issue potassium iodine tables in circumstances where it may be necessary prior to the arrival on site of the medical doctor.*

Conclusion: *Satisfactory progress to date.*

8.3 Emergency procedures (site/utility)

Gravelines NPP emergency procedures are an integral part of the PUI (sometimes called action sheets in the form of appendices to a particular chapter of the PUI). As part of the PUI, they are subject to QA review. There is a wide range of such procedures covering all aspects of the emergency response including classification of the category of emergency, activation of the appropriate emergency response arrangement, responsible personnel and/or organization to notify, alert and recommend appropriate protective measures, assessment of the plant conditions and the potential for on- and off-site consequences, radiation monitoring and sampling, and personal protection.

Procedures exist for each command centre and for staff who have specified roles in the PUI. There are also procedures for corporate EdF staff at several off-site locations, who are involved in responding to an emergency at any. EdF NPP. These are included in the EdF plan entitled 'National Organization for Crises', and in the EdF corporate telecommunications plan. They are subject to the corporate review procedure.

8.4 Emergency response facilities, equipment and resources (site/utility)

The on-site response emergency centres are located in different buildings, since Gravelines is a big site. There is a Local Control Centre (PCL), located in each of the six unit control rooms, a Local Emergency Team (ELC) located in each of the three twin unit electrical rooms and one large hardened building (BDS), which can in addition to the Management Control Centre (PCD) team and security team (PCP), if needed, accommodate all other control centre teams. All these rooms have adequate and redundant habitability systems for the case of on-site radiological contamination as well as redundant communication systems, necessary documents, protective equipment, safety parameter display systems (in the PCL and ELC) and other clerical facilities.

All command centres were found to be well set up and ready for operation. In the ELC an additional fax machine would be brought in from the control room. Personal computers would be brought to the BDS in the case of evacuation of the administration building.

In the case of evacuation of the main control room, the emergency shutdown panel can be used to place the unit in hot shutdown. It is designed also to bring the unit to cold shutdown. It has the necessary communications systems so that the local command centre team could continue its function. However, the emergency shutdown panel has no display of plant radioactivity monitors. An operator would be sent to take readings from the radiation monitoring cabinets which are situated on a different floor.

(1) **Suggestion:** Consideration should be given to the provision of a display of the most important radioactivity monitors in the remote shutdown panel.

Plant response/action: *(July 1994) The display of the highest radioactivity measurement indications (radioactivity monitors or KRT equipment) on the remote shutdown panel is not envisaged.*

Indeed, the means of control and instrumentation made up of:
- *direct controls on relays and circuit breakers,*
- *the controls and instrumentation on the emergency shutdown panel,*

enable the unit to be brought to and maintained at a hot shutdown state, then a cold shutdown state, from outside the control room.

In view of its exceptional character, ease of operation is not sought after in this field. We consider that safety must constitute the only criteria in the choice of the means to be implemented. Furthermore, radioactivity measurements are available in the electric rooms on the level above (11 metres).

IAEA comment on status: *(November 1994) Full consideration of arrangements for obtaining information from radioactivity monitors has been carried out and it has been demonstrated that satisfactory arrangements are in place to ensure that this information can be obtained and presented to the command centre during an emergency.*

Conclusion: *Issue resolved.*

The preferred rooms for the various command centres are located in the administration building on 7th and 1st floor. These rooms are not provided with habitability systems, so their use in a Level 2 emergency would be questionable and in Level 3 may not be appropriate. The evacuation from the administration buildings to the BDS later in an accident may pose problems in logistics and in decontamination.

(2) **Suggestion:** Consideration should be given to ensuring that initial assembly points for the management control teams are habitable during level 2 and 3 emergencies. This could be achieved by locating them initially in the BDS building.

Plant response/action: *(July 1994) Designating the Site Security Building (BDS) as the only muster point for the Management, Resources and Health Physics Command Posts (PCD, PCM and PCC), whatever the level of the Internal Emergency Plan (PUI), is considered as a good practice (cf. feedback from the Internal Emergency Plan (PUI) Conference of May 4th and 5th, 1994).*

A study to implement this has been undertaken by the Thermal Department (CNET) at the request of the site. This study aims at reorganizing the rooms and the floor space so as to use the Site Security Building (BDS) as the only place for the assembly of the main command posts for the Internal Emergency Plan (PUI), whatever its level.

