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REPORT

OF THE

OPERATIONAL SAFETY REVIEW TEAM

(OSART)

MISSION

TO THE

DAMPIERRE

NUCLEAR POWER PLANT

FRANCE

31 August to 17 September 2015

AND

FOLLOW-UP VISIT

20 to 24 February 2017

DIVISION OF NUCLEAR INSTALLATION SAFETY
OPERATIONAL SAFETY REVIEW MISSION
IAEA-NSNI/OSART/184F/2017

PREAMBLE

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

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

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

FOREWORD

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 ten operational areas: leadership and management for safety, organization and administration; training and qualification; operations; maintenance; technical support; operating experience feedback; radiation protection; chemistry; emergency planning and response; and accident management. Depending on individual needs, the OSART review can be directed to a few areas of special interest or cover the full range of review topics.

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

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

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

The report that follows presents the conclusions of the OSART review, including good practices and proposals for enhanced operational safety, for consideration by the Member State and its competent authorities.

CONTENT

INTRODUCTION AND MAIN CONCLUSIONS

INTRODUCTION

At the request of the government of France, an IAEA Operational Safety Review Team (OSART) of international experts visited Dampierre Nuclear Power Plant from 31 August to 17 September 2015. The purpose of the mission was to review operating practices in the areas of Leadership and Management for Safety; Training and Qualification; Operations; Maintenance; Technical Support; Operating Experience Feedback, Radiation Protection; Chemistry; Emergency Planning and Response; and Accident Management. In addition, an exchange of technical experience and knowledge took place between the experts and their plant counterparts on how the common goal of excellence in operational safety could be further pursued.

The Dampierre OSART mission was the 184th in the programme, which began in 1982. The team was composed of experts from Belgium, Brazil, Bulgaria, Canada, China, Czech Republic, Finland, Slovak Republic, South Africa, Spain and the UK, together with the IAEA

staff members and observers from France, China and Russian Federation. The collective nuclear power experience of the team was approximately 380 years.

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

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

The following report is produced to summarize the findings in the review scope, according to the OSART Guidelines document. The text reflects only those areas where the team considers that a Recommendation, a Suggestion, an Encouragement, a Good Practice or a Good Performance is appropriate. In all other areas of the review scope, where the review did not reveal further safety conclusions at the time of the review, no text is included. This is reflected in the report by the omission of some paragraph numbers where no text is required.

MAIN CONCLUSIONS

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

- effective process to facilitate the transfer of knowledge and know-how across generations during the recruitment process of more than 500 new comers over last 5 years;

- stewardship of a skills training programme for new maintenance employees that provides a credible framework to systematically deliver knowledge and skills;
- software used to better capture lessons learned from post-job debriefings, and their quick and easy integration into subsequent pre-job briefs;
- clear demarcation of zones where satellite telephone signal is available, which results in a reduced risk of a severe accident since this facilitates coordination of accident management activities;
- employees' ability to be innovative while incorporating operating experience from other nuclear power plants;

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

- improve operational practices to ensure that deficiencies are systematically identified in the field;
- enhance the rigor in human performance and supervision in the main control room during operator's actions that impact important primary parameters;
- improve the quality of operational event analyses to ensure root causes and corrective actions are systematically identified;
- consider improvement in the management of emergency drills and exercise to ensure they are adequately implemented and their effectiveness is timely evaluated;
- consider increasing the scope of the guidance provided to the plant staff to mitigate severe accidents, including accidents at multiple units, accidents occurring in reactor shutdown states and spent fuel pool accidents.

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

DAMPIERRE PLANT SELF ASSESSMENT FOR THE FOLLOW-UP MISSION

In September 2015, an international team of experts led by the IAEA conducted a review at Dampierre NPP during which the station was assessed against international best practice.

The OSART mission identified ten good practices, four recommendations and twelve suggestions. Measures taken to address these weaknesses have enabled the station to continue its progress towards safer plant operation while constantly striving to achieve excellence. In addition to these recommendations and suggestions, exchanges with the OSART reviewers have helped the station to expand on its longer-term strategies, particularly in the area of safety management.

Further to this mission and in an effort to resolve a certain number of identified weaknesses, Dampierre NPP has also continued to seek out international best practices by hosting a

WANO Technical Support Mission on the subject of safety culture, and by taking a team of leaders on a benchmark trip to Heysham 2 (EdF Energy), recommended for its good practices. Within a period of less than 16 months following the OSART mission, significant improvements have been made at the station with regard to organizational as well as equipment-related issues in order to raise the level of nuclear professionalism among our employees and partners, covering the areas of nuclear safety, radiation protection and industrial safety. Some examples of these measures are provided below:

- Installation of a campus comprising 2 full-scope simulators, one training mock-up facility, one mock-up area and classrooms equipped with teaching tools.
- Changes in control-room layout to improve control-room monitoring and minimize disruptions as well as to accommodate a third operator in charge of head-up monitoring.
- Construction and refurbishment of buildings to improve quality of work and interaction between the different work groups.
- A cross-disciplinary workspace for overseeing the execution of outages.
- Deployment of a reactivity-management guide to firm up our methods of managing plant evolutions.
- A system of daily safety messages intended for all leaders with a view to improving perception of risk and nuclear/industrial safety consequences.
- Cyclical information campaigns on operator and maintenance fundamentals aimed at embedding them across the workforce.
- Deployment of a safety-culture enhancement initiative including a long-term overview of improvement actions.
- A self-assessment programme aimed at firming up certain safety-critical processes.
- Improvements to the station's emergency preparedness organisation and the control of safety hazards including fire.

In addition to specific action plans, our response to the recommendations and suggestions issued by the OSART team has drawn heavily on these fundamental programmes. All levels of management and all departments have been involved in the resolution of issues identified by the OSART team with a view to embedding sustainable improvement programmes. Progress has already been accomplished in control-room operations, in work-site control and temporary storage arrangements, and in the detection and resolution of deficiencies. Our event investigation methods and safety-culture enhancement efforts have resulted in more effective root-cause identification and enabled us to establish the appropriate improvement measures.

The effectiveness of these measures is reflected in positive performance trends in the areas of nuclear safety, quality of operations and maintenance work, radiation protection and industrial safety performance of Dampierre EDF employees.

Year 2017 will provide Dampierre with a major opportunity to have its efforts assessed on the occasion of three reviews that will take place in February and March (in addition to the OSART Follow-Up, the NPP is hosting a WANO Peer Review Follow-Up and a review conducted by the EDF Nuclear Inspectorate). The OSART Follow-Up, the first in this line of reviews, is of particular importance to Dampierre NPP as it is a rare opportunity to gather insights from recognized IAEA experts regarding our initiatives, which will help us make further strides towards the achievement of excellence.

OSART TEAM FOLLOW-UP MAIN CONCLUSIONS

An IAEA Operational Safety Review Follow-up Team visited Dapmierre NPP from 20 to 24 February 2017. There is clear evidence that NPP management has gained benefit from the OSART process. The plant has analysed in a systematic way the OSART recommendations and suggestions and developed corrective action plans to address all of them. Furthermore, the plant has taken actions to address many of the encouragements identified during the original mission. The team noted, in particular, the significant work performed by the plant to review its policies, programmes and practices to promote stronger safety culture. The plant has launched several initiatives focused on defining objectives, actions needed and evaluating the achievements that are helping to build strong safety culture. Plant wide staff engagement was sought at each stage of this process to receive constructive feedback. A comprehensive action plan was developed after the OSART mission and results were demonstrated during the follow-up mission.

The plant has shown strong commitment to safety, willingness and motivation to consider new ideas and seek further safety improvements in striving for excellence. During the follow-up mission the plant staff's openness and transparency contributed constructively to the review process. Sustainable positive results were obtained in many areas reviewed during the follow-up mission. 31% of the issues were fully resolved, 63 % were found to have achieved satisfactory progress and 6 % (1 issue) found to have insufficient progress.

The plant resolved issues regarding: management of temporary storage on site, limiting temporary modifications in time and number; quality control, storage and labeling of plant chemicals; severe accident management configuration control; and improving effectiveness of emergency drills and exercises.

The following provides an overview of the issues which have reached satisfactory progress of resolution but where further work is necessary.

The team noted several activities to improve training preparation and evaluation. New operators' training is now implemented in accordance with plant procedures, shift managers systematically observe, evaluate, and check the items to be fulfilled by the new operators before qualification is granted. Human performance training for the operations staff during simulator training has been enhanced. Inappropriate behaviours are corrected during post-simulator training video-recording reviews or on-the-spot correction. Observations of training sessions by the line managers have increased significantly from 73 in 2015 to 151 in 2016. Simulator instructors are provided with time to be in an actual MCR to update their experience and knowledge of the plant, currently on a voluntary basis. However, there is no formal requirement and process to control and monitor this process; four out of 27 simulator instructors have not yet spent time in an actual MCR since 2014. During the field visit of the new training mock-up facilities the OSART follow-up team observed some deficiencies in the mock-up facilities that were not identified and taken into consideration.

The plant has introduced an action plan to address the issue concerning rigorous monitoring and control of key parameters in the main control room. In April 2015, version b of the Reactivity Management Guide (RMG) was published by the corporate engineering department UNIE GECC (Core-Fuel Operation Group of the National Engineering Unit). The RMG was presented to all departments involved (senior management, Chemistry, I&C/Testing, Maintenance, Engineering and Training) and, in particular, to all Operations shift teams. A reactivity management peer group was established to monitor the relevant trends and propose targeted actions to improve reactivity management performance. Regarding supervision in the main control room, the Operations department's technical memorandum 'The new role of Lead Operator' (D5140NT14120), in force since August 2016, defines the position of Lead Operator. Interviews, presentations and observations performed during the mission, showed that the plant has done significant work in the area of reactivity management, human performance and supervision in the main control room by further reinforcing the operator fundamentals. However, all Lead Operator's positions are not yet fully staffed and further work is needed to demonstrate sustainable performance.

The plant has introduced an action plan to resolve the issue concerning systematic identification of deficiencies in the field. Interviews, presentations and observations performed during the mission showed that the plant has made significant progress in this area by further reinforcing the operator fundamentals and moving the ownership to the plant operations staff. The systematic review of low level trends with actions that are SMART and tracked is proving effective in proactively addressing emerging trends and known issues. The revised training and innovative tools to refresh 'what good looks like' on the plant is engaging operators in the improvement of plant tours effectiveness. Further actions are needed to resolve the issue related to the presence of unauthorized operator aids.

The plant has taken comprehensive measures to improve the implementation of the foreign material exclusion (FME) programme. This concerns five key elements: FME training, work package preparation, FME prevention in the field, worksite housekeeping, and improvement of FME tools and equipment. FME training has been provided to plant and contract staff, and just-in-time training is now given immediately before the start of each planned outage. A stand-alone safety message on FME was delivered to all plant and contractor staff. For FME sensitive activities and equipment, the risk was carefully assessed, designated in advance, and countermeasures were taken. For high risk activities, such as activities associated with vessel head lifting, dedicated staff are now deployed as continuous FME monitors. The plant has also launched an initiative to improve worksite housekeeping and FME user-friendly tools and equipment have been purchased or developed by the plant. During the field visit, however the OSART team noted that in several cases transparent plastic was used in the Radiologically Controlled Area (RCA). Outside the RCA, transparent plastic was also found. At this moment the plant has no expectation preventing the use of transparent plastic in non-RCA areas. Further plant actions are needed to demonstrate sustainable results.

At the time of the follow-up mission periodic safety reviews (PSR) had been completed by the plant and approved by ASN for units 1&2. PSRs for units 3&4 had been submitted to the ASN and were expected to be approved in 2017 and 2018 respectively. The scope of the PSR follows the national regulations that currently do not explicitly cover factors such as safety culture, procedures, human factors and emergency preparedness. During the follow-up mission the plant demonstrated that it has implemented an effective methodology to consider human and organizational factors in the preparation and implementation of safety significant design and organizational modifications. The plant presented the evaluations which are performed to assess the adequacy and define improvement actions concerning safety culture, plant organizational effectiveness and human performance. The plant will consider the need to expand the scope of the formal PSR performed after each 10-yearly outage when preparing for the next PSR due between 2021 and 2024 taking into account the EdF Corporate and ASN position on this subject.

The plant has implemented a number of actions to improve the quality of its Root Cause Analyses (RCA). Training was provided to coordinators who perform RCA and in 2016 seventy five percent of the RCAs were performed by coordinators who had received RCA training. Plant senior managers observed the RCA, providing challenge to the quality of root causes identified and corrective actions developed. Repeat events are being reviewed to identify similar causes or nature. In the 2016 annual report, repeat events were described, and the plant also explained cases where deeper RCA was conducted for repeat events. However, at this moment, there is no clear trend showing a decrease in repeat events. The plant started to increase the number of effectiveness reviews of corrective actions derived from significant events, however this process is at an early stage and its effectiveness can not be fully demonstrated. The plant invited a corporate assessment on the effectiveness of their RCA process in November 2016, and the results showed improvements compared to the situation in 2015, however further actions are needed to achieve sustainable results.

The plant has implemented a systematic approach to define corrective measures and improve the implementation of ALARA practices. The plant introduced the pre-outage dose reviews and performs a detailed analysis of dosimetry results. Close attention was also paid to the radiation shielding. Improvements include new installations of permanent shielding as well as the optimization of shielding that is customized to the particular tasks. The Radiological Risk Control Committee reviewed and approved a new organisation for identifying and addressing hot spots. However, in 2016 only 3 out of 15 hot spots were successfully addressed. The plant will continue to work on this issue to examine alternative techniques. The plant has not considered lowering/ adjusting individual dosimeter alarm thresholds (set points) for each activity. However, the matter has been raised at Corporate level and a working group has been created to consider reconfiguring the existing settings.

The plant implemented several actions to further strengthen contamination control at the site. Zone managers have been introduced and assigned to supervise radiation protection (RP) practices at the worksites and to perform mapping and contamination checks. During an information campaign workers were reminded about their personal contamination measurement duties and also about the location of contamination control instrumentation. The plant continues to encourage workers to systematically use the friskers before the (C1) portal monitors located in front of the 'hot change' rooms. However, during the plant visit, some workers were observed not following all the self-check steps using the friskers. New contamination meters were purchased and signs are now displayed to remind workers of the need to self-check before going through the monitors and what to do if a contamination alarm is triggered. The effectiveness of implemented measures needs to be checked and demonstrated further.

To address the issue concerning the readiness of emergency facilities and equipment, the plant has undertaken comprehensive actions such as: transfering management of the emergency preparedness to a dedicated Emergency Branch created within the Dampierre Regional Office of the Rapid Response Nuclear Taskforce (FARN); respiratory masks have been added to the muster points; identification of several additional emergency response locations which may be used in case the site emergency response centre (BDS) is not habitable. The implementation of a new information system with an electronic logbook to share information between local and national command posts was initiated in 2016 but is not yet completed. A new bunker and command post – referred to as the site Emergency Response Centre (CCL) – is being built and is scheduled for completion by 2021.

In 2015&2016 the plant implemented significant changes to the procedures and documents addressing severe accidents. The Severe Accident Nuclear Safety Temporary Instruction (ITS- AG) was updated and included in the plant-specific Severe Accident Management Guidelines (GIAG). The revised GIAG now covers severe accidents at shutdown states and severe accident conditions for the spent fuel pool. However, entry points to GIAG from the relevant emergency operational procedures are not yet specified. Development of GIAG for multi-unit severe accidents is not currently considered. The management of multi-unit accidents on the site is governed by a procedure 'Guide for initial orientation and multiple events', however no specific training or exercises have been implemented to demonstrate the adequacy of multi-unit severe accident management. The Emergency senior managers on duty (PCD1) and the Technical Support Centre (LTC) personnel have not yet received specific training on multi-unit severe accidents.

The issue related to control of lifting and rigging activates was found to have made insufficient progress to date.

1. LEADERSHIP AND MANAGEMENT FOR SAFETY

The team reviewed the different areas of leadership and management for safety and found that the plant has introduced several improvement initiatives, but they are at the early stages of implementation and the effectiveness of these initiatives needs to be monitored further and evaluated. Although safety performance indicators have improved in the last 12 months, the team observed (see other parts of the report) that, at this time, the positive outcomes of these initiatives are not fully demonstrated in the field. Therefore, the team encourages the plant:

1. To incorporate lessons learned and input from other nuclear organizations into the plant leadership development project;

2. to improve and increase the application of the plant coaching program;

3. to increase the plant use of local recognition of good safe behaviours;

4. to improve the quality of safety culture improvement practices;

5. to further develop personal and collective accountability, to reduce tolerance to deficiencies;

6. to reinforce the use of human performance tools and continue the support to human performance champions;

7. to enhance the quality and scope of the data inputs into plant improvement programmes.

Details are described below.

1.1. LEADERSHIP FOR SAFETY

The Nuclear Operations Division (DPN) of EDF issued “The DPN Safety Management Guide” including three Key Safety Management Principles related to: a) Leadership; b) Personnel Development and Commitment; c) Oversight and Continuous Improvement. Under the Leadership principle the expectation is ”Management commitment towards nuclear safety must be visible to everyone. Objectives must be clearly set and understood. Strong Leadership promotes trust and achieves alignment”. The document goes further to indicate: “Leadership sets individual and collective practices on a course towards a stronger safety culture. Managers embody safety leadership through their actions, while influencing everyone’s attitudes and behaviors with regard to safety”.

The plant has developed its own leadership application and development program as described below.

Leadership for Safety

Leadership development activities at the plant are well planned and there is management support of these activities. Recently several initiatives have been introduced to develop leadership, such as the local Leadership Academy, which is offered both to EDF employees and contractors and is observed to comply with basic expectations for leadership training. The plant also sends some managers to training courses outside EDF such as the INPO leadership training, but the plant is not systematically identifying the improvements that could be obtained from the plant's leadership project. The team encourages the plant to further develop the leadership project based on lessons learned and inputs from other nuclear organizations and from managers who participated in external training.

The plant has several activities involving plant personnel and contractors, to improve the frequency and level of coaching (a very important element of leadership) in the organization. These include:

- managers in the field programme (MIF);
- development of human performance champions whose role is to coach their peers;
- general expectation regarding use of human performance tools (HPT), including each departments' own definition of when to use HPT;
- field observations done systematically by department and section managers;
- the "RZ" program (assigning special zone officers during outage for each plant zone).

The team found that some employees perceive that the coaching activities were more management control improvement, rather than a support activity. The team has identified a number of issues where improvement in compliance and application of standards could be better achieved through the consistency of leadership activities such as coaching. This is supported by team observations in the areas of operations (system operating procedures, use of pre-job brief), maintenance (control and program requirements not applied for lifting and rigging) and radiation protection (contamination controls). The concerns raised in this field may be related to the early stage of development of the leadership activities. The team encourages the plant to continue developing these initiatives with the emphasis on coaching.

The plant has also started a communication initiative called the "safety café" where over a lunch time period safety practices and standards are presented in an entertaining and eye catching manner. As part of safety improvement activities this has contributed to the safety performance improvement on site. The team considered this a good performance**.**

The plant has several positive initiatives to recognize good work, such as: the awarding of trophies and other activities to publicize good practices of teams, letters to thank groups for achieving set targets or goals, celebrations or additional days off after a successful outage. During observations and interviews the team identified that day-to-day recognition is not as frequent. Appreciating the high importance of recognition as a source of motivation, the team encourages the plant to support managers and leaders in increasing the use of more informal recognition such as verbal acknowledgement of employees demonstrating good craftsmanship.