IAEA comment on status: *(November 1994) This suggestion has been recognized by the site as a good practice and the necessary modifications are currently being developed with a planned change over to take place later in 1995.*

Conclusion: *Satisfactory progress to date.*

For certain cabinets in the command centres, an updated, controlled list of the required, controlled documentation which should be stored there, is not available. The same observation goes for the briefcases which are used by the on-call heads of the different control teams.

(3) **Suggestion:** Consideration should be given to formalizing minimum requirements for controlled documentation in the various command centres and the brief cases used by the on-call heads of the control teams.

Plant response/action: *(July 1994) The minimum requirements concerning the controlled documentation of the different Command Posts (PC) are specified in an application memo from the Organization Supplementary Manual which defines, among other things:*

- *the contents of all documentation interfacing with the Internal Emergency Plan (PUI)*
- *responsibilities in terms of management and updating.*
- *the means of verification of each document.*

The Command Post (PC) head is responsible for the enforcement of these requirements. The Command Post (PC) heads' briefcases, which contained partial or redundant copies of the existing documentation have been abolished.

IAEA comment on status: *(November 1994) The appropriate procedures for formalizing the control of essential documents in the command centres and for personal use by heads of control teams have now been produced. A further check should be carried out to ensure that individuals who have been delegated the task of updating documents in the command centres are formally aware of these new responsibilities.*

Conclusion: *Satisfactory progress to date.*

During the normal working day, there are many private cars parked outside the fence and also inside the fence. There is no clear understanding in the PUI whether these cars could be used to evacuate personnel from the site.

(4) **Suggestion:** Consideration should be given to evaluating the benefits and weak points of using the cars of the personnel on site for evacuation to the off-site control centre in Gravelines. The outcome should be clearly reflected in the PUI.

Plant response/action: *(July 1994) During an accident, the use of private vehicles is forbidden. This position is clearly indicated in instruction B1 of the Internal Emergency Plan (PUI). Consequently, all EdF and non-EdF personnel are counted and transported collectively to the offsite Command Post by specially requisitioned buses.*

Two possibilities exist:

- *contracts with a guarantee clause for the supply of buses by two local transport companies (with Power Station letters of commitment), were signed with these two companies in 1991. These arrangements are included in the PUI.*

- *the supply by the regional Prefect of civil or military public transport vehicles requisitionned in the framework of the Civil Emergency Plan (PPI).*

IAEA comment on status: *(November 1994) A review of evaluation arrangements has been carried out and the formal arrangements which utilize vehicles provided by local transport companies or via vehicles requisitioned as part of the Civil Emergency Plan (PPI) is now fully reflected in the Site Emergency Plan (PUI).*

Conclusion: *Issue resolved.*

Good performance: There is an off-site control centre in the city of Gravelines, which can be used to decontaminate and monitor all the evacuees from the plant. It is equipped with considerable stocks of clothing to replace any found contaminated. It also houses an off-site radiological laboratory.

A substantial range of equipment and resources were found at Gravelines NPP dedicated for use in an emergency. Contact between different parties involves the use of the several modern and redundant means of communication. Radiological monitoring and sampling equipment is not at the same level of sophistication as the communication equipment. All measuring points have been approved by the SCPRI. A new, improved radiological environmental monitoring system is scheduled to be installed in November 1993, which will collect on-line data from all 1 km and 5 km points, weather conditions, stack radioactivity and flow rate, analyse and display predicted effects on the environment. The quality of the meteorological equipment is satisfactory.

The redundancy in methods and completeness of radiological monitoring around the site could be improved, primarily for accidents which are beyond the planning basis of the PUI. Four on-site monitoring points and three points off-site are intended to provide information on a release of gaseous activity via an unmonitored route. These are insufficient to adequately cover all eventualities since releases to the sea are not covered and the on-site monitoring points are connected to the PCC. This is known to the plant and a new system has been ordered. It is common in many countries to place greater reliance on monitoring results which reflect actual conditions. It is also common in many countries to use around fifty inexpensive TLD monitors around the NPP, to get spatial dose distribution of the accident.

(1) **Suggestion:** Consideration should be given to the provision of additional radiological monitoring points in the new system. These points should cover also the releases directed in west and north sectors.

Plant response/action*: (July 1994) The new system uses a modified type of monitoring point and direct transmission of information to our premises. The number and position have not been changed as these have been defined in collaboration with the SCPRI. This ensures a representative check during normal operation.*

In the Emergency Plan it is envisaged that measurement of radioactivity will be carried out by the operator from the beginning of the accident in order to evaluate the real impact of releases. These measurements, taken downwind of the site or on site, enable both comparison with calculations and detection in the event of an abnormal release from the containment. We have two vehicles for this purpose, equipped with the material required for taking and measuring environmental samples.