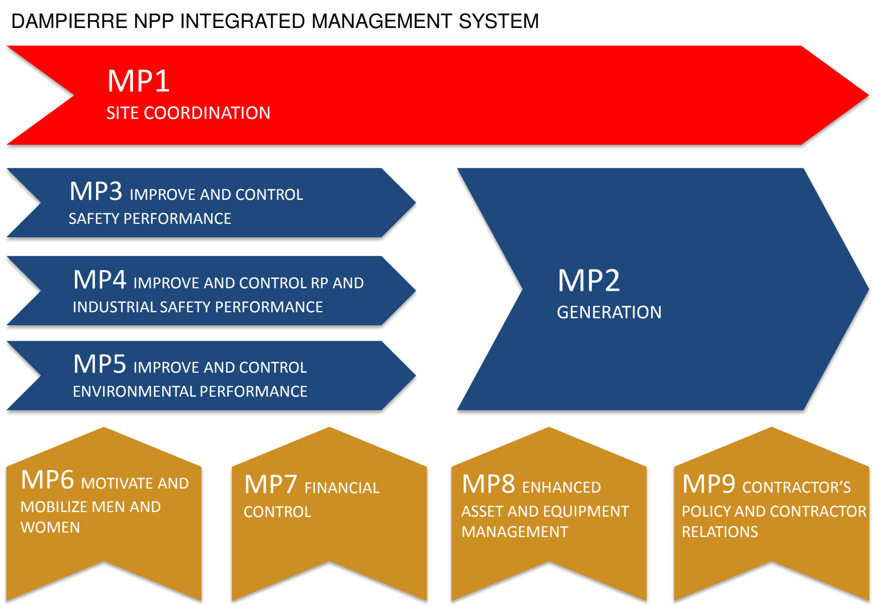
Safety Culture

The team noted that the plant has recently increased its efforts to improve safety culture on site. On the basis of plant safety reviews during 2014, including analysis of weak signals and events, the plant identified "safety culture" and "professional attitudes" as main contributor to its performance gaps. To address this, a multidisciplinary technical working group on safety culture was formed and a coordinator spending part of his working time (approx. 15%) on safety culture activities was appointed. A pilot safety culture assessment was performed based on the collection of management and expert perceptions of safety culture. Communication on safety culture was also increased. These new initiatives are in addition to two annual seminars on: human performance tools (HPT , or PFI in French) and quality work performance. However observations on behaviour and practices made by the team during the mission, indicate that further improvements could be achieved through reinforcing expertise in safety culture at the site, providing more clarity on the expectations related to safety culture, utilizing a more comprehensive methodology to perform safety culture self-assessments and generally taking advantage of international practices. The team encourages the plant to enhance the quality of its safety culture improvement practices. The plant identified personal accountability as one of two focus areas within their safety culture improvement efforts (the other focus area is leadership). The team identified that the existing guidance on safety culture on the site is focused on the individual level, concentrating on the role of the individual in performing his or her job, rather than the individual's contribution to the overall safety of the team, unit or site. While contractors' training and general training seem to be moving in the right direction in this area the team encourages the plant to explore additional methods to support employees and managers in taking personal accountability to ensure safety.

A Safety Culture Game was developed by two employees. The team considers this a good performance as a voluntary and innovative approach to the learning and practice of the Safety Culture basic concepts.

1.2. INTEGRATED MANAGEMENT SYSTEM (IMS)

The organizational structure for the plant is defined and documented in a comprehensive integrated management system. As part of the development of an integrated management structure there are nine defined main management processes (macro-processes), including a safety process called "improving and controlling safety performance"(MP3). There is also an overview macro process "site coordination" (MP1) which is a cross-cutting program of work co-coordinating and connecting all the other macro-processes together inside an integrated management system. The Macro processes also have "sub processes' that are more detailed projects and actions underpinning the achievement of the 'macro-process'. All local department actions are then underpinned with reference to "fundamental processes" which are detailed interpretation of the actions required in their area of work and work place. All of these actions can be identified as 'continuous improvement activities' and are a mixture of leadership and management actions.



The plant introduces and develops new initiatives in support of the integrated management system, such as the implementation of the new IT system (SDIN) and the grouping of initiatives to give clarity of how different activities of the organization feed into the various processes of the IMS.

Through looking at the cross cutting findings of the review, the team has identified a challenge in the implementation of the IMS. The challenge lies in the consistent implementation of the IMS on a sub and fundamental process level (see below).

The Annual Performance Contract is a contract signed every year between the Plant Manager and senior management of the Nuclear Power Generation Division (DPN) defining the commitments and expected performance results. For 2015 twelve priorities were set under 5 major “levers” – one of the “levers” includes several priorities that include: careful review of the work before starting, quality of the planning for work, quality of the preparation for work, and conformance with the requirements of the work and the procedures. These are kept as a reminder on a card for all persons on site and worn with their access pass. These are also used as prompts to the department heads in review meetings. This should promote a common and integrated approach to managing projects and work on site. However observations on behaviour and practices made by the team during the mission (see chapters 3, 4, 7 and 9), indicate that further improvements could be achieved in the implementation of standards and expectations defined in the sub and fundamental processes. The team encourages improved communication of the CAP (in particular to ensure acronyms are understood) and the processes that support the integrated management system, to ensure a good understanding of the IMS and the standards required for safe operation on a sub and fundamental process level.

Resources and staffing

The plant has recruited many new employees over the last 5 years constituting nearly one third of the staff on site. The management system for training and career development has been developed to take account of this. A large skills data base is available for managers to identify the training and qualifications of their teams, and indicates when training and/or refresher training is required.

Career meetings discuss appointments and staff movements to ensure coordination between departments and staff career development. The team considers this a good performance.

The plant is making significant investments in renovation of working spaces, in constructing a new building for contractors, and a building with a second small eatery place to provide workers with an additional place to eat. The aim of all these investments is to improve the quality of the work environment and make the plant an attractive place to work, an aim especially beneficial given the significant influx of new employees and encouragement for the retention of experienced staff. The team considers this a good performance.

1.7. HUMAN FACTORS MANAGEMENT

The plant introduced a human performance programme in 2006, but has re-launched the programme in 2013 making it part of the site’s ‘fundamental’ processes. All departments have to identify where the 6 human performance tools (HPT) chosen by the site are applied for their tasks. The tools used are; Pre-job brief, one minute review, three way communication, peer check, self check, and post job review. The inclusion of human performance tools in the ‘fundamentals’ has led to their increased use, and focus on tasks that can be made more reliable through their application. Human performance champions have been appointed and trained as local leaders for the training and coaching of the HPT usage, and their local management has made a public commitment to supporting human performance champions in their work. This is a voluntary position, and 130 champions are trained (more being trained) and are in every department on site. Contractor companies are also implementing the human performance tools and are part of the plant's human performance champions' network. Contractor companies are offered the use of the 'closed loop simulator' on site. A more extensive 'closed loop simulator' is under construction on site to extend training possibilities. The team observations identified situations where human performance tools were not used in accordance with expectations (see chapters 3, 4). The team encourages the continued support of human performance champions and the use of the human performance tools during tasks, especially during safety critical tasks.

The occupational health department provides a full service for the site personnel in both preventative and monitoring services for health. This also extends to psychosocial risks and medical staff participation in developing corporate practices and national research is noted as a strong contribution to maintaining fitness for duty for nuclear worker. The team considers this a good performance.

In partnership with the plant, the regional contractors association PEREN, provides independent advice and support to on-site contractors through the appointment of a dedicated on-site representative who provides a number of services including coaching, industrial safety advice, and training. This has resulted in better use of the error prevention techniques by contractors on the site. This is considered a good practice by the team**.**

1.8. CONTINUOUS IMPROVEMENT/LEARNING ORGANIZATION (MONITORING AND ASSESSMENT)

Continuous improvement on the site is driven by the analysis of performance through performance indicators (PIs), deviations analysis and operating experience (OE). The analysis of performance results in ‘deviations’ being raised in a central deviations data base, and they are then analyzed and corrective actions are identified and tracked to completion. Anyone on site with access to the main IT system can raise a deviation, these are trended and the analysis is taken at the committees where improvements are formulated. There is a separate OE data base for the tracking of corrective actions from OE analysis. The team identified that event analysis is not carried out in enough depth (see chapter 6). Also the team observed that the analysis of ‘weak signals’ is only partly integrated into the development of improvement programmes. The team considers that the combined analysis to formulate improvement actions is dependent on quality of the inputs and so the team encourages the plant to continue to improve the quality and broaden the scope of the inputs into plant improvement programmes.

The plant runs an innovations scheme where personnel can submit improvements for consideration. These are assessed and a trophy is awarded for the best idea. One example of the application of this scheme was the suggestion to use an electronic device to detect the approach of a person. It was suggested to be installed at the entrance of the electrical buildings to trigger a voice asking the plant staff to check the location and prevent the “wrong location” error. This was a simple solution to intervene at the point of a potential error. Secondly this illustrated the scheme’s opportunity for people not directly involved with the technical work, to offer their ideas to reduce errors. Plant managers are fostering contributions for continuous improvement from all employees on the site. The team considers this a good practice.

DETAILED LEADERSHIP AND MANAGEMENT FOR SAFETY FINDINGS

1.7. HUMAN FACTORS MANAGEMENT

1.7(a) Good Practice: The regional contractors association (PEREN) provides independent advice and support to on-site contractors through the appointment of a dedicated on-site representative, who provides a number of services including coaching. This is done in partnership with the plant.

A dedicated advisor post for the on-site contractors was set up when the Quality, Health, Safety and Environment Committee of the regional contractors association PEREN, as part of a partnership agreement with the plant, decided to streamline its organization to ensure stronger focus on:

- Better control of maintenance work quality
- Risk prevention
- Professional enhancement and development of workers through training.

A representative of PEREN is on-site at all times and provides the following:

- Field walkdowns during power operations and outages, with a focus on maintenance operations;
- Identification, analysis, and support in processing ‘near misses’ and hazardous situations;
- Advice in work planning and execution, and provision of operational experience (OE);
- Provide specific advice and contractor training e.g. on-error prevention, oversight, legal matters, and foreign material exclusion (FME);
- Coaching to first line contractor supervisors;
- Specific support to contractor firms when needed;
- ‘Just-in-time’ training before outages.

These services provide contractors with direct and independent support in the field to help them understand the plant’s regulatory requirements and communications on standards and expectations. This has resulted in better use of error prevention techniques by contractors on site.

1.8. CONTINUOUS IMPROVEMENT/LEARNING ORGANIZATION (MONITORING AND ASSESSMENT)

1.8(a) Good Practice: The plant encourages its staff to submit innovative proposals for safety improvements.

The plant implemented " an innovation" scheme where personnel can submit improvements for consideration. These are assessed and a trophy is awarded for the best idea. One example of the application of this scheme was the suggestion to use an electronic device to detect the approach of a person. It was suggested to be installed at the entrance of the electrical buildings to trigger a voice asking to check the location and prevent the "wrong location" error. This was a simple solution to intervene at the point of a potential error. The sensor, located at the entrance of the electrical building at elevation 7m, triggers a pre-recorded message: "Attention, risk of entering the wrong unit, apply the one-minute rule". This reminds people of the need to implement the correct human performance tool before opening the door.

Secondly this illustrated the scheme's opportunity for people not directly involved with the technical work, to offer their ideas to reduce errors. The idea of the sensor came from a site person not working in a technical area. Plant managers are fostering contributions for continuous improvement from all employees on the site.

Since the detector was installed, there have been no errors of wrong unit selection in that plant area. A programme for installing the same sensors in different areas of the plant has been developed.

2. TRAINING AND QUALIFICATIONS

2.1. ORGANIZATION AND FUNCTIONS

A well established succession plan and skills development process exists in the plant. It has been used effectively for recruitment (about 500 new employees in the past five years), training and qualification of plant personnel, and to maintain sufficient qualified staff considering the large number of retirements. The team considers this as a good performance.

2.2. QUALIFICATION AND TRAINING OF PERSONNEL

The fleet is renewing its training programme based on systematic approach to training (SAT) methodology. There is a schedule to revise the plant specific training programme for the different roles in line with the fleet project. The plant will complete SAT for the priority positions by 2017, and complete all production related positions by 2019. The team encourages the plant to accelerate its application once the corresponding training programme is ready.

The initial training and qualification process for new employees is well organized. There are academies available for general and specific knowledge. After that each department uses a tutoring logbook to guide the tutors to mentor and track the progress of on-the-job training activities for new employees. The logbook standardizes the competence requirements, and it is used in all plant departments. The team considers this as a good performance.

Training courses are conducted by EDF training department (UFPI) trainers, instructors or by contractors, and occasionally by plant part-time instructors. Training in classrooms, on mock-ups, on the simulator as well as on-the-job training demonstrates active engagement by trainees. However, the team observed that the trainee evaluations are not systematically applied according to training objectives in several cases. Also the performance evaluation for part-time instructors is not required by the plant. The team made a suggestion in this area.

DETAILED TRAINING AND QUALIFICATION FINDINGS

2.2. QUALIFICATION AND TRAINING OF PERSONNEL

2.2(1) Issue: There are some weaknesses in training implementation, such as training preparation and evaluation, which could prevent the consistent and effective delivery of training courses.

The team noted the following:

1. Preparation and evaluation:
   - Lesson plans and task performance evaluations are not rigorously applied in several cases, such as hands-on training in the radiological control area (RCA) error prevention training and maintenance hands-on training (ERT76).
   - Detailed performance evaluation standards are not established for on-the-job training of new operators i.e., after completion of 4 modules (about 26 weeks) on-shift training for specific knowledge, 4 evaluations were performed on only 5 or 6 objectives. Similarly, new operator qualification evaluations were signed by managers on the basis of a limited number of evaluation records.
   - Some classroom training completion certificates are issued after group discussion instead of after formal evaluation, such as the training course “maintain qualification of nuclear safety important equipment used during accident conditions”.
   - Some simulator exercise guides are not revised according to the predefined schedule.
   - At the beginning of normal operation training, some malfunctions were introduced by the instructor for diagnosis by the traineesbut were not defined in the simulator exercise guide.

2. Instructor development:
   - Part-time instructor teaching skill training is not required by the plant, and the performance of part-time instructors is not evaluated.
   - Simulator instructors are not required to be seconded into the Main Control Room (MCR) regularly to update their experience and knowledge. In one case, one simulator instructor was observed not having the knowledge to adjust the source range audio frequency meter during approach to reactor criticality.

3. Others:
   - Some failed devices (1KSC001EN, 1SIT004EN, 1ETY401EN) in the simulator hall were marked with yellow stickers, which is not the same process as in the MCR.
   - Sometimes the behavior of trainees and instructors, such as absence and late arrival, does not meet expectations.

Lack of strict control and management of training preparation and evaluation could impact the effectiveness of training programme.

Suggestion: The plant should consider improving its control and management of training preparation and evaluation to ensure the effectiveness of the training program.

IAEA Bases:

SSR-2/2

4.23. All training positions shall be held by adequately qualified and experienced persons, who provide the requisite technical knowledge and skills and have credibility with the trainees. Instructors shall be technically competent in their assigned areas of responsibility, shall have the necessary instructional skills, and shall also be familiar with routines and work practices at the workplace. Qualification requirements shall be established for the training instructors.

NS-G-2.8

4.21. All progress made in training should be assessed and documented. The means of assessing a trainee's ability include written examinations, oral questioning and performance demonstrations. A combination of written and oral examinations has been found to be the most appropriate form of demonstrating knowledge and skills. In the assessment of simulator training, predesigned and validated observation forms and checklists should be utilized in order to increase objectivity. All assessments of simulator training sessions should include an evaluation of the trainees, the feedback given and further measures considered as a result of the evaluation. Assessment should not be regarded as a one-off activity. In some States, reassessment of individuals by instructors and their immediate supervisors is undertaken at regular intervals.

4.24. In initial and continuing training, trainees should be evaluated by means of written, oral and practical examinations or by discussions of the key knowledge, skills and tasks required for performing their jobs.

5.32. All staff of the training unit, as well as simulator and technical support engineers, technicians and instructors should be given training commensurate with their duties and responsibilities. In all cases the training should be subject to some form of quality control. Instructors should also be allowed the time necessary to maintain their technical and instructional competence, by secondment or attachment to an operating plant on a regular basis, and by continuing training.

Plant Response/Action:

The site reacted to the suggestion with a number of actions which can be divided into 4 main themes.

Theme 1 - Uphold expectations and improve training assessment.

- Issue a reminder of the "Expectations and Accountability in Training" guidelines
- Presentation and adoption of the document in the Skills Management Commission.
- Document displayed in all of the classrooms.

All of these actions have been completed. The site Level 3 Training Committee has also been reminded of the need to uphold expectations. The understanding the site now has of the issue can be clearly seen in the way that absences and late arrivals during training courses are now treated.

- Management, Operations Department and the Corporate Training Centre (UFPI) fix and communicate the expectations concerning Error Reduction Tools together.

The outline of Management expectations for the use of error reduction tools by Operations has been edited as a double-sided document and shared with UFPI. The technical memo on Operations skills maintenance (NT200) and the site version – NT201 – also includes specific corporate requirements concerning error-reduction tools. For example, freezing the simulator when one of the tools is not correctly used (during non-assessed sessions and simulations).

- Improve on management presence at the opening and concluding summary of training courses, and presence during training sessions
  Fix the expectations and coordination of management presence in training, and then track:

- Managers should be assigned to open and conclude specific training sessions:

Each manager has a fixed objective of 4 "classroom presence" (FDS) per year which are tracked in an observation report (CS).

The NPP has made significant progress in this area, and the managers now adhere to the expectations for opening and concluding training courses, and being present in training sessions.

The tools are available for managers to check the comprehensiveness of on-site training.

The completion of training is monitored through the analysis of observation reports and tables used as a support during opening and concluding summaries of training courses.

Each Department and each manager has a fixed objective to complete a final summary report, which is systematically presented to the Skills Commission and the site-level Training Committee.

- Communicate the Safety Message at the beginning of each training course.

The Safety Message is repeated every day. EDF and contractor instructors have received instructions to repeat the Safety Message at the beginning of each session. Some instructors use the managers present in the training session as a support when they do not completely master the Safety Message of the week.

- Challenge managers on the tracking of absences from training courses.

- Management put into practice a consistent method for dealing with late arrivals in training sessions.

A memo on management of late arrivals in training sessions was edited and validated by the site training committee, and has now been applied

One person from Training reception collects all absences or late arrivals each morning. The manager of any employee concerned is informed as soon as possible by a specific email for either an absence or a late arrival. Following this, the manager is responsible for dealing with the employee.

In addition, a table monitoring absences and late arrivals is completed each day, and a weekly report of deviations and any process initiated by management is presented systematically during the Operational Management Review (RMO)

- Implement the training assessment guide which will be available from the Nuclear Production Division in the first half of 2017 on the sites.

The corporate guide is still in the project phase. Training is assessed on 4 levels.

Level 1: Compares the effectiveness of training to expectations	Measured by an employee satisfaction survey
Level 2: Concerns the skills acquired during training	Measured through individual assessment.
Level 3: Concerns the use of acquired skills in the work place	Measured by a Skills and Work Practices Observation or by a post-training assessment by the employee.
Level 4: Concerns how the training has contributed to individual or team performance	Measured using a pre-determined indicator to reach a certain level of performance or even by measuring the reduction of a deviation.

So far, assessments are more or less systematic for Level 1 (except for some just-in-time training sessions). Level 2 assessments are carried out when necessary (essentially for corporate-level licensing training).

Few Level 3 and 4 assessments are carried out. However, Level 4 assessments for training linked to skills for Maintenance/Operations-induced errors are monitored by the site Training Committee.

Theme 2 – Utilise the Corrective Action Programme (PAC), OPEX and Maintenance/Operations-induced errors (NQME)

- Make sure that skills are considered when analysing errors (NQ).
- Guarantee that actions implemented to develop professional skills are adequate
- Give support to people involved in training in the use of OPEX data and especially in the use of the CAP in Level 1 Training Committees (CF1) and Level 2 Training Committees (CF2)
- Make sure that the Corrective Action Programme is systematically used and can subsequently be tracked by changing the report framework.

The skills factor in errors is correctly analysed. These elements are included as basic input data in the framework used in the Levels 1 and 2 Training Committees. All skills-related errors are systematically monitored in the site Level 3 Training Committee (CF3). The subject is also raised in the Quality Assurance Commissions (RAQ).