As the site map shows, Gravelines NPP has enough space (about 500 metres) between the reactors and the sea to enable representative measurements to be made of ambient radioactivity and atmospheric contamination, in case of real or suspected gaseous releases towards the sea.

In conclusion, we consider the current measures to be satisfactory. Measurements taken at sea would without doubt be difficult to achieve and would add little useful information on the consequences of the accident.

IAEA comment on status: *(November 1994) The consideration given by Gravelines site management to this suggestion is clearly a reflection of the policy of EdF in this respect. The acceptability of this response is entirely dependent on being able to demonstrate that the current arrangements are capable of detecting any release of activity beyond the site fence and to have knowledge of the magnitude and direction of such a release.*

Further consideration should be given to ensuring that the arrangements are capable of carrying out this function in relation to the following circumstances:

- *a large release within 30 minutes (before the mobilization of vehicles)*
- *sudden changes of wind direction*
- *wind direction changes and changes in the rate of release.*

Conclusion: *Little or no progress to date*

There are two new four wheel drive vehicles (mobile laboratories) on site for environmental monitoring. The vehicles are well equipped and can readily measure background radioactivity but in the case of an early release the two plant radiological monitoring vehicles, with their sensitive equipment might be contaminated on-site, before their mission.

(2) **Suggestion:** Consideration should be given to the possibility of having one of the two radiological monitoring vehicles parked outside the plant.

Plant response/action: *(July 1994) The two radiological monitoring vehicles have both been parked outside the plant near the Public Information Centre since October 1993.*

IAEA comment on status: *(November 1994) Implementation is now completed satisfactorily.*

Conclusion: *Issue resolved.*

The off-site fire brigade at Gravelines has one special vehicle for monitoring chemical and radiological contamination. A similar vehicle is available from the fire brigade in Dunkerque. There is one emergency vehicle located at the plant site medical facility, dedicated for on-site transport, the next nearest is with the Gravelines fire brigade (10 minutes) away.

Protective clothing and respiratory protection at the different common centres is adequate. The standard of first aid/medical equipment is impressive. This is stored at the medical facility and in the central control rooms.

8.5 Off-site emergency planning and preparedness organization

In France, a well defined system of off-site organizations and agencies involved in planning, implementing and control of all kinds of emergency activities exists. There are three governmental levels involved:

- level of the Prime minister,
- central government level including:
  - the ministry for the Interior,
  - the ministry of Industry,
  - the ministry of Health,
  - the ministry of Transport,
- local level with the Prefect and nuclear power plant operator.

The local off-site organization for planning, implementing and control of emergencies is the responsibility of the Prefect of the district Nord stationed in the city of Lille. The Prefect delegates the responsibility for emergency planning to the director of the Regional Interministerial Service for Economic and Civil Affairs, Defence and Civil Protection.

The Prefect is in charge of the off-site response. The Prefect has a control centre (PCF) from which the off-site response is managed. Local representatives from the relevant government ministries attend the PCF. In addition, representatives from Gravelines NPP (who bring a mobile radio station), the DSIN, IPSN and SCPRI attend the PCF to provide advice on nuclear and radiological safety. The Prefect is responsible for taking all the necessary measures to assure safety and public order. If he judges it to be necessary, he starts his emergency plan (PPI). He informs the Prefect of the Pas de Calais district and the neighbouring Belgian and UK local authorities.

The decisions taken by the Prefect at the PCF are implemented by the operational control centre (PCO) in Dunkerque, headed by the vice-prefect. The PCO manages the control of the affected off-site area by the police, gendarmerie, monitoring by fire brigades, etc. He also controls the actual implementation of sheltering, evacuation and issue of iodine tablets to the public.

If needed, the Prefect can always ask for resources from the national and regional offices of the Directorate of Civil Protection (DSC).

Off-site emergency preparedness infrastructures to implement the plan at local level is adequate. National level infrastructure to cope with any emergency is very good. It has been organized very systematically with an approach to planning for different disasters based on lessons learned from a variety of events in France and abroad.

8.6 Off-site emergency plans

The Plant Manager of Gravelines NPP, in his role as head of the Management Control Centre (PCD) as defined in the PUI, has the executive command over the damaged plant on-site. The Prefect provides the executive command and integration of all actions by off-site organizations. The Director of the Nuclear Division of EdF supported by the EdF crisis team, which is in turn supported by the EdF design departments and Framatome crisis teams, provides analytical and technical support of the whole of the EdF and Framatome to the. PCD. The Director of DSIN, supported by the crisis team of IPSN monitors the actions of the local and EdF control centres and gives advice to the Prefect with respect to the status of technical nuclear safety and the prognosis of the accident development on-site.

The IPSN crisis team is in contact with the National Meteorological office and with SCPRI. It has the analytical capabilities to assess and predict plant accident states, source terms, atmospheric dispersion, doses, and magnitude of affected population for the accident phase and post accident phase.

SCPRI supported by a team of medical experts provides online data of gama dose rate measurements over France, and provides advice to the DSIN and the Prefect on all radiation protection measures for the population and the environment (including distribution of iodine tablets). The SCPRI provides mobile whole body counters to monitor the evacuated population and sets up large scale radioactivity monitoring for post accident measures.

All off-site organizations also have their own emergency plan or action sheets, covering their responses.

The planning base of the emergency plans for the Prefect (PPI), EdF and Gravelines NPP (PUI) are the same. The off-site emergency plan specifies the procedures for alerting; the structure of Fixed Command Centre, (PCF) and Operational Command Centre, (PCO); the tasks of each Command Centre; the tasks of all the logistics support services; duties of police forces; and the means of public and media information.

The PPI is available by law to members of the public at the Prefecture in a version which is written without sensitive information, such as communications details. The PPI defines a 5 km zone (with approximately 20,000 population) around the NPP for evacuation, and a 10 km zone (with approximately 39,000 population in nine communities) for sheltering. It also defines the control of access, traffic rerouting (on roads, railway and water) and the instructions for food and drinking water consumption. The PPI defines the muster points inside the 5 km zone for the population to be evacuated and the sorting points for the evacuated population on the 10 km perimeter, with monitoring and decontamination facilities and units if needed. It defines the evacuation routes, provisions for transport, housing and food for the evacuated and logistic support for all units involved.

The two zones are divided into sectors, and only sectors actually affected by wind will be considered for evacuation. If necessary the evacuation zone could be extended.

The PPI, rev.0, dated 3 January 1987, which was available for the review, is based on the circular letter from the Ministry of Interior to the districts dated 29 December 1978. There is no written feedback on the actual distribution of the controlled copies. The PPI, rev.1, which during the OSART review was in the process of being signed by the Prefect, is based on the Law of 22 July 1987 on prevention against major disasters and the decree of the Prime Minister of 8 May 1988 defining the content of PPIs. On the other hand, the PUI is in the process of revision to take into account of the new EdF 'Model' PUI, which in turn is in the final stage of review at DSIN; the Prefect has not been consulted.

(1) **Suggestion:** Consideration should be given to ensuring regular verification, updating and controlled distribution of the PPI and PUI and the proper and timely exchange of relevant information when revising the PUI and PPI to optimise interfaces.

Plant response/action: *(July 1994) According to the Decree N° 88-622 of 6.5.88, the Prefect requires the operator's comments on the PPI when it is prepared or significantly modified. Monitoring the consistency of prefecture and site documentation concerning the Internal Emergency plan (PUI) and the Civil Emergency Plan TH) is done by the Internal Emergency plan (PUI) co-ordinator during annually programmed visits to the Prefecture.*

The local updating of Internal Emergency Plan documents results from :

- *the periodic re-examination of memos which is required by our quality organization manual,*
- *modifications following consideration of experience feedback and following Edf corporated level audits and inspections by the Safety Authorities.*

The controlled issuing of the Internal Emergency plan (PUI) and the Civil Emergency Plan (PPI) is ensured by means of acknowledgement of the receipt of documents or by accompanying letters [(see reply to item 8.1(1)].

As far as the revision of the National Model Emergency Plan is concerned, see reply to item 8.1(2).

IAEA comment on status: *(November 1994) The site response to this suggestion has been fully addressed in 8.1(1) and 8.1(2).*

Conclusion: *Satisfactory progress to date.*

The intervention levels for stable iodine radioprotective prophylaxes have not been established. Administration of stable iodine is not a substitute for prompt evacuation or sheltering of the general population for a severe accident. Several countries consider the risk of iodine prophylaxes as minor and have established the intervention levels for the general population.

(2) **Suggestion:** Consideration should be given to re-evaluating the risk of administering stable iodine to the general population for thyroid blocking and the risks of high thyroid dose and to draw simple conclusions in emergency plans.