A reminder on the type of input data to be considered in the training committees is given regularly in the networking meetings for people involved in skills development on the site. If necessary, the person representing the Joint Training Department will do the same in the Training Committees.

The minutes framework ensures that all the types of input data are addressed and studied during the meeting, as well as giving traceability to the analyses even if no skills issues emerge.

- Include Operator-induced errors in the future NT201 Technical Memo

Operator-induced errors and the resulting action plan are systematically tracked by the Training Committee when there is a connection with skills (see answer above).

The NT200 Technical Memo includes all the training needs resulting from the corporate analysis and linked, among other factors, to Operations-induced errors (after analysis by the Skills Advisory Unit (PCC) and corporate-level UFPI). When the NT201 is developed, the Skills Training Support Group (AFCO) and the OPEX Committee (COREX) integrate Operations-induced errors from the Operations perspective into the analysis of training requests for the following year.

Theme 3 - Strengthen our Skills and Succession Management (Work on sound management of working practices and skills by the people concerned)

- Strengthen Skills and Succession Management for instructors in the Joint Training Department by introducing a string of 3 to 4 full-time Rapid Response Team (FARN) members and by creating a Skills and Succession Management scheme specific to young Operations professionals.

- Create a three-year Skills and Succession Management project for the people involved in skills management on the site (Skills Training Support (AFCO), craft champions, methodology support (APM), etc).

The people involved with skills management are now included in the Skills and Succession Management for the Joint Training Department (RF, AFCO, APM). The crafts work with the Joint Training Department for the renewal of positions. The Joint Training Department has also proposed “Part-Time Instructor” training via the Skills Management programme, following a request from managers.

In addition, there are now 5 part-time FARN/UFPI employees, which is the equivalent of 2.5 full-time employees, of which 1.5 have all the required competences and 1 full-time in the process of reaching the required professional level (2 young professionals).

- Finalise the Instructor Immersion Programme on the simulator to update their knowledge.

Improvements in Skills and Succession Management in the Department allows instructors to be more present on the site and in immersion. Immersions are organised between Department Management and the workers concerned during the annual assessment interview. Instructors also organise their schedule so that they are on the installations with the crafts when any activities are linked to their professional project.

– Provide training for all intermittent instructors.

Training for intermittent instructors is available in the corporate training catalogue and can be requested during the yearly training survey. The existence of this training is frequently mentioned in Level 1 and Level 2 Training Committees, and also in the Skills Management Committee. At the end of the year, we sent a sample mission statement to the managers. We also opened 2 extra training sessions on the site in January. A census of part-time instructors, their missions and the development of their professional competences is in progress.

Theme 4 - Resources

– Introduce new tools, new methods and new organisations to strengthen the way we operate.

– Roll out the SAT approach to reach the level rating "Good" in 2017.

The roll-out of this approach started in September 2015 and so far we have adhered to the provisional schedule. The craft guidelines were rolled out as follows :

– 2015 : Completed for I&C, Testing, Fuel, Chemistry- Environment.

– 2016 : Completed for Boilerwork, Valvework, Fuel Work Coordinator, Reactor and Fuel Engineer (IECC), Safety Engineer, Safety Assurance Engineer (IRAS), Chemistry Engineer, then Waste-Transport, Field Operations, Operations Block, Waste Engineer.

– Set up the Joint Training Department to limit the number of interfaces and improve effectiveness.

The Joint Training Department (SCF) was set up on 01/01/2016, with the Nuclear Production Division (DPN) and UFPI teams now working together. One year later, the first observations can be made. Some time-consuming interfaces have now disappeared so there is less chance of DPN and UFPI duplicating activities and more opportunity for both teams to share challenges. One entity joining UFPI and DPN to create the Joint Training Department means that managers have one single interface and that the department can also give them coherent and rapid responses.

After one year, OPEX needs to be used to optimise the Training Department structure, which will then enhance the service given to managers.

– Introduce new initial and refresher training monitoring tools (FORQUART, PERFORM)

FORQUART : Table for the Operations Department

The FORQUART tool was rolled out after relevant training sessions, in several stages over two years, two units at a time; the first phase provided a vision of the training courses, the second is for the organisation of the employees' working schedule/holidays.

The roll out was successful; the employees use the tool correctly, as required.

PERFORM : a tool to collect training needs

This application was rolled out on the site of Dampierre in 2016

Training sessions were set up for managers to discover and get used to this new tool.

This tool gave the possibility of producing a more refined survey.

New training sessions have been made available this year.

The application is now also used to monitor initial and refresher training to give a global and direct vision of employees' training needs, with a colour code which helps to identify very easily any possible deviations among the employees.

The last training courses completed, validity dates, as well as possible registration for required training courses are instantly accessible.

- Use a refresher training plan to simplify the structure and tracking of licensing training courses.

This new training plan includes risk prevention and safety quality refresher training and was set up at the beginning of 2016. It offers more fluidity and simplifies tracking. It is clear that it improves chances of detecting any deviations. It is also easier to manage licences.

- Construct a digital simulator.

The digital control simulator has been in use since 2015. The industrial commissioning of this tool was in June 2016. The arrival of this second simulator has led to more flexible and reactive scheduling of training sessions. In addition, crafts such as Engineering, I&C technicians, Electricians, and Testing technicians are using the simulator more and more, which is helping them to understand the impact that their activities can have on unit operations.

- Construct a work space which includes mock-up and full-scale model facilities.

The Ampere building has around twenty classrooms plus 3 computer rooms, and one room dedicated to e-learning which has been in service since January 2016. It also houses a full-scale model area with 5 booths, one workshop and one storage area, which has been available for use since Spring 2016. As for the mock-up facilities, they were moved and improved a short while ago, and have become a great tool for training. The first training session was mid-December 2016.

IAEA comments:

The plant has carefully analysed this issue and many actions have been taken to address it.

The plant enhanced the Human Performance training for the operations staff during simulator training. Inappropriate behaviours were corrected by post-simulator training video-recording review or on-the-spot correction.

New operators' training is now implemented in accordance with plant procedures, shift managers systematically observe, evaluate, and check the items to be fulfilled by the new operators before qualification is granted.

The plant has implemented a periodic review of maintenance deficiencies related to skills and human performance. The 2016 data of maintenance deficiencies related to skills and human performance show a generally improving trend.

Observations of training sessions by the line managers have increased significantly from 73 in 2015 to 151 in 2016.

Simulator instructors are provided with time to be in the MCR to update their experience and knowledge of the plant, currently on a voluntary basis. There is no formal requirement and process in the plant to control and monitor this process. There are four out of 27 simulator instructors who have not spent time in the MCR since 2014.

During the field visit to the new training mock-up facilities by the OSART follow-up team, it was observed that some of the deficiencies in the mock-up facilities in use are not identified during training preparation, such as a wood plate used in the Steam Generator mock-up manhole, FME covers not in place on some pipe and valve openings, and wooden materials stored in the electrical cabinet training room. It was explained by the plant that the mock-up facility is not fully completed at the moment and improvements will be made.

Conclusion: Satisfactory progress to date

3. OPERATIONS

3.1. ORGANIZATION AND FUNCTIONS

The plant has recently developed a set of new operations fundamentals with practical themes, to allow the department to make improvements in safety performance. The use of these new fundamentals to provide clarity and direction to the department staff is considered a good performance.

The integration of operations with processes and activities managed by other groups could be strengthened (e.g., the shift supervisor was not aware of lifting activities taking place near an in-service generator.) This could further improve the influence of operations on activities that may indirectly affect plant performance. The team encourages the plant to better integrate operations with other processes and activities to further improve operational performance.

3.3. OPERATING RULES AND PROCEDURES

The plant has developed and implemented a pre-job brief checklist for sensitive activities. This document, known as a sensitive activity list, considers risks, procedures, operating experience and critical steps for the activity. The preparation and issue of the pre-job brief documents ensures that they are available when needed and can be readily attached to procedures and work packages. The team considers this is a good performance.

The policy of the plant for the use of operating procedures does not require checklists for normal system operation. The team encourages the plant to enhance its policy and practices with regard to the use of system operating procedures.

3.4. CONDUCT OF OPERATIONS

The plant has a set of requirements for use of the human performance tools (HPT). However, observation of simulator training revealed shortfalls in the application of the human performance tools and pre-job briefing for a sensitive activity. An observation of turbine generator synchronization revealed the inconsistent application of 3-way communications and peer checking. The team has made a recommendation in this area.

The plant has developed a “quarterly forum” to improve the quality and standards in plant tours. This forum reviews issues from plant tours, training requirements, standards and expectations, and event trending related to plant tours. However, the team identified that during operator rounds, insufficient attention was paid to identify and report deficiencies related to industrial safety, plant equipment, temporary storage and labelling. The team has made a recommendation in this area.

3.6. FIRE PREVENTION AND PROTECTION PROGRAMME

There are two well equipped fire vehicles that provide added agility and flexibility to the response team. These vehicles are equipped with interactive fire plans and provide a real-time communication stream to the emergency response centre. The team considers the use of this equipment in the vehicles as a good performance.

Some of the equipment used for fire response that is required to be tested is not clearly tracked to ensure operability, namely fire extension hoses. The plant already has an improvement plan to ensure these are well identified and tracked, however the team found several examples where it was not possible to confirm when the extension hoses were last tested and their suitability for use. The team encourages the plant to improve the readiness and tracking of fire extension hoses.

In terms of fire prevention, hot work is managed effectively by using a dynamic risk assessment process that allows staff to identify the risks associated with their work package with the associated required mitigations. This process creates a sense of ownership with staff and ensures that relevant risks are prioritised. The plant also provides a hot work safe portable container where the risks from hot work are mitigated. The team has found the use of the dynamic risk assessment process in conjunction with the hot work safe portable container as a good performance.

3.7. CONTROL OF PLANT CONFIGURATION

The plant has applied lessons from operating experience to reduce the likelihood of equipment damage due to loss of configuration control. A metal jig is used to lock identified manual valves in the open position to protect the pump. This metal jig can be used readily and is effectively controlled by the operations group. As a result of this improvement, there have been no events associated with these pumps since beginning of 2014. The team finds this as a good practice.

DETAILED OPERATIONS FINDINGS

3.4. CONDUCT OF OPERATIONS

3.4(1) Issue: The Plant evolutions that impact important primary parameters are sometimes not performed in the main control room with the expected levels of rigor in human performance and supervision.

The team noted the following:

- During load increase of approximately 3% on Unit 1, there was no pre-job briefing conducted before the incoming shift operator began the load increase, this is in line with the plant policy.
- During the same load increase of approximately 3% on Unit 1, there was no evidence of peer checking or 3-way communication related to the load increase or its initiation.
- During the synchronisation of Unit 1 to the grid, there was no observable evidence of 3-way communication in the control room.
- During the synchronisation of Unit 1 to the grid, there was no observable evidence of peer checking in the control room.
- During initial simulator operator training, the operator was withdrawing the rods on manual to go critical, while at the same time having a training discussion with the simulator instructor behind him.
- There is no expectation to carry out a peer check on a load increase less than 15%.
- There is no expectation to use 3-way communication for all reactivity management activities.
- During refresher training on the simulator, Unit load reduction followed by disconnection from the grid was initiated without a formal structured pre job brief being held. The plant requires pre-job briefing to be held prior to this sensitive activity.
- During refresher training on the simulator, a load reduction was initiated without 3-way communications to confirm the initiation.
- During simulator refresher training, the initial load reduction commenced without an operator exclusively dedicated to monitoring reactivity. However, this is in-line with the plant requirements.
- On 23/02/2015, the criticality prediction calculation was not correct due to ineffective use of the procedure.
- On 17/05/2015, Unit 2 was using the residual heat removal system. An emergent issue with the control rod drive mechanism required the operator to take action, which he took in consultation with the instrument and control department. This action resulted in the control rods dropping in from positions between 0 and 5 steps, without the shift manager being consulted or informed.

Performing plant evolutions that impact important primary parameters without the highest levels of rigor in human performance and supervision has the potential to result in unintended power transients and operating parameters outside of design limits.

Recommendation: The plant should enhance the level of rigour in human performance and supervision in the main control room during evolutions that impact important primary parameters.

IAEA Bases:

SSR-2/2

7.20 The operating organization shall be responsible for establishing a safe reactivity management programme under a strong management system for quality.

7.22 Reactivity manipulations shall be made in a deliberate and carefully controlled manner to ensure that the reactor is maintained within prescribed operational limits and conditions and that the desired response is achieved.

SSR-2/2

3.5. The management system shall integrate all the elements of management so that processes and activities that may affect safety are established and conducted coherently with other requirements, including requirements in respect of human performance and so that safety is not compromised by other requirements or demands.

4.29. Tools for enhancing human performance shall be used as appropriate to support the responses of operating personnel.

NS-G-2.14

4.31. Operators should adhere strictly to plant policies with regard to the use of procedures, communication protocols, response to alarms and the use of methods in place to prevent or minimize human error. Operations management and supervisors should make themselves aware of the behavior of operators in this regard and should ensure that high standards of performance are enforced at all times.

5.23. Reactivity manipulations should be made in a deliberate, carefully controlled manner, and should include appropriate time intervals between reactivity changes, during which the reactor is monitored to verify that the desired response has been obtained.

5.24 Any planned major changes to the reactor power or to any other operations relating to reactivity should be initiated only after a pre-job briefing on the expected effects of the change. Prior to any major change being made, any conflicts in procedures should be resolved and possible distractions from work or contingency action should be discussed.

5.25 Self-assessment and error prevention techniques, such as the stop, think, act, review (remembered as the mnemonic STAR) methodology and peer checking, should be used during reactivity manipulations. Effective and appropriate control should be established over other activities that could affect reactivity or the removal of residual heat and which are performed by other plant personnel such as chemistry technicians or instrumentation and control technicians.

Plant Response/Action:

Since the end of 2009, corporate special requirement DP 168 ‘Error reduction in work execution’ has stipulated the relevant implementation of 6 human performance (HP) tools for all plant activities. The approach defined by DP 168 is designed to create a working environment in which using HP tools comes naturally to all workers, and their use is relevant.

In April 2015, version b of the Reactivity Management Guide (RMG) was published by the corporate engineering department UNIE GECC (Core-Fuel Operation Group of the National Engineering Unit). Site-level roll-out of the guide required the station to establish a special action plan, sponsored by a member of senior management, and under the operational stewardship of the Core-Fuel Engineer.

The RMG was presented to all departments involved (senior management, Chemistry, I&C/Testing, Maintenance, Engineering and Training) and, in particular, to all Operations shift teams.

Implementation of the RMG is detailed for each department in a separate memorandum. For the Operations department, requirements are set out in memorandum ‘Organisation for reactivity management in the Operations department’ (D5140NT15097). In the Operations department, each shift team designated a Reactivity Management Lead. These RM Leads are coordinated by the department’s Operations Engineer, via four meetings per year. These meetings are used to review new OPEX (site and fleet), to share good practices and to present recent developments in the subject.

The RMG provides details of the requirements for reactivity management and, more specifically, gives details of expectations for using HP tools during such activities. Expectations for the use of HP tools are therefore clearly set out for each type of activity and each job-role.

For the Operations department, decision-record ‘Quality control of operations activities’ (stipulating the requirements that must be complied with during sensitive activities) was revised to incorporate the requirements of the RMG, particularly for planned load variations.

The content of the table below was approved during a department management meeting on 06/09/2016. The table – derived from the RMG – details the station’s requirements for conducting pre-job briefings, deploying procedures, and control room supervision. These rules have been followed by shift teams since October 2016.

Table 1: Dampierre Operations department expectations governing planned load variations

EXPECTATIONS	Load transients < 15%Pn	Load transients ≥ 15%Pn	
		Load variations	Plant operation – Control of intermediate power range
Preparation - Definition of a strategy using a guide	NO*	YES	
Pre-job briefing	YES		
Deployment of procedures	YES		
Restricted access to MCR	Operator decision	YES	Operator decision
Supervision by a 3rd party	Shift Manager decision*	YES	Shift Manager decision
Enhanced supervision	NO*	Position in front of the panel and parameter monitoring in accordance with operating procedures	Frequent presence in front of the panel (as defined in good practice PP62) and monitoring of parameters in accordance with operating procedures
Debrief	NO*	To be performed at least once a shift	

* The Shift Manager decides on the type and extent of support given to anyone carrying out a task for the first time.

In practice – and as stipulated by memorandum 'Organisation for reactivity management in the Operations department' (D5140NT15097) - the operators must apply HP tools for all sensitive activities that have an impact on the important primary-side parameters.

As regards supervision in the main control room, the Operations department's technical memorandum 'The new role of Lead Operator' (D5140NT14120), which has been in force since August 2016, defines the position of Lead Operator. The Lead Operator ensures the application of HP tools and, more widely, of the rules governing sensitive activities. He is responsible for supervising control room activities, and enforces deployment of the measures detailed in the Operations department's 'Quality control of operations activities'.

Every week since the end of 2015, reactivity parameters have been determined for each unit via I&C surveillance test EPC KGB016. The calculations give Operators a comprehensive overview of the main parameters affecting reactivity. The Operators therefore have real-time data to help them respond to any changes to the load profile and make the necessary operating adjustments. The Shift Supervisor or Lead Operator conducts a technical check of these parameters, which are available at all times in the main control room. The Operators use these parameters to establish an order of magnitude for reactivity management operations and to prepare for transients.

Since the end of 2015, all Operators must practice applying the methodology, using HP tools and making the calculations needed for criticality, once per cycle. This is practiced by performing weekly surveillance test EPC KGB015.

Following in-house and external inspections, the methodology and traceability of second-level analyses of criticality operations were revised. The resulting instruction (D5140COFCOR0) was approved at corporate level and supplemented with site-specific OPEX. This step-change has delivered a reduction in the number of quality-assurance gaps in the station's 2016 criticality files and in the reliability of criticality states. In addition, this instruction has made it possible to apply a quality-assurance system to the factsheets reiterating the criticality requirements.

Since March 2016, as part of the station's drive for error reduction, criticality state 1 has been posted in the main control room. This data is backed-up by the values for the last known stable state, for each unit, which are posted in the main control room on a weekly basis. This data is relevant in the event of a reactor trip or unplanned shutdown with criticality.

Since the end of 2015, the training course on plant operation (CPIL) has been totally redesigned in terms of content and format. This course introduced learning on the requirements of normal operating rules (preparing a transient, flux form (delta-I) target, operation at low power levels) and how to meet these requirements. The course was delivered to all the shift teams in sessions attended by the Core-Fuel Engineer and wrapped-up by line management. The Operators valued the training and praised its usefulness. This course is now mandatory and must be attended every year. The station has decided that its content will be adjusted annually to meet site-level needs and factor-in recent OPEX.

The requirements for using HP tools are also in force within the training department UFPI, where they are set out in an Operations /UFPI joint memorandum. Simulator instructors drive these standards during Operator training and refresher training. Trainers were reminded of the need to reinforce these requirements, and the enforcement of standards is an observation-topic for Operations management walkdowns.

Use of HP tools represents one of the learning objectives of operator theory initial training and of corresponding evaluations (CFTO). It is included in the assessment of learning achievements. HP tool use is generally one of the essential learning-retention objectives defined in technical memorandum 'Corporate specifications for Operations personnel skills upkeep', also subject to evaluation. During the annual course on plant operation (CPIL), all the requirements of the GRM are reviewed by the Operators, including the requirement to use HP tools.

IAEA comments:

The plant has introduced an action plan to address the OSART mission recommendation focused on the subject of monitoring key parameters in the main control room. The plant focused it's response on three main areas:

- Consistent implementation of a reactivity management guide across the station
- Implementing and embedding revised expectations governing planned load variations

- The development and deployment of the new role of Lead operator in the main control room

The plant has demonstrated progress in the area of human performance and supervision in the main control room. In particular, the focus placed on observing and improving reactivity management activities demonstrates an improved engagement of operations staff in this area. Also the development of periodic knowledge checks and self assessments performed by the operations crews and reviewed by the reactivity management peer group allows for targeted actions based on any trends to improve reactivity management performance.