Plant response/action: *(July 1994) A study by professors Schlumberger, Parmentier and Dublan concerning the correct action to be taken following accidental contamination by radioactive iodine isotopes appeared in 1988 in the* *review Presse Médicale, volume : PRESSE MED. , 1988,17 : 386 388. This study shows that in the event of an accident, stable iodine can be administered in massive doses to the population.*

The Iodine 131 content must now exceed a value of 800 Bq/m3 of breathed air for a period of < 10 days or 8000 Bq/m3 of breathed air for a period of < 24 hours.

The distribution of stable iodine by the general population is decided by the Prefect responsible for the Civil Emergency Plan following :

- *a circular letter from the Minister of the Interior dated 11 January 1989, which presents the criteria to be taken into account for level 3 counter measures according to ICRP 40 and,*
- *an instruction issued jointly by the Minister of Health and the Minister of the Interior dated 18 August 1992 which details how to implement such distribution.*

IAEA comment on status: *(November 1994) A full evaluation has been carried out and specific instructions are in place. They were issued by the appropriate Government Ministers to the Prefect responsible for the Civil Emergency Plan.*

Conclusion: *Issue resolved.*

8.7 Off-site emergency procedures

Detailed procedures or action sheets exist for the response of Prefect's organization and are an integral part of the PPI. The alerting system is based on a small number of on-call personnel with pagers and provides for a call out of all local organizations. Direct and redundant links exist between Gravelines PCD and prefecture telephone station.

Both the DSIN and IPSN have a substantial range of procedures and action sheets, which cover alerting, communication, assessment and provisions to give advice.

8.8 Off-site emergency response facilities equipment and resources

The off-site command centres (PCF and PCO) are not dedicated facilities. All other centres have dedicated facilities. All have dedicated and redundant telecommunications facilities. DSIN and IPSN also have computer links with all French

NPPs and training simulators. There is no dedicated room for the PCF in Lille to control radiological or other major industrial emergencies.

The national system for alerting is good. It will be further improved this year by connecting the new siren system at higher risk industries with radio links. The off-site communication equipment is good, based on multiple redundant and diverse systems.

The national on-line radiological monitoring is comprehensive and can be accessed also by the population by using Minitel. Integration of this system, which is run by SCPRI, into the computer assessment and predictive applications of the EdF, DSIN and IPSN is not yet on the same level.

The meteorological prediction capabilities which exist within the National Meteorological office are good, and are accessible from several command centres.

The mobile laboratories and dedicated emergency vehicles have adequate equipment for contamination monitoring and decontamination of a number of persons and small areas. If needed, additional equipment and resources would be brought in to the area.

The fire fighting equipment in the city of Gravelines is of a high standard and adequate. For a major fire all neighbouring fire brigades would assist.

Computerized accident assessment equipment or system is available at DSIN, EdF and IPSN. IPSN has a large array of additional computers and software models available for predicting the development of events and consequences. SCPRI can provide large scale whole body monitoring within 24 hours or earlier. The capacity could be up to 15000 a day. The same equipment is used for measuring the level of contamination in samples of food, water and foodstuffs. Airborne contamination monitoring and remote survey by robots can also be provided. First aid/medical support equipment is very good.

Good performance: The mobile whole body monitoring equipment of SCPRI is good, since it allows large scale monitoring of the population and also gives, considerable reassurance to members of the public. The airborne and robotic surveillance capabilities from external organizations are well thought-out.

8.9 Training, drills and exercises

The training programme of Gravelines NPP for the PUI is under revision. The general training programme of control room operators includes the use of all procedures which require the implementation of the PUL The training of a new member of the PUI duty roster is based on self training methods, reading the action sheets and chapters of the PUI which will concern his duties. National PUI courses are required for personnel at command centres and personnel attend as places on courses become available. The current training of personnel having emergency duties in the PUI is not optimal. The prior qualifications, mandatory and recommended training are not defined.

(1) **Recommendation:** The revision of the emergency preparedness training for the PUI should be continued and integrated into the existing training programme for operators and others with duties in the PUI. The training should be mandatory and easily available.

Plant response/action: *(July 1994) The organization of Internal Emergency Plan (PUI) training is underway. The training of staff involved in the Internal Emergency Plan (PUI) has been undertaken. As far as the operators are concerned, a specific four hour module has been incorporated into compulsory safety training (training course 2303). An application memo defines the general outline and the minimum requirements demanded for training and specifies the setting up of the necessary organization.*

Futhermore, a co-ordinator is named for each Command Post (PC). He is in charge of co-ordinating and scheduling the training sessions of his team and must keep training records and ensure follow-up. An idea has been launched at site level to integrate Internal Emergency Plan (PUI) training into the compulsory curriculum and to define its practical implementation. Training, as well as other aspects related to emergency planning and preparedness, is reviewed during inspections by the Safety Authorities.

IAEA comment on status: *(November 1994) Considerable progress has been made in formalizing the arrangements relating to Emergency Plan training for all staff, who are required to perform emergency duties. Specifications have been produced together with planning and monitoring arrangements. The new specifications are being applied to new appointments but will be retrospectively applied to current post holders. Formal appraisal after training is not carried out but reliance is placed on performance during exercises. Consideration should be given to including a suitable form of assessment following completion of training. Refresher training at set intervals is yet to be incorporated. Further consideration should be given to ensuring that newly appointed command post heads have experienced a full exercise before being assigned to the Emergency Rota.*

Conclusion: *Satisfactory progress to date.*

An annual schedule of exercises and drills for the PUI is produced and includes at least two exercises and drills per year at different command centres in the plant. From 1977 on there were total of 11 PUI exercises and drills on site and two emergency alerts.

The annual schedule of exercises and drills does not reflect the whole range of exercises and drills which take place in different divisions of the plant. It also cannot be demonstrated, that all persons who have roles in the PUI are drilled and exercised. There are no drills of assembly at muster points and accounting of personnel. Frequency of drills which include the fire brigade and rescue vehicles or evacuation to the retreat facility ('fall back' house) is low.

(2) **Recommendation:** The schedule should be revised to show all exercises and drills at the plant for a period of several years. The scenarios simulated in exercises should be more realistic and include assembly and accounting of personnel, use of rescue vehicles, etc.

Plant response/action: *(July 1994) A programme of all practice exercices to be carried out on the site is created annually for a period of two years (cf. NA/CN 24 01 16). It takes into account previous exercices practised by the site, whether global or partial.*

The content of the 94/95 programme aims at working on the following levels :

- *national level,*
- *internal/external level with departmental partners,*
- *Command Post level,*
- *the mobilization of PUI on-call personnel,*
- *the verification of telephone links and the transfer of calls to PUI on-call personnel at home*
- *the use of internal and external emergency help.*

An exercise involving EdF and governmental authorities at local and national levels is scheduled for Gravelines in 1996.

IAEA comment on status: *(November 1994) The programme of exercises designed to test emergency preparedness has been reviewed and presented in the form of a two year rolling programme. The number of site only based exercises have been increased in number and designed to have more testing scenarios. As exercises are the principal means by which the assessment of individual or team competence is judged it is recommended that this is used as the basis for a continuing review process for adequacy and frequency of prescribed training programmes. A more formal role by the appropriate regulatory body in determining the acceptability of* *emergency exercises could be a beneficial way of demonstrating an acceptable standard of emergency preparedness to the public as in the practice in some other countries.*

Conclusion: *Satisfactory progress to date.*

The nationwide exercises, seven to eight per year, are scheduled by the ONC, and are based on scenarios which are run on the training centre simulators. DSIN initiates two or three exercises every year involving the DSIN and EdF emergency management systems. The General Secretary of the Interministerial Committee for Nuclear Safety organizes an exercise every year involving the entire EdF and government emergency management systems.

For each exercise, drill and actual alert a written report is prepared. The leader of MSQ follows up the recommendations. A feedback mechanism is established, for example, as a result of the national exercise of November 1990 by which the PCL team leader of a non-affected twin unit was added to the PCL of the affected unit. A PCD spokesman and a person in charge of the press room was added to the PCD and fax machines for sending press releases were improved.

8.10 Liaison with the public and media

The on-call personnel designated in the PUI for ensuring emergency public information activities are professional and trained in public information practices. They also receive special crisis management training every two years. The public information programme during normal operating activities is satisfactory and extensive.

One leaflet exists, which was prepared by the Gravelines NPP and distributed by DRIRE in Gravelines, which gives warning signs and instructions of the new national alerting system for all major industrial and nuclear accidents. Farmers received a booklet from their national association with advice on what actions to take in the event of a radiological accident. No leaflet has been issued to the general population and farmers in the EPZ describing measures provided for in the PUI and PPI.

(1) **Recommendation:** Leaflets should be prepared by the public authorities for the general population and farmers describing the basic emergency arrangements contained in the site (PUI) and off-site (PPI) emergency plans. The leaflets should be distributed yearly.