Interviews, presentations and observations showed that the plant has done significant work in the area of human performance and supervision in the main control room by further reinforcing the operator fundamentals. However, all Lead Operator’s positions are not yet fully staffed, the reactivity management peer group activities have just started and further work is needed to demonstrate sustainable performance improvement.

Conclusion: Satisfactory progress to date

3.4(2) Issue: The Plant operational practices are not always adequate to systematically identify deficiencies.

The team observed deficiencies that were not identified or assessed by the plant staff:

In the radiological controlled area:

- In the demineraliser valve room 9ND472 there were 3 unauthorised operator aids attached with tape.
- An unauthorised, fading and handwritten maintenance aid was attached to valve 4RCV023VP in the chemical and volume control system.
- At the borated water storage tank ground level, scaffolding was stored without authorisation and was not seismically secure. This store was blocking access to the south west end of the tank.
- On the containment spray system of Unit 3, pump 3EAS003PO contained corrosion and residual boron crystals, without a defect tag.
- On the containment spray system of Unit 3, valve 3RIS056VB contained boron traces without a defect tag.
- The spent fuel pool cooling water pump 3PTR001PO was leaking, with a build up of boron crystals, without a defect tag. Although a work request was confirmed in the system. The plant requirement is that all leaks have a defect tag attached.
- There was an unauthorised operator aid in the form of an A4 paper attached with tape inside an electrical panel in area W455.
- A drain line on the nuclear island chilled water system 4DEG618VD showed significant corrosion due to condensation, without a defect tag.
- On the nuclear island chilled water system valve 4DEG301VD, significant corrosion was observed due to condensation, without a defect tag, which is in line with the plant policy.
- An unauthorised handwritten operator aid located on steam generator blow-down system valve 3APG056VL.
- There was a pair of old gloves discarded beside boron dilution tank 3PTR001BA.
- On the spent fuel cooling system valve 4PTR005MD there were two labels, one official and one unofficial (on paper) attached.
- The label used on a filter operating valve 3APG056VL was handwritten and not robust.
- On the fire tank in room NB327, there was a handwritten operator aid on a sticker specifying the normal working level of the tank.
- On the plant radiation monitoring system valve 4KRT464VA, an unauthorised paper operator aid had been in place since 16/10/2008.

In other areas:
- On Unit 2, there is an unauthorized paper operator aid attached with tape on the grid synchronisation and connection system 2GSY002AR, informing the operator that a lamp test may result in a turbine trip.
- On Unit 2 in the turbine hall basement, excessive water was overflowing from a surface drain due to misplaced leak management.
- On Unit 2 in the turbine hall, there was a build up of oil in the bunded area as a result of an oil leak at the turbine lubricating oil system GGR-001RF.

Not identifying deficiencies could result in a reduction in the reliability of related plant components and systems thereby affecting effective response to planned and unplanned plant evolutions.

Recommendation: The plant should improve its operational practices to ensure that deficiencies are systematically identified.

IAEA Bases:

SSR-2/2

7.10 Administrative controls shall be established to ensure that operational premises and equipment are maintained, well lit and accessible, and that temporary storage is controlled and limited. Equipment that is degraded (owing to leaks, corrosion spots, loose parts or damaged thermal insulation, for example) shall be identified, reported and corrected in a timely manner.

NS-G-2.4

6.28. Regardless of the extent of automation of the plant, the final decisions and resulting final responsibilities of the operation should rest with plant operating staff. The operating organization of a site, therefore, should establish shift crews for continuity of the responsibilities in the tasks of plant operation. Examples of tasks or activities to be executed by a shift crew include, but are not limited to, the following:

(1) For normal operation: to monitor whether there are any indications of deviations from normal operation by plant walk-through;

NS-G-2.14

4.36. Factors that should typically be noted by shift personnel include:
1. Deterioration in material conditions of any kind, corrosion, leakage from components, accumulation of boric acid, excessive vibration, unfamiliar noise, inadequate labelling, foreign bodies and deficiencies necessitating maintenance or other action;
2. The operability and calibration status of measurement and recording devices and alarms on local panels throughout the plant, and their readiness for actuating or recording;
3. The proper authorization for, and the condition and labelling of, temporary modifications in the field (e.g. the presence of blind flanges, temporary hoses, jumpers and lifted leads in the back panels);
4. Indications of deviations from good housekeeping, for example the condition of components, sumps, thermal insulation and painting, obstructions, posting of signs and directions in rooms, posting of routes and lighting, and posting and status of doors;

5. Deviations from the rules for working in safety related areas such as those relating to welding, the wearing of individual means of protection, radiation work permits or other matters of radiation safety or industrial safety;
6. Deviations in fire protection, such as deterioration in fire protection systems and the status of fire doors, accumulations of materials posing fire hazards such as wood, paper or refuse and oil leakages, or industrial safety problems such as leakages of fire resistant hydraulic fluid, hazardous equipment and trip hazards;
7. Deviations in other installed safety protection devices, such as flooding protection, seismic constraints and unsecured components that might be inadvertently moved.

6.17. The system for controlling operator aids should prevent the use of unauthorized operator aids or other materials such as unauthorized instructions or labels of any kind on equipment, local control panels in the plant, boards and measurement devices in the work areas. Operator aids should be placed in close proximity to where they are expected to be used and posted operator aids should not obscure instruments or controls.

6.18. The system for controlling operator aids should ensure that operator aids include correct information that has been reviewed and approved by the relevant competent authority. In addition, all operator aids should be reviewed periodically to determine whether they are still necessary, whether the information in them needs to be changed or updated, or whether they should be permanently incorporated as features or procedures at the plant.

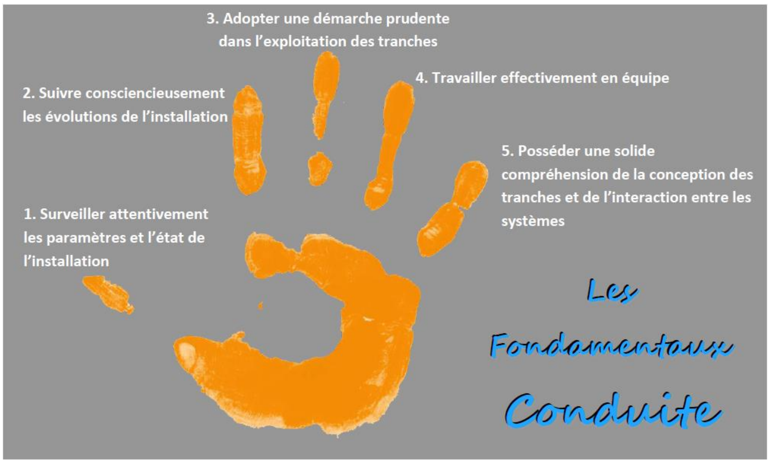
Plant Response/Action:

The monitoring action plan in the field has been developed on the basis of the following objectives:

- Putting monitoring in the field back at the heart of operations priorities.
- Clarifying expected behaviours for monitoring
- Developing the tools needed for high-quality monitoring in the field
- Enhancing plant responsiveness in processing deficiencies identified in the field

Based on the findings of the last OSART, which were also identified in our areas for improvement, we have:

- Enhanced coordinate on of the 3 MPS 07 macro-process: “Ensuring monitoring in the field”. Coordination in this area is now the responsibility of a shift manager, who is supported by two deputy shift managers to provide the managerial heft needed to successfully implement our actions. Trend analysis for this process is undertaken on a quarterly basis (high-level event analysis/ low-level event analysis/ independent safety section perspectives/ external OPEX), in addition to an action progress report. Reports are delivered to the operations department head, who is responsible for coordinating the 3 MPS (Securing nuclear safety performance) committee.
- Implementation of cyclical training activities based around the five fundamental operating principles:



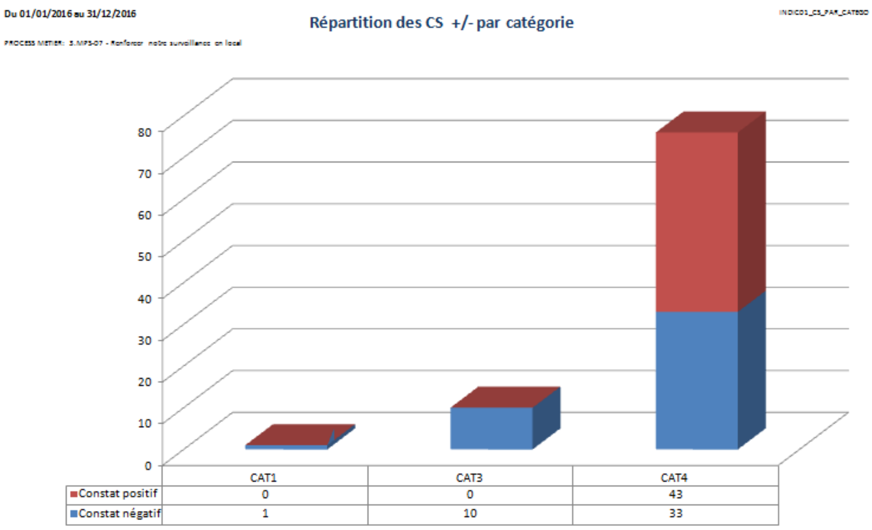
The principle: each cycle lasts for 7 weeks, to allow our 14 teams to take part, and covers one of the fundamentals, with a targeted focus on an activity typical of said fundamental. Training materials are prepared by our shift crews and subsequently approved by the department management team. They are then made available to all teams. Training activities are made up of three stages:

- Field operator self-assessment against the baseline
- Refresher on requirements relating to the activity
- Management field observation of appropriate understanding of and compliance with requirements. This observation session is tracked and fed into our corrective action programme.

From 29 February to 17 April 2016, our teams received training on monitoring in the field.

The next training session on this topic is planned for 6 February to 23 March 2017.

- We have deliberately focused our management field visits on these five fundamentals, including monitoring in the field, for which there were 41 management field visits by operations management and 90 observation sessions in 2016. In 2017, we will also be challenging our deputy shift managers and our Industrial Safety Operations Supervisors on these fundamentals, so as to boost our field presence and pursue reinforcement of expectations in these areas.



– Work was undertaken throughout 2016 on the role played by each employee in these operator fundamentals, with a view to creating a role-based booklet setting out the relevant requirements. The booklet for field operators naturally focuses on monitoring in the field, and will be personally given to each field operator during the 2017 appraisal interviews.

The 2017 action plan is divided up into four components:

1. Content of monitoring in the field

– Key action: Introduction of area-focused field rounds. Deadline: 03/02/2017

In line with our baseline, field round content will be adjusted in order to focus on a specific subject area every day and enhance our monitoring in the field. Given the large number of subject areas to be covered during field rounds, it is not possible to ensure optimal vigilance across all areas at all times. For this reason, area-focused field rounds will be introduced. Each weekday will be linked to a different focus area (fire, volumetric protection etc.). All field operators will of course need to be alert to other subject areas as well, and to report any noted deficiencies.

These subject areas have already been identified, and notifications are currently being added to the WINSERVIR software to facilitate the management of these field rounds by field operators and allow them to see the focus area for a given day.

- Key action: creation and implementation of training on expectations for field rounds and in-the-field monitoring. Deadline: 31/12/2017

  As part of the operations department skills management programme, training on monitoring in the field is currently under development, to include a scenario-based dress-up exercise. This will be implemented in 2017 and will be delivered to all our field operators.

- Key action: Team self-assessment against the IN monitoring in the field baseline. Deadline: 31/01/2017

  To ensure that our teams are meeting installation monitoring requirements, a self-assessment process is currently underway among the field operators of the two operations departments. The feedback from this self-assessment process will allow us to ensure consistency of our action plan, and to finetune our diagnostics and actions if necessary.

- Key action: Updating the field round booklet and field operator support. Deadline: 30/06/2017

  We are updating the field round booklet used by the two departments in order to standardise them and incorporate new requirements. Once this work is complete, field operators will use it as a guide while conducting their monitoring field rounds (¾ complete in operations, ½ ongoing in operations)

2. Operator aids displayed on plant

- Key action: bring signage displayed on plant into line with the quality assurance process. Deadline: 31/07/2016

  The plant identified signage displayed on plant that was not compliant from a quality assurance perspective. The quality process for this signage is being upgraded, and a list has been drawn up of plant signage to be maintained. The system procedures relating to these operator aids are in the process of being modified, so that diagrams and operator aids for these procedures can be incorporated as annexes.

3. Taking account of specific conditions relating to unit status

- Key action: introduction of specific outage field rounds and standardisation of field rounds across twin units. Deadline: 31/12/2017

  A specific action has been put in place to update the summary reports requested for field rounds in the WINSERVIR software. In particular, these updates will help to simplify these reports if the equipment in question is not operating (Implementation deadline: 31/01/17) and will help to identify reports to be prepared in line with unit status. On the plant's initiative, a working group has been set up with the Chinon and Saint Laurent NPPs with a view to sharing this work (Deadline 31/12/2017).

4. Checks and quality assurance

- Key action: introduction of a checking and monitoring loop for deficiencies identified during field rounds. Deadline: 31/01/2017

  An additional line of defence relating to improved detection and identification of deficiencies in the field is currently being rolled out. This line of defence is a weekly checking loop for effective detection, the raising of related work requests and appropriate identification of the deficiency on plant. This will be performed by field operators on Sunday afternoons. Deficiencies will be corrected and reported back to the team leader. The methodology and related material are under development.

Enhancing plant responsiveness in processing deficiencies identified on the installation:

Approaches that are not part of the field round process, developed by the plant, also play a role in improved deficiency management, to reduce the number of deficiencies to be noted during field rounds:

Packing action plan (Recommendation **4.6(2) Issue:** The plant expectations related to storage of material on site are not consistently implemented).

FME action plan (Suggestion **4.6(1) Issue:** The plant's foreign material exclusion (FME) programme is not always effective).

An internal NPP action plan implemented to improve scaffolding management in relation to seismic risk (threat/target pairing).

"Ensuring Exemplary Plant Condition - MEEI", a process which features a regular assessment of plant condition in connection with the corporate level.

Coordinating Equipment Anomaly Work Requests management (backlog), where results are compared across the EDF NPP fleet. Dampierre is one of the leading NPPs in terms of performance in this respect, and is showing good progress over time.

IAEA comments:

The plant has introduced an action plan to address the OSART mission recommendation focused on the subject of systematically identifying deficiencies in the field. The plant focused the response on three main areas:

- Strengthening the identification and tracking of defects on the plant
- Addressing unauthorized operator aids
- Developing a consistent approach to plant rounds and operator standards

The plant has demonstrated good progress in the area of identification of deficiencies on the plant. The re-energisation of the working group has moved the ownership to the field operators resulting in tangible and valuable improvements. The systematic review of low level trends with actions that are SMART and tracked through the plant rounds working group is proving effective in proactively addressing emerging trends and known issues. Also the revised training and innovative tools to refresh ‘what good looks like’ on the plant is engaging operators in the learning and improvement of plant tours.

Interviews, presentations and observations performed during the mission showed that the plant has done significant work in the area of systematically identifying deficiencies in the field by further reinforcing the operator fundamentals and moving the ownership to the plant operators. Further work is needed to ensure the performance improvement is sustainable. Specifically, the plant needs to continue using the plant tours peer group and progress the existing action plans. One such existing action is the resolution of known unauthorized operator aids which the plant has identified but is at an early stage of progress. Another is to further reinforce defect identification to ensure the improved performance and expectations are sustainable.

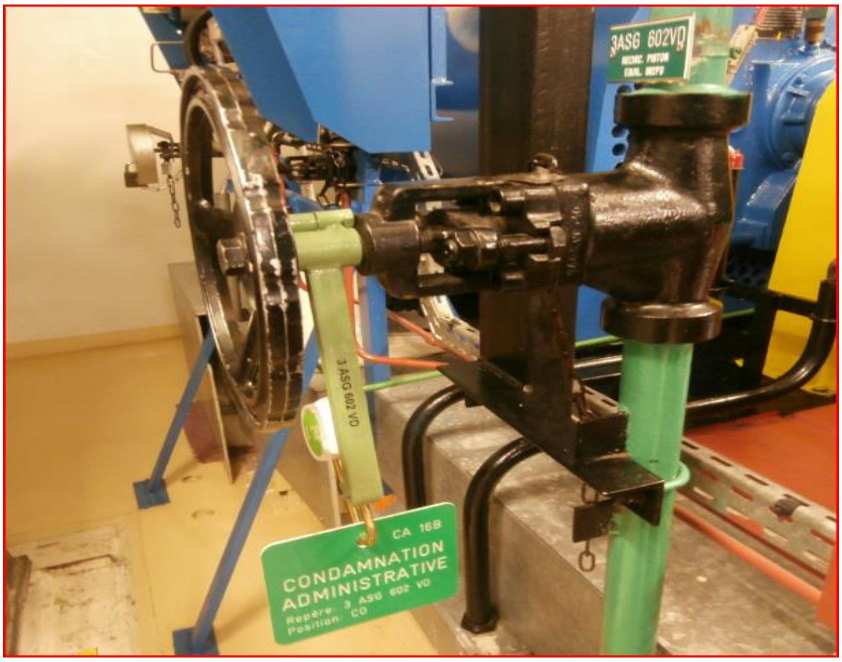
Conclusion: Satisfactory progress to date

3.7. CONTROL OF PLANT CONFIGURATION

3.7(1) Good Practice: Installation of a metal jig on the normally open valves of the motor-driven auxiliary feedwater pumps

The Plant has installed a metal jig on the normally open valves of the motor-driven auxiliary feedwater pumps. Once in place, this jig guarantees that the valve is open.

As a result of fleet-wide Operating Experience (weakness identified in this area at another French plant), the Plant designed these devices for safety lockouts.



This tool can be readily utilized and manufactured by site maintenance.

This tool may also be utilized by field operators during isolation and tagging activities.

The tool is clearly visible and allows the operator to readily identify gaps in the application of this jig. Use of this jig complements the safety lockout without overcomplicating it.

The valve safety position as open is physically guaranteed, preventing damage to the pump. It also eliminates human error as regards valve position.

4. MAINTENANCE

4.1. ORGANIZATION AND FUNCTIONS

The plant has implemented the Stewardship of Skills maintenance programme and received corporate support to deliver training to new employees focusing on mentoring the workers in specific areas to develop the knowledge and skill necessary for them to be productive and proficient. The team has recognized this as a good practice.

4.2. MAINTENANCE FACILITIES AND EQUIPMENT

The plant has a suite of instruments used to calibrate system components and troubleshoot plant equipment. These instruments are managed by an inventory system for traceability. Although the plant policy and expectation is that these instruments be checked before use, many of these instruments have not been returned and are out of calibration, the team encourages the plant to improve the oversight of the instrument returns and their calibration.

4.3. MAINTENANCE PROGRAMMES

The plant has established both on line and outage work programmes. There has been improved performance in coding, prioritizing and scheduling all aspects of the prescribed maintenance strategy. The different elements are being managed with key performance indicators with a focus on backlog reduction. However, there are a number of preventive maintenance activities overdue on safety significant systems. Even though the plant has conducted an ad hoc analysis for each overdue preventive maintenance activity, the team encourages the plant to conduct analysis of the impact for safety of all delayed safety related preventive maintenance and perform the preventive maintenance on time.

4.5. CONDUCT OF MAINTENANCE WORK

Workers performing lifting and rigging activities are not consistently demonstrating knowledge and skill when performing steps and checks as per the expectations of the established programme. The control and assessment of risk for lifting and traversing loads in the turbine hall is not consistently performed. The team made a suggestion in this area.

Prior to the outages, the plant has initiated a strategy to review maintenance activities with previous sub-standard performance in order to learn and define what can be done better to ensure the work is executed safely and without rework. These activities are identified, categorized into seven categories for analysis and improved planning preparations. The team considers this as good performance.

4.6. MATERIAL CONDITIONS

The Foreign Material Exclusion (FME) Programme has been implemented and communicated at several workshops and training sessions. However, expectations are not always implemented in work practices which results in inconsistent application of FME barriers and prevention tools. The team made a suggestion in this area. A review of the implementation of the temporary storage policy at the plant has revealed inconsistencies and tolerance to hazards, resulting in a potential impact on plant operation. Examples of these have been identified in the radiological controlled and conventional plant areas. For 2014, statistical information from the plant shows that around two thirds of all storage areas are not compliant with plant expectations. The team made a recommendation in this area.

DETAILED MAINTENANCE FINDINGS

4.1. ORGANIZATION AND FUNCTIONS

4.1(a) Good Practice: The Stewardship of Skills training programme for new maintenance employees has provided a credible framework to systematically deliver knowledge and skilled training to the workers.

The plant has received corporate support to deliver a training programme to new employees that focuses on mentoring the staff in specific areas to develop the knowledge and skill necessary for them to be productive and proficient. The output is a log book which is completed, reviewed and used as a tool to track progress.

The programme makes use of experienced workers and leaders that are willing to share and coach new employees to transfer knowledge and skill prior to retirement.

The programme is focused on skills and knowledge gaps that were identified through analysis of sub standard work and event history.

The effectiveness of this initiative is measured by the department leaders and between 2011 and 2015 there has been a marked improvement in this area while the plant has increased the number of new employees by 100 new workers per year for a total of 400 new staff. This represented a significant challenge and the improvements can be seen in the following indicators linked to the performance of the workers:

- the number of safety significant events has declined from 40 in 2011 to 20 in 2015
- the number of sub-standard maintenance work events has reduced from 27 in 2011 to 16 in 2015
- the number of events resulting in a production loss has reduced from 15 in 2011 to 4 in 2015

4.5. CONDUCT OF MAINTENANCE WORK

4.5(1) Issue: Lifting and rigging activities are not always adequately controlled and programme requirements are not consistently applied.

The team noted the following:

- During an observation in the turbine hall, the lift team did not perform a pre-lift test prior to lifting the component from the ground level to the turbine floor. For all lifts, a pre-lift test is to be performed just off the ground, allowing the component to stand free for a period of time to ensure that the load is balanced and the brakes are tested before lifting. During the same lift activity, tie lines were not used and workers were handling the load when it was at shoulder height without a risk assessment and approval to do so.

- Unsafe worker practices were observed during the installation of a large frame on the outside wall of the turbine building. The lift utilized a crane, a man-lift and a work platform, all of which were at different elevations and aligned one on top of the other without a defined safe lift zone. The signalman was on the ground, one worker on the man lift and one worker on the platform. The load was swinging and the workers had difficulty stabilizing the frame and mounting it on the wall. The worker on the platform was standing on a hand rail and handling the load.

- Unsafe worker practices were observed outside the reactor building when an individual was working directly below the man lift platform where two workers were located.

- Unsafe worker practices were observed during a lift in the turbine hall when a worker remained in the lift zone next to the load when it was lifted. This lift was stopped and the worker left the lift zone. During the same observation, another worker performing a lift on the gantry crane impacted a fence that was set up over the gantry rail. The safe lift zone was not checked prior to the movement.

- During an observation of a lift involving a large container in the loading bay destined for the Unit 3 turbine floor, the container was not lift tested before the lift commenced. In this case the lift traversed directly over steam lines in Unit 3.

Failure to comply with the lifting and rigging programme requirements and practices can lead to serious personal injury and equipment damage.

Suggestion: The plant should consider enforcing the consistent implementation of its lifting and rigging requirements.

IAEA Bases:

SSR-2/2 Requirement 31;

8.8 A comprehensive work planning and control system shall be implemented to ensure that work for purposes of maintenance, testing, surveillance and inspection is properly authorized, is carried out safely and is documented in accordance with established procedures.

NS-G-2.6;

8.18. The operating organization should ensure that adequate facilities and space as well as clear access ways are provided in the design of the plant for all plant items that are likely to be removed and transported.

8.19. Plant management should provide suitable mobile lifting and transport facilities…before major operations involving lifting and rigging, and cautionary notices limiting movements of loads over specified areas. All operations involving lifting and rigging should be performed by trained personnel.

4.23. Procedures and work related documents should specify preconditions and provide clear instructions for the work to be done, and should be used to ensure that work is performed in accordance with the strategy, policies and programmes of the plant.

5.4. Maintenance that could either affect the performance of items important to safety or potentially endanger the health and safety of personnel should be preplanned, and should be performed in accordance with properly approved written procedures or drawings appropriate to the circumstances

GS-G-3.1;

2.21. All work that is to be done should be planned and authorized before it is commenced. Work should be accomplished under suitably controlled conditions by technically competent individuals using technical standards, instructions, procedures or other appropriate documents.

Plant Response/Action:

The OSART suggestion led the site to examining its “lifting and rigging” organisation more thoroughly to understand the real reasons for our challenges. This analysis, which incidentally reinforces previously initiated actions, was done by a working group coordinated by a lifting advisor, newly appointed at the beginning of 2016. With this context, the “Mechanical handling of loads” memo D5140/NT/12.158. index b is applicable until the 2016 working group conclusions can be implemented.

The working group conclusions on the site lifting organisation have led to:

- reconsidering the organisational side by creating a lifting team coordinated by lifting advisors
- supplementing the operational side with a mission statement for lifting and rigging champions in each craft, a mission statement for a tools champion and the creation of a lifting and rigging network within the NPP
- the lifting advisors setting up tailored training sessions:
  - for the crafts champions, for the tools champion
  - for managers
- revising our documents: creation of a separate operational memo from the organisational memo.

The site also uses the following additional support to improve in the area of “lifting and rigging”:

1. Corporate support is available via the lifting and rigging network with members who contribute in:
   - Sharing good practices
   - Examining changes in the regulations
   - Low level events
   - Audit preparation

2. Since 2016, the site has created positions for two lifting advisors who are situated close to the projects (Outage platform). They are designated and trained experts, with mission statements.

3. The Industrial Safety instructions D2000COS00026 index 2, published in June 2016, give precisions on how to do an adequacy test. The conditions for lifting activities are also defined. Information on the use of these safety instructions is recommended for 2017, as support for the updated Index 2 "Adequacy Test" sheets, dated 07/06/2016 and the Index 2 "Adequacy Test" form in Word format, dated 07/06/2016.

4. Tools, such as the "inspection sheet" are available in the NOTES MP4 PE 4MRC04 data base. These sheets list expectations concerning lifting and rigging, and act as a support for managers during observations of lifting activities. The use of a sextant is recommended when choosing slings.

5. Focus on industrial safety risks started in 2016., Using set and known criteria, the work coordinator follows guidelines to organise an "industrial safety committee" before a lifting activity.

<u>The following criteria are used to define high-risk handling activities:</u>

- Infrequent handling activity and/or risks identified (specific slings with risk for the surrounding area, for personnel safety, etc.)
- Handling of large or cumbersome components (turbine rotor, alternator rotor or stator, large metallic structures).
- Handling activity when the crane operator cannot maintain permanent visual contact with the load during the lift.
- Specific types of load handling: i.e. recovering or turning the load.
- Handling activity using several items of lifting gear.
- Handling with an unknown centre of gravity
- Handling with a need to lift at an angle
- Handling activities under power lines
- Handling dangerous substances (radioactive, or fulfilling criteria in D5140/CS.04)
- Handling activities with the lifting apparatus at 90% or more of its nominal capacity to lift the load.
- If the lifting activity is outside, wind speeds (even gusts) of above 30km/h,
- The lifting activity is going towards or coming from an area of water.
- Lifting Assets for the Safeguarding of Interests (EIP)
- Lifting activities in confined areas or near safety-related systems, structures or components (EIPS)
- Lifting activities when the only way to successfully carry out the activity is to lift the load over a person (using an established procedure)

For a complex lifting activity, a lifting plan including a sling plan must be created and brought to the attention of the workers.

A corporate study is in progress to define NPP criteria for hazardous handling activities by taking into account specific site features (special dispensations)

6. Training: awareness sessions have been given to the Departments most concerned

7. An Integrated Management System "Lifting Review" took place on 17/10/1016. It was chaired by the Industrial Safety & Radiological Protection Senior Advisor, and the industrial safety correspondents from each Department were present. The review included a reminder of the rules and regulations, and also the scope of the lifting advisor's mission.

8. For the management of lifting gear:
   - Memo D5140/NT/14.036 index B Regulatory checks in the domains of machinery, electricity, lifting and rigging, Personal Protection Equipment and automatic doors and gates.
   - FMTE-ORG 16-008: Padlocking overhead cranes (28/11/2016)
   - D5140/NT/02.359 "Monitoring of lifting apparatus managed by the Logistics and Technical Department (SLT)"
   - D5140/NS/OUT.07 "Monitoring of lifting apparatus managed by the Logistics and Technical Department (SLT)"

9. As outlined in D5140/NA/ORG.21 and D5140/NA/ORG.22, regulatory checks of lifting gears are the responsibility of a licensed organisation. The results of these inspections are available as a read-only document in the ECM database. In case of immediate danger for users, the inspector promptly warns the work coordinator responsible for the equipment, who then takes the appropriate actions to prohibit access to the area of danger or to padlock the defective equipment. A provisional report indicating the type of danger is issued. Any padlocking is identified in the register provided.

IAEA comments:

The plant response to the issue regarding adequacy of control over lifting and rigging activities includes the establishment of a working group and revising the structure with aligned leads in all groups involved with lifting and rigging.

The plant response has been focussed on the organisation with some actions in place to modify the organisational structure, with an engaged lifting advisor and support from the industrial safety engineer. Although this response may help to clarify roles, it is not currently clear how the reorganisation will address the observed gaps in implementing and embedding the existing standards and expectations. An observation of two lifts highlighted that the gaps that have been raised on control of lifting and rigging activities are still present. The awareness and standards of the lifting advisor was strong and demonstrates his role can help progress this issue. The plan to develop a lifting and rigging peer group to drive actions and improvements may help accelerate addressing this issue and is supported and encouraged. However, based on the current situation, there is little evidence of actions and improvements to address adequacy of control and consistent application of requirements in the area of lifting and rigging.

Conclusion: Insufficient progress to date

4.6. MATERIAL CONDITIONS

4.6(1) Issue: The plant's foreign material exclusion (FME) programme is not always effective.

The team noted the following:

- In the Spent Fuel Pool area in Unit 2, there was loose garbage observed on the surface of the walkway in very close proximity to the fuel pool. The material could have easily entered the water.

- During Unit 4 Emergency Diesel Generator air compressor maintenance, the workers and their supervisors did not know the FME related expectations. While mechanics were removing a drain and instrument air manifold on the redundant diesel air compressor, the two lines from above the manifold were not covered with FME covers. This was pointed out to the maintenance workers and the supervisors. They were not aware of this expectation and considered these openings low risk.

- During the Unit 3 outage in 2014, a lifting ring was left in a bearing housing which significantly damaged the turbine bearing.

- During maintenance of Unit 1 Emergency Feedwater pump, the maintenance workers were performing activities to check instrumentation parameters. While disconnecting the pressure device an open tubing connection was covered with a plastic bag instead of the correct cover which should have been used as it is designed for the task and signifies a FME barrier.

- During work package preparations for the removal of a valve and valve actuator located in the Unit 0 Demineralised Water Plant, the assessment for the FME risk was omitted. The workers identified FME as a risk during the pre-job brief but it was not identified in the work package. During the work activity, FME covers for the instrument tubing were not installed when the actuator was removed.

- The FME cabinets located throughout the plant for stocking FME covers do not contain all shapes and sizes. The Tool Store cabinet is fully stocked but the cabinets in the plant are not.

Without an effective FME programme, foreign materials are more likely to enter plant equipment and systems challenging safety.

Suggestion: The plant should consider enhancing the rigour of its maintenance practices with respect to FME policy to ensure its effective implementation.

IAEA Bases:

SSR-2/2 Requirement 28

7.11 An exclusion programme for foreign objects shall be implemented and monitored, and suitable arrangements shall be made for locking, tagging or otherwise securing isolation points for systems or components to ensure safety.

NS-G-2.5

3.9 The areas for the handling and storage of fresh fuel should be maintained under appropriate environmental conditions….and controlled at all times to exclude chemical contaminants and foreign materials.

4.2 The steps necessary to ….In all procedures for fuel handling and maintenance, it should be ensured as far as possible that no foreign material is introduced into the reactor.

6.8 Where appropriate, programmes should be established for the surveillance and maintenance of core components during service…..Maintenance programmes should include procedures to prevent the introduction of foreign materials into the reactor.

Plant Response/Action:

Since the January 2014 event involving a turbine bearing, which was discussed with the IAEA reviewer, Dampierre NPP has lost 1 EFPD due to foreign material intrusion over a period of nearly 3 years (0 EFPD in 2014 – 1 EFPD in 2015 – 0 EFPD in 2016).

Over this period, there was no safety related significant event linked to foreign material intrusion.

In an effort to further improve implementation of FME measures in the field, we have continued to drive an action plan focused on establishing a FME culture, worker awareness of foreign material intrusion hazards, availability of FME equipment, and more stringent factoring-in of foreign material intrusion risks in work packages, during work preparation.

The priority target of this action plan is implementation in the field. The station therefore approved the continued services of a full-time FME Advisor, present in the field and providing support to worksites in their deployment of countermeasures for foreign material intrusion. He also acts as a facilitator for FME logistics, ensuring amongst other things that the self-serve FME cabinets are always well stocked. He accompanies EDF teams from workshop to worksite, from kick-off meeting to debrief, in order to coach work-teams and focus attention on FME – particularly relevant as these workers must also supervise our suppliers. Training workers to focus on FME is a task that is also assigned to Area Owners, who are given training on FME and who include 2 FME Leads. The association of service providers, PEREN, also contributes to spreading the FME message by organising awareness campaigns before an outage cycle, or on special request, for example for teams that have to pay particular attention to the risk of foreign material intrusion. Upskilling on FME can now also be done in a new mockup facility, comprising a FME-area worksite. Managers must strongly reinforce FME so as to underpin the effectiveness of the measures that have been taken. This is why the station has included FME amongst the 5 key drivers selected to address substandard maintenance and operations activities, and why the station's inspection programme now comprises the topic of FME.

To give workers the necessary means for successful FME, the store has expanded its array of FME tools for the RCA, and any tool replacement is now undertaken by factoring-in the risk of foreign material intrusion. The restocking of self-serve FME cabinets has been added to the subsequent logistics contract, to standardise the process. And to ensure that all workers know what FME equipment is available on site, and where it is located, FME brochures are available for all new arrivals at the site reception centre. The station will soon be trialling a DPN (Nuclear Generation Division) innovation, consisting of FME endoscopes connected to a tablet used to record circuit-closure reports, including evidence of cleanliness checks before closure.

In an effort to improve consideration of foreign material intrusion hazards during work preparation, we have decided to flag up tasks comprising a high risk of foreign material intrusion as so-called sensitive activities, within trade sections. We have also drawn up a list of valve components, for which intrusive maintenance systematically generates a high risk of foreign material ingress. Roll-out of the ADRREX application is underway on site, and will make use of past risk assessments to build a library of identified risks and corresponding countermeasures for particular tasks.

We also experimented during unit 2 steam generator preventive cleaning operations, by establishing a FME-area around the secondary-side SG manholes, and a formal handover of this FME-area between the 2 parties assigned to the job – results were satisfactory.

To address foreign material intrusion hazards at the reactor building 20m level, and in response to OPEX from the unit-3 refuelling outage in 2016, the decision was taken to systematically erect barriering as close as possible to the FME-area, and to appoint a FME warden, working in three 8-hour shifts, from deployment of the first BR100 stage (100 individuals allowed inside the reactor building) to the last BR16 operations (allowing 16 individuals inside reactor building).

In the fuel buildings at 20m-level, a study is ongoing for a permanent set-up (a cabinet, a container, and self-serve dispensers) right at the entrance. This would allow workers to leave behind any unnecessary/unauthorised items, and pick up FME-accessories. This arrangement will be in place before the start of the 2017 cycle of maintenance outages, at the latest.

Moreover, an initiative to regain good worksite housekeeping was launched for a refuelling outage. The initiative was deemed to be worthwhile, as evidenced by results in the field. It relied on communicating and organising extensive management presence in the field throughout the outage, from start to finish. It also provided an opportunity to:

- Remind stakeholders of their roles and responsibilities for worksite housekeeping;
- Agree to suspend any worksite that presented a deficiency that could not immediately be resolved;
- Deliver feedback to projects regarding priorities (e.g. systematic status report during outage meetings).

This initiative – which also had a significant impact in terms of the assistance given on FME, and in terms of control of foreign material intrusion hazards – will be replicated in 2017.

IAEA comments:

The plant has taken comprehensive measures to address this issue, which includes five key elements, FME training, work package preparation, FME prevention in the field, worksite housekeeping, and improvement of FME tools and equipment.

FME training has been provided to plant and contractor staff, and in case of outage, just-in-time training is now given just before the start of each outage to enhance awareness of FME and other related topics. A stand-alone safety message on FME was delivered to all plant and contractor staff, and activities to increase the awareness of FME were arranged on special occasions in the plant.

For activities and equipment requiring FME precoution, the risk is now carefully assessed and designated in advance, and countermeasures taken commensurate with the potential risk involved. Pre-job briefings emphasise the specific FME risk of these activities. More than 500 observations were done by line managers during maintenance in the field, one of the focuses was on FME, and a similar number of observations is planned for 2017. A Check-list for observable FME deviations has been prepared to facilitate observations. For high risk activities, such as those associated with vessel head lifting, a dedicated person is present at the work site as a continuous FME monitor.

The plant has also launched an initiative to improve worksite housekeeping, which is closely linked with FME. It is expected that the action plan for worksite housekeeping will be approved by February 2017, and fully rolled out in 2017.

FME user-friendly tools and equipment have been purchased and developed by the plant, such as FME magnetic covers for easy application on openings. In 2017, twenty seven (27) different FME user-friendly tools and equipment were acquired for valve, electrical and pressurizer maintenance.

In 2016, there were no FME events, compared with one in 2015, which caused loss of one equivalent full power day. Low level FME deviations observed and recorded by line management in the field have increased. The plant explained that this is partly due to enhanced FME awareness.

During the field visit by the OSART team, it was identified that in several cases transparent plastic was used in the Radiologically Controlled Areas (RCA), which is not in line with plant FME expectations. Outside the RCA, transparent plastic was also found. However, at this moment, it was noted that there is no plant expectation preventing the use of transparent plastic in non-RCA areas. In one diesel generator maintenance worksite with standard FME risk, a broken FME cover was found stored together with good ones.

Conclusion: Satisfactory progress to date

4.6(2) Issue: The plant expectations related to storage of material on site are not consistently implemented.

The team noted the following:

- In the radiological controlled area:
  - There are five air supply connection units stored in a corridor without documentation to support this storage in room L208.
  - There are a collection of oxygen cylinders incorrectly stored without authorization or assessment.
  - In room NC570 of nuclear auxiliary building a scaffolding, a temporary room for contractors and some other materials are stored not in optimal place above filter covers.
  - Non-conformant ladders, lifts and gates are stored in room ND570.
  - Three fork lift trolleys are stored in room L209 with no formal assessment or authorization.

- In the turbine hall building:
  - In the common area between the generators of Unit 2 and Unit 3 (all four units are in operation) at level +15m only a small walking route is available between the equipment in operation and maintenance areas because of a large amount of stored equipment and lifting works done by the contractors. Access to the equipment in operation at this level of the turbine hall is hindered by a large number of scaffolds and fences. However, this was in accordance with approved plant documents.
  - There is unauthorized storage of thermal insulation and garbage for ongoing work near the high pressure turbine of Unit 1.
  - Adjacent to generator 2, there is a mobile platform stored without authorization or assessment.
  - Opposite generator 2, two large plastic containers are stored without the correct assessment and authorization
  - At the ground level of the turbine hall building a large plastic storage unit is stored without authorization or assessment, directly above which is a collection of cables.
  - At the ground level of the turbine hall, some plastic material, including barriers and plastic chain are stored without authorization or assessment.