Plant response/action: *(July 1994) The Arreté of 28 January 1993 lays down the technical rules for preventive information for persons likely to be affected by an* *accident in an installation presenting high potential risks to the public or the environment. The NPP, as well as other industrial sites around Dunkerque is governed by this Arreté which requires :*

- *information to be given to the population on the dangers from the installation, within the perimeter involved in the emergency plans.*
- *dissemination of this information at least every five years, or if an installation is modified*

At local level, the SPPPI (Permanent Secretariat for the Prevention of Industrial Pollution of the Calais - Dunkerque coastline) under the aegis of the Prefect of the region, groups together those industrial sites governed by the Arreté and co-ordinates action to inform the public.

Within this framework:

- *information was given to the population in May 1991*
- *a new information campaign was decided upon and implemented in mid 1994, three years after the previous campaign.*

It is not the NPP's decision to undertake these information campaigns and their periodicity. At the local level we must remain consistent with action taken elsewhere.

To complement these campaigns, Gravelines NPP conveys its own information during visits by the public to the site and by participating in local exhibitions, debates etc.

Finally, at DSIN's request, the Local Information Commission (CLI) should be reactivited in the near future, it is composed of local elected representatives and is generally a good medium for public information.

IAEA comment on status: *(November 1994) The responsibility for informing the public on emergency arrangements in the area surrounding Gravelines NPP rests with the regional local authorities. This is satisfactorily carried out with significant input and contribution from Gravelines NPP. The information booklet is available to local residents and is re-issued on regular intervals. The station is responsive to continue to consider ways of improving this line of communication.*

Conclusion: *Issue resolved.*

Good practice: DRIRE and the Mayor of Gravelines made an excellent public campaign in 1991 to warn the public of potential hazards of several high risk industries in the area and to promote preventive behaviour. Gravelines NPP actively participated in this campaign.

Procedures for co-ordinating and approving press releases between the PCD, PCF and EdF-PCD and for distribution to the media exist. Media centres are located close to the PCF in Lille and close to the EdF-PCD in Paris. On-site, the Belvedere Press Centre with dedicated communication equipment for the media would be used during an emergency event. It would accommodate at least 40 journalists. It could not be used for level 2 or 3 emergencies, in which case a second facility would be used in Dunkerque (10 km distance).

(2) **Suggestion:** Consideration should be given to relocating the press centre to a location off-site. This would avoid the problems of dealing with media on-site whilst trying to control an emergency situation.

Plant response/action: *(July 1994) The moving of the EdF press centre offsite is not envisaged. In fact it is the responsibility of the government authorities to create a press centre located in an appropriate place, if necessary. This is defined and foreseen in the Civil Emergency Plan (PPI). This press centre is created by decision of the regional Prefect and is decentralized at the 'Palais du Littoral de Grand-Synthe' located some 15 km from Gravelines.*

IAEA comment on status: *(November 1994) When considering the totality of Emergency facilities this suggestion can be satisfactorily refelcted in the existing arrangements.*

Conclusion: *Issue resolved.*

ACKNOWLEDGEMENTS

The Government of France, the Nuclear Installations Safety Directorate (DSIN), Electricité de France (EdF) and Gravelines 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 four previous OSART missions, has already established many personnel contacts and a common basis for efficient work.

Throughout the whole mission, Gravelines nuclear power plant management, EdF corporate office staff and counterparts were open minded, co-operative 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 to complete the review 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 Gravelines nuclear power plant review.

TABLE 1

SUMMARY OF STATUS AT NOVEMBER 1994 OF RECOMNENDATIONS AND SUGGESTIONS OF GRAVELINES OSART MISSION (MARCH-APRIL 1993)

	RESOLVED	SATISFACTORY PROGRESS	LITTLE OR NO PROGRESS	WITHDRAWN	TOTAL
Management, Organization & Administration	2R 4S	2R 10S	-- --	-- --	4R 14S
Training & Qualification	2R 1S	9R 16S	-- 1S	-- --	11R 18S
Operations	2R 6S	2R 2S	-- --	-- --	4R 8S
Maintenance	2R 1S	1R 1S	-- --	-- --	3R 2S
Technical Support	1R 7S	1R --	-- --	-- --	2R 7S
Radiation Protection	-- 8S	-- 1S	-- --	-- --	-- 9S
Chemistry	-- 11S	1R 4S	-- 1S	-- --	1R 16S
Emergency Planning & Preparedness	1R 8S	2R 4S	-- 1S	-- --	3R 13S
R TOTAL	10R (37%)	18R (63%)	--	--	28R (100%)
S	46S (53%)	38S (44%)	3S (3%)	--	87S (100%)
TOTAL	56 (49%)	56 (49%)	3 (2%)		115 (100%)

nens/osart/94/66/f
gravelines.rpt/kwh
1994-12-22

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 GRAVELINES OSART TEAM

Experts:

CAREY, James - UNITED KINGDOM
Site Inspection Manager
Health and Safety Department, Nuclear Electric plc
25 years of nuclear experience
Review area: Assistant Team Leader

DOMENECH ROJO, Miguel - IAEA
Senior NPP Operational Safety Officer
Division of Nuclear Safety
22 years of nuclear experience
Review area: Operations

FIRTH, Edwin - U.S.A.
Arizona Public Service Corporation
Palo Verde Nuclear Generating Station
17 years of nuclear experience
Review area: Training and Qualifications

GOTO, Hideyuki - JAPAN
Assistant General Manager
Hokkaido Electric Power Co. Inc.
20 years of nuclear experience
Review area: Operations

GREGORIC, Miroslav - SLOVENIA
Director
Slovenian Nuclear Safety Administration
17 years of nuclear experience
Review area: Emergency Planning and Preparedness

KURATA, Chiyoji - IAEA
NPP Operational Safety Officer
Division of Nuclear Safety
13 years of nuclear experience
Review area: Maintenance

Experts:

LÖWENDAHL, Bengt - SWEDEN
Senior Manager, Radiation Protection and Security
Oskarshamn Nuclear Power Plant
30 years of nuclear experience
Review area: Radiation Protection

MOORE, Brian - IAEA
Senior NPP Operational Safety Officer
Division of Nuclear Safety
29 years of nuclear experience
Review area: Team Leader

OTERO, Maite - SPAIN
Director Project IPE-APS
Central Nuclear Vandellos II
15 years of nuclear experience
Review area: Technical Support

ROOFTHOOFT, Roger - BELGIUM
Head of Department Chemistry in Power Plants
Laborelec
25 years of nuclear experience
Review area: Chemistry

SEUFFERT, Bernhard - GERMANY
Deputy Manager Operations Department
Bayernwerk AG, Grafenrheinfeld NPP,
10 years of nuclear experience
Review area: Technical Support

WELSH, Peter - UNITED KINGDOM
Station Manager
Hinkley Point Power Station
16 years of nuclear experience
Review area: Management, Organization and Administration

Observers:

KISS, István - HUNGARY
Head, Simulator Center
Paks Nuclear Power Plant
13 years of nuclear experience
Training area: Training and Qualifications

KOULKLIK, Ivo - CZECH REPUBLIC
Head, Operations Department
Dukovany Nuclear Power Plant
10 years of nuclear experience
Training area: Operations

LIU, Xin Rong - CHINA
Deputy Director General
Beijing Institute of Nuclear Engineering
29 years of nuclear experience
Training area: Technical Support and Operations

ANNEX II: COMPOSITION OF GRAVELINES OSART FOLLOW-Up TEAM

Experts:

HIDE, Keith - IAEA
Head, NPP Operational Safety Services section
Division of Nuclear Safety
Years of nuclear experience: 23
Review areas: Team Leader; Maintenance

MOORE, Brian - CANADA
Nuclear Safety Specialist
Years Of nuclear experience: 30
Review areas: Operations; Technical Support;
and Chemistry

LANGE, David - USA
Human Factors Assessment Branch
Reactor Controls & Human Factors
U.S. Nuclear Regulatory Commission
Years of nuclear experience: 20
Review areas: Training & Qualifications; and Radiation Protection

WELSH, Peter - U.K.
Manager, Hinkley Point Power Station
Years Of nuclear experience: 19
Review areas: Management, Organisation and Administration; and
Emergency Planning and Preparedness.

ANNEX III: SCHEDULE OF ACTIVITIES

1.	Official request from the Resident Representative of France to the IAEA to conduct a mission to Gravelines Nuclear Power Plant	4 September 1991
2.	IAEA confirmation of OSART review	10 October 1991
3.	Preparatory meeting for OSART review of Gravelines Nuclear Power Plant	24 June 1992
4.	Recruitment of team members	Sept. 1992-Jan. 1993
5.	Advance Information Package sent to team members	January 1993
6.	OSART Mission	15 Mar.-2 April 1993
7.	Submission of OSART mission report to the Resident Representative of France	August 1993
8.	Official letter requesting OSART Follow-up Visit to Gravelines Nuclear Power Plant	19 April 1994
9.	IAEA's confirmation of OSART Follow-up Visit	3 June 1994
10.	Recruitment of team members	August-October 1994
11.	OSART Follow-up Visit to Gravelines Nuclear Power Plant	7-10 November 1994
12.	Submission of OSART Follow-up Visit report to the Resident Representative of France	January 1995