- Statistical information from the Plant shows that last year 66% of storage areas were not compliant with plant expectations. The main contributors are absence or expiration of permission and non-compliance with fire loads.

- The plant expectation is that if material is incorrectly stored and discovered, it is marked with a sticker and the owner is contacted to address this discrepancy. This unauthorized storage may then not be corrected for up to two weeks from the time of flagging, without mitigation.

Without strict application of plant storage expectations, safety may be jeopardized due to fire risks, access and exit routes being compromised and stored items not being secured affecting adjacent equipment.

Recommendation: The Plant should enforce the consistent implementation of the standards and expectations for storage of all material on site.

IAEA Bases:

SSR-2/2

5.21 The arrangements for ensuring fire safety made by the operating organization shall cover the following: Such arrangements shall include, but are not limited to:

(b) Control of combustible materials and ignition sources, in particular during outages;

Requirement 28: Material conditions and housekeeping

The operating organization shall develop and implement programmes to maintain a high standard of material conditions, housekeeping and cleanliness in all working areas.

7.10 Administrative controls shall be established to ensure that operational premises and equipment are maintained, well lit and accessible, and that temporary storage is controlled and limited. Equipment that is degraded (owing to leaks, corrosion spots, loose parts or damaged thermal insulation, for example) shall be identified and reported, and deficiencies shall be corrected in a timely manner.

NS-G-2.1

6.5. Administrative controls should be established and implemented to ensure that areas important to safety are inspected periodically in order to evaluate the general fire loading and plant housekeeping conditions, and to ensure that means of exit and access routes for manual fire fighting are not blocked. Administrative controls should also be effected to ensure that the actual fire load is kept within permissible limits.

6.7. Administrative procedures should be established and implemented to control the storage, handling, transport and use of flammable and combustible solids and liquids in areas identified as important to safety. The procedures should be established in accordance with national practice and should provide controls for solids and liquids.

NS-G-2.14

6.20. Plant housekeeping should maintain good conditions for operation in all working areas. Working areas should be kept up to standard, well lit, clean of lubricants, chemicals or other leakage and free of debris; the intrusion of foreign objects should be prevented and an environment should be created in which all deviations from normal conditions are easily identifiable (such as small leaks, corrosion spots, loose parts, unauthorized temporary modifications and damaged insulation). The effects of the intrusion of foreign objects or the long term effects of environmental conditions (i.e. temperature effects or corrosion effects or other degradations in the plant that may affect the long term reliability of plant equipment or structures) should be evaluated as part of the plant housekeeping programme.

6.26. Management should give due consideration to any disused equipment and to the detrimental effects of such items on the behaviour of operators and the overall material condition of the plant. Plant policy should provide for the removal of all disused equipment from areas where operational equipment important to safety is located. When it is the practice at the plant to accept the retention of such equipment in work areas, the item of equipment should be clearly marked and should be covered by the plant housekeeping programme. Attention should be paid to such an item of equipment to avoid its condition affecting safety at the plant and the ability of the staff to maintain the required operational conditions.

Plant Response/Action:

After receiving these observations, the site started to take steps to simplify the process and the tool used to create requests, and to set up field inspections for a greater impact. A working group, coordinated by consultants, developed and assessed the strategy using the method Define – Measure – Analyse – Implement – Check ("DMAIC"). This process concluded with an action plan divided into 5 themes: communication for the users in the craft departments, the "storage sheet" document, the process for requesting storage, the setting up of a storage team and site organisation.

The aim of the first part of this action plan is to remind everyone involved of the rules in place. This was done via a plant memo which was distributed widely on the site. Management is giving maximum endorsement to these expectations, and housekeeping representatives have raised the point concerning these expectations during departmental management meetings. A new tool called Epsilon 2 has been rolled out on the site, with numerous half-day training sessions for the users. More than 200 individuals have been trained to this date. Storage rules are repeated during these sessions, including the necessity for a weekly storage inspection only where the fire load density is above 40 MJ/m². To control the use of space in the industrial areas, emphasis is also placed on the obligation to request storage authorisation, even if the package represents no fire load.

The rolling out of the new tool has provided a new level of formality to storage requests. This new 100% computerised support now allows for on-line modification of a storage request which makes it easier for workers to return to storage sheet files if they wish to extend their storage time. There is now also a summary sheet available with this new tool, which lists the areas where storage is strictly prohibited, so users waste less time waiting for a negative response from the storage team.

In addition, as part of the plan to optimise the storage process, storage requests with a fire load density exceeding 400 MJ/m² are now clearly directed towards the fire protection team to avoid any tedious to-ing and fro-ing. The package owner can now send their request directly to the storage team. The Epsilon2 software can also alert the package owner of the need to manage deadlines by extending them or evacuating the area, to prevent any deviations. At the end of the storage time, the owner closes their request in the on-line tool, and the storage area is then flagged as available again.

As for inspections, a storage walk-down is carried out weekly to check for compliance.

If there is any unidentified storage, the storage team sends the equipment back immediately if they find out that it has come from a store, to avoid starting the process for handling deviations. In all other cases, the deviation will be tracked and flagged for impounding. A physical merger of the storage and lifting teams is being considered once the one-stop counter becomes a permanent fixture, to enhance effective sharing of information: if a handling activity is requested without a corresponding storage request, the deviation will be captured before it even happens.

If identified storage is not inspected one week, but the package is in compliance with the storage sheet, the storage team will sign to validate the weekly inspection. All other cases of non-compliance will be tracked as a deviation, and the owner will be warned by email that they have one week to correct the situation.

Despite these different measures, if a package is identified as a deviation, it is evacuated to a cold pound as stipulated in the process in place.

A storage champion has also been appointed, as intended in the action plan, for better supervision and improved coordination of the service provided plus its indicators, and as support for the craft owners.

An action to promote clean and tidy worksites was developed along with the measures above in the “DMAIC” phase, and was enforced during a refuelling outage. The observed results in the field indicate that this action had a positive impact, mainly through the use of communication and the high level of management presence in the field from the beginning to the end of the outage. This also helped to:

- Remind people of the roles and responsibilities for clean and orderly worksites.
- Reach agreement to stop a worksite in the event of any deviation which cannot be corrected immediately.
- Give feedback to the project teams on the priorities which require attention (e.g. a standard topic in the outage meeting)
- Make sure that deviations were handled by the owner as soon as possible.

This action also had a significant impact on temporary storage and will be renewed in 2017.

IAEA comments:

The plant has introduced an action plan to address the OSART mission recommendation focused on the subject of effective storage of material on site. The plant focused the response on the following main areas:

- Simplification of the process and expectations for storage of material on site
- Introduction of formality and tracking of storage areas
- Weekly storage walk downs to confirm and ensure standards and expectations are adhered to

The plant has demonstrated strong progress in the area of storage of material on site. Specifically, the appointment of a storage champion and additional rigor and formality in managing storage on site with good ownership from the temporary storage contractor has demonstrated a step change observed on plant tours and through interviews with personnel.

The awareness of the storage champion and the working group of the low level trends and development and tracking of a living action plan demonstrates a means to sustain this improved performance. There continues to be gaps in management of storage on the plant, however the reduced number of storage anomalies, increased number of observations and overall condition of storage on the plant demonstrates that the actions in place are effective. The plant has a set of future and ongoing actions that will allow this improved performance to be sustained.

Conclusion: Issue resolved

5. TECHNICAL SUPPORT

5.1. ORGANIZATION AND FUNCTIONS

Responsibilities for technical support are divided between different organizational units in the plant line organization and corporate level units. In the plant management system technical support belongs to several macro-processes and sub-processes. Corporate level units provide significant technical support to the plant. The interface between the corporate level and plant engineering units (and between plants) is well defined on different levels of the organization. The team considers this effective interface between Corporate and the plant engineering unit as a good performance.

The Engineering and Equipment Reliability Department (SFI) applies a reliability work process originally developed by INPO. As a part of that process, both system level qualitative reliability analyses and critical component failure analyses are performed. Mimic panels were developed by the plant to provide an overview of system reliability of the various systems for each unit. The team considers the use of mimic panels at the plant as a good practice.

5.2. PERIODIC SAFETY REVIEW

The Periodic Safety Review (PSR) is synchronized with the 10-yearly outage cycle during which the major fleetwide modifications are implemented. The purpose of the PSR is to obtain regulatory approval for the next 10-year cycle. The PSR scope, as defined by EDF corporate, is not in line with the 14 safety factors recommended by the IAEA. The scope does not take into account safety factors relating to management. These factors are typically evaluated yearly or in connection with modifications. In such cases, the PSR should review these evaluations and assess trends. The team made a suggestion to enhance the scope of the PSR.

5.5. USE OF PSA

Probabilistic Safety Assessment is used at the corporate level to assess modifications, Operating Technical Specifications and their temporary changes and surveillance testing frequencies. Also yearly precursor analyses are performed at the corporate level. Technical experts of the plant are not given basic training about the main risk contributors nor the vulnerabilities of the plant from PSA perspective. The team encourages the plant to improve the awareness of plant technical experts on main results of PSA and how PSA is used at corporate level.

5.6. SURVEILLANCE PROGRAMME

At the plant, when the acceptance of a surveillance test is assessed, three possibilities exist: satisfactory, satisfactory with reservations and not satisfactory. In case of a failure in the first attempt but a success in the second attempt, the test is considered satisfactory with reservations. The second attempt is only performed after an analysis of the first failure. There is no specific procedure for a situation where consecutive failures take place in the first attempt but the second attempt is successful. The team encourages the plant to establish a feedback loop for such situations.

5.7. PLANT MODIFICATION SYSTEM

Design documentation for a permanent modification is required to be ready at the latest four months before the outage. Sometimes the packages are late and the modifications need to be postponed, unless they are required by the regulatory body. The Fukushima accident changed the priorities of modifications which also has caused delays to other modifications. Delays in the preparation of permanent modifications lead to an increased number of temporary modifications. A large number of temporary modifications exist at the plant. Some of them are very old; the oldest being from 2005. The team made a suggestion in this area.

There is a systematic procedure to independently verify in the main control room (MCR) after outage and before the restart of the plant that the updated versions of the different documents are used in the MCR. This systematic procedure does not cover incident and accident procedures. They are verified once a year, but not in connection with outages. The team encourages the plant to widen the scope of the independent verifications after outages to also cover these documents.

DETAILED TECHNICAL SUPPORT FINDINGS

5.1. ORGANIZATION AND FUNCTIONS

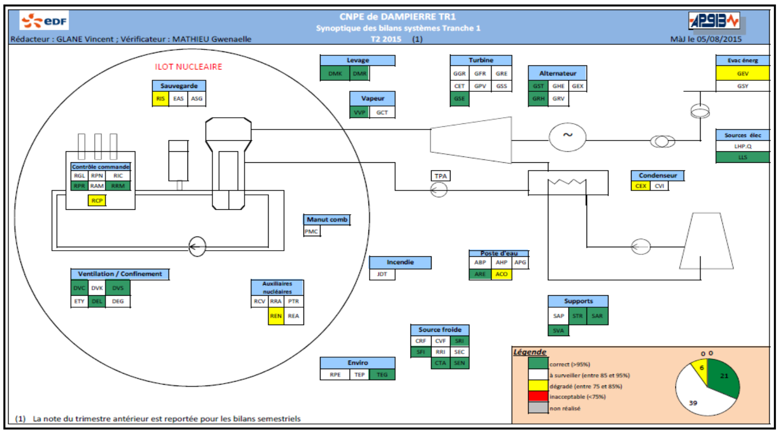
5.1(a) Good Practice: Improved component reliability by a detailed assessment of critical component failures and evaluation of system reliability.

- The aim of the INPO AP913 approach is to improve nuclear power plant reliability. The essential elements of the implementation at the plant are the following:
  - A systematic root cause analysis for each **critical component failure,**
  - The use of a **reliability mimic panel** created every quarter for each unit based on AP913 system health reports.

- The specific features of this process at the Dampierre plant include system experts performing independent quarterly plant tours and monthly reviewing all work requests concerning their systems.

- A yearly report is compiled to identify the main causes of critical component failures and to check the effectiveness of actions implemented.

This approach uses a mimic panel developed at Dampierre plant, based on AP913. A simplified drawing of a nuclear power plant gives a quick vision of the reliability level of the various systems for each unit. The colour coding allows for easy identification of the safety functions (reactivity, cooling or containment) which are affected by critical failures. The mimic panels are presented during the reliability committee meetings. The most degraded areas are given priority in planning maintenance interventions.



Results:

The number of «red» and «yellow» systems went from 9 per unit during 2014 to 6 per unit during 2015. Systems have been more reliable since the implementation of this practice. This increases their capacity to fulfill their safety functions.

The yearly assessment of critical component failures shows that, in 2014, for all 4 units at Dampierre, only 33 critical component failures were recorded.

The main cause of critical failures is the degradation over time of some materials. In most cases, the situation was already known but two new issues were identified in 2014:

- Ageing of exhausts on diesels
- Cracks in pipes used for the regulation of the intake of the turbine

For both, replacement programmes were started.

5.2. PERIODIC SAFETY REVIEW

5.2(1) Issue: The scope of the Periodic Safety Review (PSR) does not take into account safety factors relating to management.

The team noted the following:
- The PSR scope is not in compliance with the 14 safety factors recommended in the IAEA Safety Guide SSG-25 Periodic Safety Review for Nuclear Power Plants.
- The safety factors not addressed within the scope of the PSR are Organization, the management system and safety culture (factor 10), Procedures (factor 11), Human factors (factor 12) and Emergency planning (factor 13).
- Some safety factors are typically evaluated annually or in connection with modifications. In such cases, the PSR should review these evaluations and assess trends. This was not done and the safety factors relating to management were not addressed.

Without the PSR covering the safety factors relating to management the scope of the PSR does not take into account the importance of management factors on nuclear safety. This could have adverse effects on nuclear safety.

Suggestion: The plant should consider enhancing the scope of the PSR process to cover all safety factors.

IAEA Bases:

SSR-2/2

4.44.Safety reviews, such as the periodic safety reviews or alternative arrangements shall be carried out throughout the lifetime of the plant, at regular intervals and as frequently as necessary, typically no less frequently than once in 10 years. Safety reviews shall address, in an appropriate manner, the consequences of the cumulative effects of plant ageing and plant modification, equipment requalification, operating experience, including national and international operating experience, current national and international standards, technical developments, and organizational and management issues, as well as site related aspects. Safety reviews shall be aimed at ensuring a high level of safety throughout the operating lifetime of the plant.

SSG-25

2.13. The 14 safety factors recommended in this Safety Guide are listed in the following and described in detail in Section 5:

Safety factors relating to the plant

(1) Plant design;

(2) Actual condition of structures, systems and components (SSCs) important to safety;

(3) Equipment qualification;

(4) Ageing.

Safety factors relating to safety analysis

(5) Deterministic safety analysis;

(6) Probabilistic safety assessment;

(7) Hazard analysis.

Safety factors relating to performance and feedback of experience

(8) Safety performance;

(9) Use of experience from other plants and research findings.

Safety factors relating to management

(10) Organization, the management system and safety culture;

(11) Procedures;

(12) Human factors;

(13) Emergency planning.

Safety factors relating to the environment

(14) Radiological impact on the environment.

4.1. The scope of the PSR should include all safety aspects of a nuclear power plant and should be agreed with the regulatory body. The review should cover all facilities and SSCs on the site covered by the operating licence (including, if applicable, waste management facilities, on-site simulators, etc.) and their operation, together with the operating organization and its staff.

Plant Response/Action:

As indicated in the Safety Review Conclusion Report (RCRS), which sets out the conclusions of the safety review, the review programme is pre-determined, discussed with the French Nuclear Safety Authority (ASN) and implemented in accordance with the approved and finalised programme. This is a national programme.

The regulatory structure around safety reviews is not yet fully established (the draft decision submitted to the ASN by EDF was unsuccessful).
However, until now the ASN has delivered a positive opinion on the Review Focus Dossier (DOR), which is the responsibility of the corporate Division for Engineering, Decommissioning and the Environment (DIPDE). This corporate review programme is approved by the ASN.

As such, EDF has not separated “equipment” from “socio-organisational considerations” with regard to nuclear safety: they form a single whole. For example, demonstrating nuclear safety centres on the following principles:

- The safety review itself relates primarily to equipment and related rules, based on national and/or international operating experience in particular. Should it be found that instructions and operating rules require review, the review will reassess the human and organisational factors related to these changes.

- Furthermore, the impact on human and organisational factors is assessed where equipment modifications are made.
- The Safety Review Conclusion Report states that when the NPP indicates that a safety-review-related modification is incorporated and that any impact on documentation has been taken into account, this means that the related human and organisational factors have also been reassessed and incorporated.

The suggestion made by the reviewers that the plant should consider enhancing the scope of the PSR process to cover all safety factors has therefore been incorporated through analysis conducted as part of organisational and equipment changes, from the design stage onwards.

IAEA comments:

At the time of the follow-up mission, the status of the PSR completed for units 1 to 4 of the plant was as follows: units1&2 PSR were completed in 2011 and 2012 and approved by the regulatory authority- ASN in 2015 and 2016 respectively; PSR for unit 3 was completed and the approval of the ASN is expected in 2017; the PSR for unit 4 was completed in 2015 and regulatory approval is expected in 2018. The scope of the PSR follows the national regulations that currently do not explicitly cover PSR factors such as safety culture, procedures, human factors and emergency preparedness.

During the follow-up mission, the plant demonstrated that it has implemented an effective methodology to consider human and organizational factors in the preparation and implementation of safety significant design and organizational modifications. Furthermore, the plant presented the evaluations which are performed to assess adequacy and define improvement actions concerning safety culture, plant organizational effectiveness, human performance, documentation. It was considered that such annual assessments may benefit from being analysed as part of the plant PSRs, as it is done for the other important safety factors included in the PSR. Furthermore, the PSR aspects related to emergency preparedness and response were discussed. The plant will consider the need to expand the scope of the formal PSR performed after each 10-yearly outage when preparing for the next PSR due from 2021 to 2024, taking into account the EdF Corporate and ASN positions on this subject.

Conclusion: Satisfactory progress to date

5.7. PLANT MODIFICATION SYSTEM

5.7(1) Issue: The temporary modification programme does not ensure temporary modifications are limited in time and number.

The team noted the following:

- A large number of temporary modifications exist on the plant. The number of temporary modifications is 137 (some of which concern similar equipment). Based on assessments made for all temporary modifications, it was concluded that 38 of those can directly impact nuclear safety.
- The number of temporary modifications older than one year is 121 and older than three years 74. The oldest is from 2005. The purpose of the temporary modification from 2005 is to reduce the number of reactor trips.
- The plant has initiated attempts to reduce the number of temporary modifications but this has not been effective.
- There are several temporary arrangements at the plant which are not categorized as temporary modifications due to the definition of temporary modifications. There is no centralized system to manage these kind of temporary arrangements and the administrative requirements for them are lower than those concerning temporary modifications.
- Several temporary arrangements were found without adequate identification at their location.

Without a robust programme to manage temporary modifications at the plant, the integrity of the design of the plant is threatened which may lead to deviations from the assumptions and intent of the design and degrade nuclear safety.

Suggestion: The plant should consider ensuring that temporary modifications are limited in time and number.

IAEA Bases:

SSR-2/2

4.38 Controls on plant configuration shall ensure that changes to the plant and its safety related systems are properly identified, screened, designed, evaluated, implemented and recorded. Proper controls shall be implemented to handle changes in plant configuration that result from maintenance work, testing, repair, operational limits and conditions, and plant refurbishment, and from modifications due to ageing of components, obsolescence of technology, operating experience, technical developments and results of safety research.

4.39 A modification programme shall be established and implemented to ensure that all modifications are properly identified, specified, screened, designed, evaluated, authorized, implemented and recorded. Modification programmes shall cover structures, systems and components, operational limits and conditions, procedures, documents and the structure of the operating organization.

4.41.Temporary modifications shall be limited in time and number to minimize the cumulative safety significance. Temporary modifications shall be clearly identified at their location and at any relevant control position. The operating organization shall establish a formal system for informing relevant personnel in good time of temporary modifications and of their consequences for the operation and safety of the plant.

4.42.The plant management shall establish a system for modification control to ensure that plans, documents and computer programmes are revised in accordance with modifications.

NS-G-2.3

4.13. The scope, safety implications and consequences of proposed modifications should be reviewed by personnel not immediately involved in their design or implementation. These reviewers should include representatives of the operators and engineering personnel, the design organization, safety experts, and other technical or managerial advisers. The latter may also include independent external advisors, particularly for major modifications, as necessary to ensure that a full and adequately informed discussion of the modification, including all its safety implications for the plant, can be held. These reviews should also include independent validation and verification of software changes for major modifications.

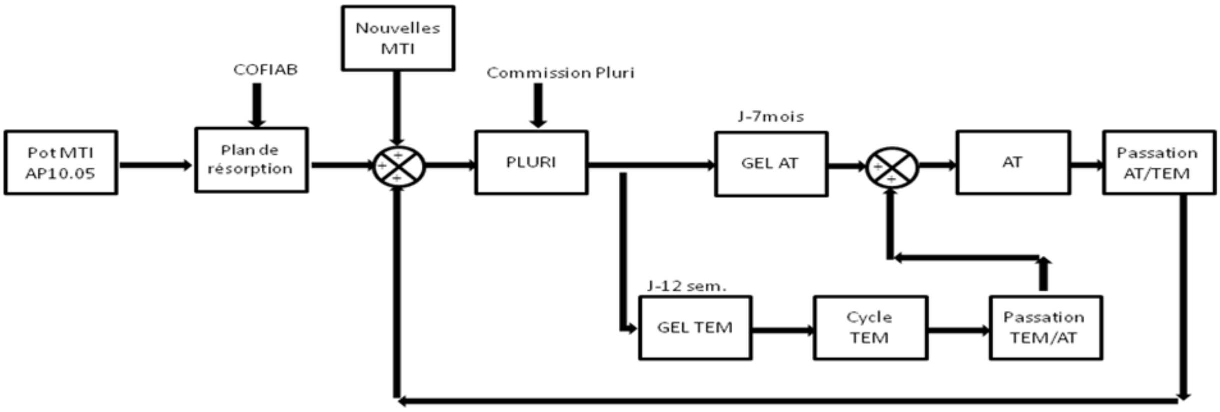
6.3. The number of temporary modifications should be kept to a minimum. A time limit should be specified for their removal or conversion into permanent modifications.

6.6. Temporary modifications should be clearly identified at the point of application and at any relevant control position.

Plant Response/Action:

As part of the MP8 macro-process, a technical process was launched on 22/09/2015, the primary aim of which was the establishment of a long-term strategy to reduce the number of temporary modifications on plant.

This was set down in a technical memo (reference number D5140NT16182). It features several actions intended to reduce the number of temporary modifications on plant, and includes both “long-term” temporary modifications and “new” temporary modifications.



<u>Phase 1:</u>

An operational coordinator responsible for reducing temporary modification numbers is appointed within the Engineering and Reliability department. This Coordinator, working in cooperation with the Multi-year process team, prepares a medium- to long-term plan for the reduction in the number of temporary modifications.

A set goal for the removal of 10 temporary modifications per unit and per year has been set, in line with fleet process AP 10.05.

Based on this multi-year plan, an evaluation and a yearly validation of temporary modification removal commitments per project are presented to the Reliability Committee. These commitments are tracked on the MP8 macro-process dashboard.

Reports are also delivered for AP 10-05 by means of the annual corporate review organised by this entity.

Phase 2:
As part of the Multi-year/ Outage and Multi-year/ Unit in Operation transfers (launched in 2016 and planned for 2017 respectively), project heads undertake to remove the temporary modifications that are assigned to them.

Reduction plan for 2017:

Of a total of 164 temporary modifications, of which 77 are long-term temporary modifications (35 have a FACR sheet*>0), the target for 2017 is to remove 86 temporary modifications, of which 43 are long-term (22 have an FACR sheet* >0). These are divided between the operational projects as follows:

For outages: 53 temporary modifications, of which 26 are long-term (20 have an FACR sheet* >0)

DAM1 (maintenance outage)	DAM2 (refuelling outage)	DAM3 (maintenance outage)	DAM4 (refuelling outage)
25	7	20	5

For units in operation: 33 temporary modifications, of which 17 are long-term (2 have an FACR sheet* >0)

DAM1	DAM2	NAB9	DAM3	DAM4	NAB8	Joint0
4	6	5	5	3	4	7

Reduction plan for 2018-2019:

For 2018, the reduction schedule is 50 temporary modifications, of which 33 are long-term (11 have an FACR sheet*>0).

For 2019, the reduction schedule is 13 temporary modifications, of which 11 are long-term.

*FACR: An FACR sheet analyses the regulatory framework, ie by checking whether plant modifications require a regulatory authorisation

IAEA comments:

The plant has analysed and identified the root causes of the issue and has taken a systemic approach to ensure that temporary modifications are limited in time and number. A strategic plan was developed in 2015 to address the issue, including the establishment of a team made up of an owner, a strategic sponsor (member of senior management) and representatives from various site departments. This team is responsible for ensuring that removal of temporary modifications is planned and prioritized for permanent resolution and their number is reduced in number and time as soon as practicable. The process for introduction and removal of temporary modifications is now embedded in the relevant plant projects and contracts are signed with the maintenance teams in charge of their installation and removal. The plant has prepared a unit specific schedule to control temporary modifications till 2020 and will be doing this on a 5- yearly basis in the future.

In December 2016, the plant reviewed the progress achieved and implemented further improvements such as: establishing regular communications, including quarterly meetings with the participation of all stakeholders involved in installation and removal of temporary modifications; development of a single data base for easy control of temporary modification status; securing spare parts needed to close temporary modifications; establishing a deadline for each temporary modification; and defining methods for modification removal as part of the modification work contracts. The planning for installation and removal of temporary modifications covers both outages and normal operation periods.

The implementation of the well established process to ensure that temporary modifications are limited in time and number resulted in 86 temporary modifications being planned for removal in 2017, 43 of which were older than 3 years and 22 were related to safety significant equipment. The plant demonstrated the implementation of the new arrangements for control of temporary modifications during a tour in the field.

The actions taken by the plant and the management review carried out in 2016 ensure that sustainable results for control of temporary modifications are to be achieved and the issue's root causes were satisfactorily addressed.

Conclusion: Issue resolved

6. OPERATING EXPERIENCE FEEDBACK

6.3. SOURCES OF OPERATING EXPERIENCE

The plant participates in the EDF Innovation Challenge every year and has a robust process to collect and screen improvement ideas from the fleet. Every year, the plant integrates around 20 new improvements through this process. The team considers this as a good practice.

Results from other OSART missions in France are not incorporated into the plant operating experience. They are to some extent used to improve fleet-wide programmes. However they are not directly distributed to the sites. As the fleet is standardized, the team encourages the plant to integrate lessons from OSART results from other sites.

6.4. SCREENING OF OPERATING EXPERIENCE INFORMATION

In addition to WANO SERs, around 600 international events are screened by EDF corporate every year to check for valuable lessons learned. In the recent years, this screening did not lead to nuclear safety related requests for actions from EDF corporate for the site. Encouragement is made by the team to broaden the scope of use of international Operating Experience (OE).

6.5. INVESTIGATION AND ANALYSIS

A number of plant event analyses have not performed in sufficient depth. Sometimes the correct root causes are not identified. Sometimes the corrective actions do not address all the root causes identified. Root cause analysis is not used for recurring significant events. The assessment of events also lacks a number of expected attributes. Therefore the team recommends the plant to improve the quality of its event analyses.

6.7. UTILIZATION AND DISSEMINATION OF OPERATING EXPERIENCE

An operating experience newsletter is compiled monthly by some plant maintenance departments and distributed to maintenance staff and relevant permanent contractors. It provides lessons learned from technical events which occurred at the Plant or at other sites in the fleet. This is an easy way to increase the involvement of maintenance staff in OE and to disseminate lessons learned. The team recognises this as a good performance.

The plant has developed a user-friendly tool to improve the quality of maintenance activities via the effective and timely capture of lessons learned. During post-job debriefings, maintenance workers report their lessons learned in this common application. This is then used by maintenance workers to quickly and easily access recent OE data needed to prepare their work. It includes both plant and fleet wide OE. It has been implemented successfully and the team recognises this as a good practice.

DETAILED OPERATING EXPERIENCE FEEDBACK FINDINGS

6.3. SOURCES OF OPERATING EXPERIENCE

6.3(a) Good Practice: Learning from others via the Fleet Innovation Challenge by collection and systematic integration of good practices.

Each year, the Fleet Innovation Challenge collects best practices proposed by the 19 NPP sites of the fleet and corporate entities. These improvement ideas are then presented and debated during a 2-day meeting, which is a good opportunity to understand what each site could implement locally.

The plant has developed a process to make sure that the fleet's best practices are screened and integrated on site, when useful, using the existing tools of the Corrective Action Programme . This ensures that the plant takes stock of the most useful best practices out of around 160 presented each year as part of the Challenge.

After a first screening during the Challenge, plant participants come back with a shortlist of ideas that could bring benefits to the plant. These ideas are then presented and further screened during multidisciplinary meetings. After validation, around 20 good practices are integrated into the Corrective Action Programme.

Benefits:

Good practices are part of the Corrective Action Programme process, designed to reinforce the tracking of these innovations. Deployment of these innovations is tracked by the «innovation representatives» and at the daily managerial Corrective Action Programme meeting.

This is a fully integrated initiative, since it uses the Plant's existing CAP tools to track all the fleet's good practices.

Every year, the plant integrates about 20 new good practices through this process. Examples include improvements to isolations, roleplay to practice using human error prevention tools, mockups for training, etc.

6.5. INVESTIGATION AND ANALYSIS

6.5(1) Issue: Event analyses at the plant are not always performed in sufficient depth.

The Team noted the following:

- In 6 out of 10 Root Cause Analyses (RCAs) reviewed by the team, root causes were not all correctly identified ("5 WHYs" stopped too early).
- In some RCAs, corrective actions don't address some of the root causes.
- In RCA Nr 4.03.14, "the change" analysis does not identify all issues and this leads to the potential non-identification of a root cause.
- RCAs do not include an analysis of consequences of same events at different power levels / different operational mode.
- RCAs do not systematically include an assessment of extent of conditions and causes.
- Among 9 recent RCAs performed in 2015, only one has a strategy for assessing the effectiveness of the corrective actions.
- The RCA team is led by a lead ("strategic pilot") who oversees the process, and includes a coordinator in charge of the team that performs the RCA. The RCA Lead does not have refresher training in RCA methods. RCA training is not a prerequisite to be a coordinator ("operational pilot"). This point has been identified by the plant and there is a plan to solve this issue.
- There is no formal deadline for non significant events concerning the preservation of evidence in case of Apparent Cause Analysis (ACA). One ACA was discussed at a monthly Corrective Action Programme meeting on 07/09/2015. The department responsible for the ACA explained that the analysis is complicated by the fact that the workers involved belonged to a contractor whose contract had expired. It is too late now to conduct interviews and secure all information needed for the analysis.
- RCA and ACA reports don't systematically have an analysis of similar past events indicated, to determine whether previous corrective actions taken were not effective at preventing recurrence. There is no indicator monitoring the number of recurring events (neither from internal nor external OE). There is no code available for repeated event in the Terrain database (PAC).
- The plant has to date not decided to perform any formal RCA for recurring significant events. The RCA methodology used at the plant is not adapted for multiple events.
- The ACA Nr 07-39121 "Unavailability of the polar crane" was presented at the monthly Corrective Action Programme meeting on 07/09/2015 for validation. Among the causes was a communication issue during the shift turnover. No corrective action was decided to address this cause as part of the ACA. The plant has 2 Human Factor Consultants. Their presence is not mandatory at this validation meeting, even for validation of event reports involving human or organisational factors.

Without adequate depth in the analysis of events, recurrence of events could happen and could compromise nuclear safety.

Recommendation: The plant should improve the depth of its event analyses

IAEA Bases:

SSR-2/2

Requirement 24: The operating organization shall establish an operating experience programme to learn from events at the plant and events in the nuclear industry and other industries worldwide.

5.28. Events with significant implications for safety shall be investigated to identify their direct and root causes [...]

5.30. As a result of the investigation of events, clear recommendations shall be developed for the responsible managers, who shall take appropriate corrective actions in due time to avoid any recurrence of the events. Corrective actions shall be prioritized, scheduled and effectively implemented and shall be reviewed for their effectiveness. [...]

NS-G-2.11

5.2. The development of recommended corrective actions following an event investigation should be directed towards the root causes and the contributory causes, and should be aimed at strengthening the weakened or breached barriers that failed to prevent the event.

Plant Response/Action:

The actions taken by Dampierre NPP since OSART 2015 to improve the quality of event analyses have been focused on training for the Operational Coordinators (PO) and the Strategic Coordinators (PS) and on strengthening the overall analysis approach, which is based on management confirming their commitment, strict implementation of the In-Depth Analysis method (AAE) and adherence to the analysis process.

Action Plan Stages:

2015/2016:

A list of Operational Coordinators created for each Department.

Training started for coordinators.

The Safety Quality Senior Advisor (CMSQ) supervises the quality of Safety Significant Event reports.

Measuring effectiveness is defined and checks for OPEX.

Development of the OPEX sheet for communication of lessons learnt from events.

Refresher training for Operational Coordinators based on the analysis quality review from the Corporate Nuclear Safety Committee (GPNS).

Result 2016: Dampierre has progressed from last position to fifth in the EDF NPP ranking.

EDF fleet-wide event OPEX is analysed by the process leaders for the 4 site result indicators.

2017:

Training for Operational and Strategic Coordinators is ongoing. The Safety Quality Senior Advisor continues to supervise analysis.

A multi-speciality meeting (with a quorum of 3 Operational Coordinators) has been set up to monitor the process, increase Operational Coordinator skills (3 Operational Coordinators at each meeting), and improve analysis quality.

EDF fleet-wide event OPEX is analysed by the process leaders for the 4 site result indicators and by those responsible for the high challenge Processes.

Identification of causes and depth of analysis

Before reaching the level of the validation meetings, there are visible changes in the tighter monitoring of Operational and Strategic Coordinator training, in more consistent meetings between Operational Coordinator and Strategic Coordinator, in the quality control of Significant Event reports required from certain Departments; in the Safety Quality Senior Advisor's presence at the validation meeting to check that the quality of the analyses is at the correct level. The In-Depth Event Analysis experts from the Corporate Nuclear Safety Committee – Engineering and Operations Unit (GPSN-UNIE) observed an improvement in event analysis quality during the review on 22/11/2016.

As from 01/01/2017, the site has decided to promote continuous improvement by changing the process to include weekly meetings, scheduled over the year, for validation of Significant Event reports. If no Significant Event reports need validating, this weekly meeting will be used as a forum for In-Depth Analysis actors at Dampierre (Strategic Coordinators + Operational Coordinators + Human Factor Consultants + Safety Quality Senior Advisor) to promote discussions on the In-Depth Analysis process and method (difficulties experienced, improvements to be made) and on cross-functional lessons learned from analysed Safety Significant Events.

- Evidence: Technical Safety Committee on 6/1/2016, the Corporate Nuclear Safety Committee (GPSN) Review on 25/11/2016, Significant Event Meeting and/or minutes from the weekly Safety Significant Event analysis meetings.

Operational and Strategic Coordinator Training

The site is committed to giving initial training to all Operational Coordinators and Strategic Coordinators. The training code for Operational Coordinators is APSURCAAE (4 days). The training code for Strategic Coordinators is APSURCAAB (2 days) or AA ESH SA 010 which is a site-level just-in-time training session (1 day) dispensed by the Human Factors Consultant. Refresher training (1 day), in the form of a review and a group event analysis using an analysis grid, will be organised every two years with the participation of GPSN-UNIE. This type of refresher training took place on site for the first time on 25/11/2016.

On 07/12, 27 Operational Coordinators out of 39 had been trained (approximately 70%) on Dampierre NPP. Training sessions have been scheduled in 2017 to reach the target of 100% trained Operational Coordinators. In the meantime, priority is given to Operational Coordinators who have been trained to carry out event analyses. As for the 6 Strategic Coordinators, they have all been trained. The trained coordinators must then carry out at least one in-depth analysis (Safety, Environmental, Radiological or Technical Significant Event) per year.

– Evidence: CAAE, CAAB, AA ESH SA 010 training presence sheets signed by Operational and Strategic Coordinators.

Participation of the Human Factors Consultant

As from 01/01/2017, the start date for the new organisation of the In-Depth Analysis process (see Observation 1), the Human Factors Consultant is systematically involved in In-Depth Safety Significant Event analyses. Depending on any constraints in their schedules, they attend, at a minimum, the validation meetings for Significant Event reports with Organisational and/or Human causes,

The Human Factors Consultants will be called upon to coordinate at least one Event per year.

– Evidence: The new organisation for the In-Depth Analysis process.

Relevance and effectiveness of corrective actions

Beyond a doubt, the improvement in analysis quality (See above) helps to improve the relevance and effectiveness of the corrective actions. This improvement also stems from the quality of collaboration between the people present at the validation meeting (Operational and Strategic Coordinators, Manager(s) from the Departments concerned, Human Factors Consultant and the Safety Quality Senior Advisor) who must agree on corrective actions, using the SMARTER (*) tool if necessary. As for measuring effectiveness, the Strategic Coordinator systematically asks the question during the validation meeting for every corrective action adopted. The decision of whether or not to apply these measures is taken case by case.

(*) : Spécifique (Specific), Mesurable (Measurable), Atteignable (Reachable), Réaliste (Realistic), Temporel (Time scale), Efficace (Effective), Revue (Review)

– Evidence: The In-Depth Analysis Check sheet (Operational and Strategic Coordinator meetings, proofreading phase completed by the Departments concerned), Significant Event reports (effectiveness measured in the validation meetings)

Analysis of the consequences of similar-repeat events in different conditions (power, operating procedures)

The In-Depth Analysis guideline currently in use requires the identification of "the hazards, plus the real and potential consequences" of events (Chapters 3.2 and 3.3) for nuclear safety, availability, industrial safety/radiological protection and the environment on-site and off-site. This analysis performed by the site Safety Engineers identifies consequences of similar events at different power levels and for different operating procedures. The In-Depth Analysis guidelines also require the identification of similar past events (Chapter 4.1) *to check the existence of other defective conditions with identical causes on the site or in the fleet*. This analysis of existing OPEX helps to determine if corrective actions previously implemented have contributed (or not) to avoiding duplicate or repeat events.

– Evidence: Chapters 3.2, 3.3 and 4.1 of the In-depth Analysis guidelines.

Follow-up and analysis of repeat-multiple events

The Human Factors Consultants provide assistance to management level (Plant Director, Safety Quality Senior Advisor, First-Line and Second-Line Managers) by monitoring and analysing gaps, and carrying out the trend analysis with the CAP Committee – based on Simple Observation reports (including Safety Significant Events) – every quarter, semester and year. These analyses lead to the identification of repeat and multiple events, and any chain effect. The Yearly Nuclear Safety Diagnosis (DAS) includes a quantitative and qualitative events analysis (low level and high level events) which leads to the identification of repeat root causes and to the coordination of an action within the Nuclear Safety process action programme. It is also a means to check the effectiveness of implemented actions. To allow coding of repeat events, the site created the observation code "EOM 16: repeat event" in the Terrain database in 2015. This code was used around ten times in 2016.

In 2017, measurements in effectiveness are followed in the same way as actions resulting from event analyses.

- Evidence: Weekly Safety Meeting (RHS), Nuclear Safety Technical Committee (CTS), trend analyses, Yearly Nuclear Safety Diagnosis, weekly monitoring of Improvement Actions.

Retaining evidence for "non-significant events" (specific case of events involving contractors)

"Non-significant events" undergo a simplified analysis. Related evidence is permanently retained in the same way as for "significant events", with no formal time limit. Events involving contractors are analysed using the same method and within the same time limits. Potential difficulties in the analysis phase, which are linked to the lack of availability of external actors, are inherent to contractor relations and to the distinct responsibilities of the companies concerned. These difficulties are still quite negligible as the companies involved in events are open. They are committed to identifying the root causes and implementing the necessary countermeasures to avoid repeat events which penalise them as much as anyone.

- Evidence: Simplified analysis reports in the Terrain database.

IAEA comments:

The plant has implemented a number of improvement actions to address this issue. Training has started for the coordinators who perform Root Cause Analyses (RCA). It is also specified that refresher training will be conducted every two years. Seventy five percent of the RCAs in 2016 were conducted by coordinators who had received RCA training compared with forty one percent in 2015. There was a visible improvement in coordinator training on RCA.

The plant is now closely monitoring the timeline of RCA investigations, and some examples showned by the plant indicated that the timeline was followed. However, it was explained that improvements are still needed in some other cases. Plant senior managers attend the RCA, providing challenge to the quality of root causes identified and corrective actions developed. The use of RCA tools, such as five WHYs, is now being explored in a deeper manner as specified in corporate procedures. The participation of staff from different disciplines is requested depending on the nature of the events being analysed. Repeat events are being reviewed to identify similar causes or conditions. In the 2016 annual report, repeat events were described, and the plant also explained cases where deeper RCA was conducted for repeat events. However, at this moment, there is no clear trend showing a decrease in repeat events.

The plant started to increase the number of effectiveness reviews of corrective actions derived from significant events. In 2016, 20 actions were identified for effectiveness review compared with one in 2015. The process for effectiveness review is partially covered by the current procedure. The plant indicated that consideration will be given to fully document the process after more experience is obtained from the current effectiveness review.

The plant invited a corporate assessment on the effectiveness of their RCA process in November 2016, and the results showed improvements compared to the situation in 2015. However, some improvements are still needed, such as quality of some root causes identified and corrective actions developed.

Conclusion: Satisfactory progress to date

6.7. UTILIZATION AND DISSEMINATION OF OPERATING EXPERIENCE

6.7(a) Good Practice: Software used to better capture lessons learned from post-job debriefings, and quickly and easily integrate them into pre-job briefs.

The Plant has developed a user-friendly tool to improve the quality of maintenance activities via the effective and timely capture of lessons learned.

The software is designed to be used by maintenance workers to quickly and easily access recent OE data needed to prepare their work. With just two clicks, they can include relevant OE in their pre-job brief and perform their work more safely.

During each post-job debriefing, maintenance workers report their lessons learned in this common application. They are therefore fully involved in this process. This application does not add to the long list of existing tools but is truly integrated, in that it extracts data from the Terrain database. It includes both plant and fleetwide OE.

It has been tested by workers, who find it useful to build up their own OE. It has helped them realise the usefulness of post-job debriefings and of the integration of OE in PJBs. The capture of lessons learned has tangibly increased, as well as their direct integration into future work via PJBs.

Since June 2014, 292 post-job review findings have been raised, and this is a considerable improvement. A tangible decrease in the number of sub-standard maintenance tasks has also been observed in the department since implementing this tool.

7. RADIATION PROTECTION

7.1. ORGANIZATION AND FUNCTIONS

Some advanced initiatives are in place to improve radiation protection at the plant. Example include the special tool developed for monitoring radiation levels during decontamination of pressurizer piping, and an integrated work control centre which brings together RP, logistics and, in outage, operations, all in the same place. The team considers those initiatives as good performance.

7.4. CONTROL OF OCCUPATIONAL EXPOSURE

Methods of dose reduction are not consistently taken into account. The plant accepts dose rates below 2 mSv per hour inside controlled areas, thus collective doses may increase unnecessarily at the plant. A gap exists regarding the use of dose constraints that are not specific to the job in hand and dose rate alarms are not effectively set to maintain the doses as low as reasonably achievable. Expectations regarding the use of operating experience during pre-job briefings are not formally established, and the relevant operating experience is not formally reviewed during the pre-job briefing. The team made a suggestion in this area.

In 2012, a hot particle with 112 KBq found on a site road triggered the plant to start a road survey which revealed 2 more hot particles for that year. In 2013, plant staff found 6 hot particles on the road survey, one of them with 1.2 MBq, giving an effective dose rate of 3000 microsieverts per hour. In 2014, plant staff found 23 hot particles on the road. In 2015, no particles were found outside the radiological controlled area, indicating the beginning of a favourable trend that still has to be confirmed. Inside a highly contaminated working area however, no controls are in place to periodically monitor the workers with a suitable detector, in order to quickly identify possible hot particles on each worker's body. Persons do not systematically monitor hands and feet before the C1 portal contamination monitor and no action is taken to capture particles from contaminated persons. The decontamination facility is not located at the exit of the controlled area, thereby increasing the potential for spreading contamination outside the controlled area. The team made a suggestion in this area.

7.5. RADIATION PROTECTION INSTRUMENTATION, PROTECTIVE CLOTHING AND FACILITIES

Radiation protection instruments are distributed to workers at the hot shop. The radioactive source checks of the instruments are not made using a defined geometry, are not carried out by RP technicians, and are not formally recorded for trending and tracking the instruments' performance while in use. The team encourages the plant to log the radiation-meter check source tests, and track and trend instrument performance.

7.6. RADIOACTIVE WASTE MANAGEMENT AND DISCHARGES

One of two waste evaporators at the plant has been out of service for more than one year. Because of the greater demands placed on the single waste evaporator to process liquid radwaste, an increase in the activity of liquid effluents is evident. In case of possible fuel failure in one or more units, the dose constraints for the public arising from the effluents may be challenged. The team encourages the plant to recover the redundancy to process liquid radwaste and reduce the activity of liquid effluents.

DETAILED RADIATION PROTECTION FINDINGS

7.4. CONTROL OF OCCUPATIONAL EXPOSURE

7.4(1) Issue: The radiation protection practices are not always effective to ensure full implementation of ALARA principles.

The team noted the following:

- Lead shielding in a scaffold wall had a radiological posting hidden by the lead blanket, and only part of the sign was apparent during the plant tour inside the radiologically controlled area. An opening on the lower part of the shielding reduced the effectiveness of radiation shielding, without any posting or explanation for the opening.
- The set points for dosimeter alarms are not set specifically for each activity in order to protect workers from low radiation levels. Doses below 200 microsieverts per day may be received without being noticed, as the minimum setpoint value is 200 microsieverts. In the same way, dose rates below 2000 microsieverts per hour will not trigger a dose rate alarm, because the minimum alarm setpoint value is 2000 microsieverts/hour. This hampers the plant's efforts to reduce collective dose.
- The radiological work permit delivered to the OSART team allows each team member a daily dose of 8 microsieverts. However, the dosimeter alarm threshold is 200 microsieverts per day with a dose rate of 2000 microsieverts per hour, which is far higher than current authorized and expected values.
- Metallic boxes are spread out across the site and at the BAC (waste conditioning building) with notices indicating contents rated as less than 2 millisieverts per hour. Despite the ambient dose rate indicated on the walls, there are no warning postings to inform workers regarding possible higher dose rates close to the boxes, thus risking unnecessary doses for workers and masking radioactive particles.
- There is no systematic use of RP indicators to monitor safety performance in an effective and objective way. Items such as the number of personal contamination events per number of entries into the radiological controlled area; daily average collective dose; daily average dose; daily ratio of alarms and yearly integrated ratio of alarms at the C1, C2 or C3 portal contamination monitors per entries into the radiological controlled area; and other items, are not tracked or trended and are not communicated to the RP department or other departments.
- No briefing of relevant operating experience is delivered before first use of the radiological work permit for entering the radioactive sources storage room. When asked, the counterpart stated that this is not a requirement.
- During the plant tour inside the radiological controlled area, a plant supervisor approached some piping associated with the spent fuel pool cooling circuit. The RP

technician taking part in the tour did not challenge the supervisor, but later explained that the correct practice was to find a monitor to take radiation measurements before being allowed to approach the equipment.

– There is no rule enforcing the use of safety goggles in the radiological controlled area to protect the lens of the eye against radiation from low energy photons and beta particles.

Without an effective implementation of ALARA principles, radiation protection for workers may not be always ensured and doses due to exposure to ionising radiation may be unnecessarily incurred.

Suggestion: The plant should consider reinforcing its radiation protection practices to ensure full implementation of ALARA principles.

IAEA Bases:

SS-R 2/2

5.11. The radiation protection programme shall ensure that for all operational states, doses due to exposure to ionizing radiation in the plant or doses due to any planned releases of radioactive material from the plant are kept below authorized limits and are as low as reasonably achievable.

GSR Part 3

3.77. Employers, registrants and licensees:

(a) Shall involve workers, through their representatives where appropriate, in optimization of protection and safety;

(b) Shall establish and use, as appropriate, constraints as part of optimization of protection and safety.

NS-G-2.7

3.43. Preparation of the work area may be necessary, for example by: cordoning it off and posting warning signs; laying down temporary coverings to retain contamination; and providing local changing areas for protective clothing, solid waste bins, additional radiation monitors, temporary radiation shielding or ventilation.

3.67. For the control of radiation exposure of personnel, consideration of the optimization of radiation protection is required in the design and operation of a nuclear power plant [1, 21] (see paras 2.14–2.33) in order to keep doses as low as reasonably achievable, economic and social factors being taken into account. In line with this requirement, in examining working procedures and activities, the reduction of doses should be given the highest priority. A hierarchy of control measures should be taken into account in optimization. Firstly, removal or reduction in intensity of the source of radiation should be considered. Only after this has been done should the use of engineering means to reduce doses be considered. The use of systems of work should then be considered and, lastly, the use of personal protective equipment.

Methods of dose reduction that should be considered include:

(a) reducing radiation levels in work areas, for example, by the use of temporary shielding;

(b) reducing surface and airborne contamination;

(c) reducing working time in controlled areas;

(d) optimizing the number of workers in the work team;

(e) increasing the distance from the dominant radiation source;

(f) identifying low dose areas where workers can go without leaving the controlled area if their work is interrupted for a short time.

Experience from previous work should be taken into account.

Plant Response/Action:

The station's drive to reinforce radiation protection practices has revolved around 2 priorities: organisation and equipment.

Concerning the organisational priorities, the station focused in 2016 on pre-outage dosimetry reviews. These consist in cooperating with trade sections to examine their predicted dosimetry objectives in light of planned work activities; verifying that the trades have factored-in OPEX; challenging them regarding small doses (particularly for repeat works); and jointly analysing any gaps between contractual dose limits and predicted doses, in order to examine the justifications for such gaps. Review meetings are also held to establish what went well, unforeseen issues, problems to be addressed and areas for improvement, so as to incorporate these aspects into future activities.

In addition, during outages, radiological work permits (RWP) are monitored daily via a new dashboard. Whenever a RWP is noncompliant, the trade section is notified and has a face-to-face meeting with the work coordinator, depending on the deviation and the remaining margin for dose uptake.

The station also establishes ALARA Committee meetings for all high-dose works, to challenge contractor companies on the measures taken to optimise worksite dosimetry. A specifications logbook was therefore created, setting out the expectations of an ALARA Committee; the logbook was updated to incorporate OPEX from previous ALARA Committee meetings. Once work has been completed for a job subject to an ALARA Committee ruling, the job is systematically analysed by the contracting trade section and the Risk Prevention department to extract OPEX.

Furthermore, the process for identifying and addressing hot spots was put back on track. The Radiological Risk Control Committee reviewed and approved a new organisation. Benchmarking was carried out against stations that are further ahead in this regard, such as Cruas and Blayais NPPs. In 2016, only 3 hot spots were successfully addressed, as flushing operations were not effective for some hot spots. The station will continue working on this issue, to factor-in the OPEX from these flushing operations and examine alternative techniques.

As regards dose and dose equivalent rate alarms, the station is not in a position to make changes, as the alarm settings for operational dosimeters are established at corporate level.

IAEA's feedback was passed on to the corporate departments, and a working group has been created to consider reconfiguring the existing lower limit settings.

The station will push forward with its efforts in 2017, and place special emphasis on establishing a list of activities that have useful OPEX – briefs will be written up gradually to help underpin successful work execution. The purpose of these OPEX briefs will be to share the lessons learned by workers during their activities, and to help young technicians. However, OPEX linked to document modifications and fleet OPEX is already systematically factored-in after debriefs, and incorporated in procedure updates.

Concerning the equipment priorities, the station has invested in installing permanent, seismically-qualified biological shielding, in transit areas presenting a significant dosimetric impact. Some equipment has been fitted with this shielding, such as nuclear sampling system air coolers REN1RF to 4RF on units 1 and 2 (with the unit 3 and 4 coolers scheduled for the upgrade during 2017), and chemical and volume control system coolers RCV002RF on all 4 units.

In addition to the permanent biological shielding already in place, the station is working to establish a standard blueprint of biological shielding for each outage, customised to the planned workload. Further work will be done with the Logistics-Technical department (SLT) to arrange for the operatives in charge of installing lead shields to physically locate and identify components masked by biological shielding. This will ensure maximum protection for workers walking near these areas, minimise the exposure time of workers manipulating valves, and reduce the removal of shields by workers looking for particular valves.

Moreover, wearing safety glasses in the controlled area has been mandatory since the beginning of 2016. To this end, all station workers have been issued with safety glasses and all RCA hardhats have been fitted with visors. Contractor companies have been instructed to equip their personnel. Eye protection has been made a priority, partly in response to the comments of IAEA reviewers, but also in an effort to reduce the risk of damage to eyes from dust and chemical products.

Lastly, concerning areas with higher dose equivalent rates, the station is considering motion-sensor beacons that trigger flashing lights and alarms whenever anyone enters the area. This will be trialled in one of the twin units during online operation, and then during outages, depending on results. The aim of these beacons would be to warn workers that they are entering a high dose equivalent rate area, and should therefore limit their time in this area.

All the different initiatives taken in the past year have helped control outage dosimetry, and allowed the station to attain a collective dosimetry result for the unit 1 refuelling outage that is one of the best in the fleet of 900MW series plants.

IAEA comments:

The plant has implemented a systematic approach to define corrective measures and improve the implementation of ALARA practices. The status of the implementation of the corrective measures at the time of the mission was as follows:

- The plant introduced the pre-outage reviews of dose budgets and performs a detailed analysis of dose recorded by the dosimetry. During outages, validity of radiation work permits are monitored daily via a new dashboard.
- The plant has initiated the development of pre-job briefing guides that consider local and fleet radiation protection related operational experience (OPEX). The purpose of these OPEX pre-job briefs is to share the lessons learned by workers during their activities, and also to help new technicians. Pre-job brief guides are progressively being written and a list of activities with useful local and fleet OPEX is being drawn up.
- The station ALARA Committee meetings now include operating experience from all high-dose work activities, and this is an expectation.
- Close attention was also paid to the biological shielding. Improvements include new installations of permanent shielding as well as the optimization of shielding that is customized to the planned workload.
- The Radiological Risk Control Committee reviewed and approved a new organisation for identifying and addressing radiological hot spots. However, in 2016 only 3 out of 15 hot spots were successfully addressed. The station will continue to work on this issue to examine alternative techniques.
- Motion-sensor beacons that trigger flashing lights and alarms whenever anyone enters the high dose risk area are being considered. These beacons would further improve ALARA.
- The station has not considered lowering/adjusting of individual dosimeter alarm thresholds (set points) for each specific activity. However, the matter has been raised with the Corporate entity and a working group has been created to consider reconfiguring the existing lower limit settings.
- Since 2016 it is a requirement to wear eye protection in the RCA, and information posters have been placed at the RCA entrance. However, in the RCA some workers were observed not wearing eye protection.

Conclusion: Satisfactory progress to date

7.4(2) Issue: The plant contamination controls are not always effective to prevent spreading of contamination**.**

The team noted the following:

- The instruction for workers triggering an alarm at the C1 portal contamination monitor is to remove their clothing and repeat the monitoring. If there is no other alarm, they are allowed to leave the controlled area. Consequently, discrete radioactive particles, which are potential causes of alarms, may remain on the protective clothing and not be collected.

- On 3 August 2014, some black dust was observed by the workers while working in the steam generators; however no additional precaution was put in place. This later led to 5 internal and 2 external contaminations of workers.

- Recent event at Blayais NPP with significant contamination demonstrates the importance of the effective control of the discrete particles also for Dampierre.

- The plant, according to fleet standards, does not perform routine dosimetry surveys to surch for discrete radioactive particles, does not search for hot particles inside the working areas and at the C1 portal contamination monitor exit by using specific techniques. In addition, it does not track or trend hot particles found in the controlled area.

- With regards to all positive contamination counts at the C2 portal contamination monitor, which do not require medical assessment, no skin dose assessment is made to identify a possible recordable dose.

- In 2014 and 2015, for all positive contamination counts recorded at the C2 portal contamination monitor (some of them requiring intervention from the medical staff) no skin dose assessment was carried out. Two of them were contaminations with 400 counts per second, about 2100 Bq, which means a received skin dose of about 5.9 millisieverts for 2.5 hours of work, as calculated by the Varskin code. However, no dosimetry was performed regarding skin contamination, because the plant´s recordable level for skin dose is 50 millisieverts.

- Frequently, positive counts at C2 portal (one of them presenting more than 3000 Bq) are not confirmed at the medical centre, located outside the controlled area and the protected area.

- Once confirmed, the values measured at C2 portal contamination monitor are sometimes not consistent in terms of activity with the values measured by the plant’s medical staff.

- Contamination forms do not have fields for entering exposure time, type of contamination (distributed over the body area or localised).

- Workers leaving the radiological controlled area do not systematically use the friskers required to monitor feet (because the C1 portal contamination monitor has no foot radiation detector). Before the C2 portal, workers remove their safety shoes, and possible radioactive particles masked by the shoes may remain undetected.

- Close to the friskers at the C1 portal contamination monitor exit, there are no phones to inform RP staff about detected contamination.

- The personal decontamination facility is not located at the radiological controlled area exit.

- Inside the clearance material area, there is material wrapped in plastic close to the wall, without any visible contamination level indication.

By not effectively applying contamination controls, the plant´s resilience against contamination events may be reduced, leading to possible spread of contamination and possible doses caused by contamination.

Suggestion: The plant should consider strengthening its contamination controls, in order to effectively prevent the spread of contamination and to protect against possible doses caused by contamination.

IAEA Bases:

GSR Part 3

3.88. Registrants and licensees shall designate as a controlled area any area[32] in which specific measures for protection and safety are or could be required for:

(a) Controlling exposures or preventing the spread of contamination in normal operation;

3.90. Registrants and licensees:

…(d) Shall establish measures for protection and safety, including, as appropriate, physical measures to control the spread of contamination and local rules and procedures for controlled areas.

…(g) Shall provide, as appropriate, at exits from controlled areas:

(i) Equipment for monitoring for contamination of skin and clothing;

(ii) Equipment for monitoring for contamination of any objects or material being removed from the area;

(iii) Washing or showering facilities and other personal decontamination facilities;

3.100. For any worker who usually works in a controlled area, or who occasionally works in a controlled area and may receive a significant dose from occupational exposure, individual monitoring shall be undertaken where appropriate, adequate and feasible. In cases where individual monitoring of the worker is inappropriate, inadequate or not feasible, the occupational exposure shall be assessed on the basis of the results of workplace monitoring and information on the locations and durations of exposure of the worker[33].

3.130. Registrants and licensees shall ensure, as appropriate, that:

(a) Specific provisions for confinement are established for the design and operation of a source that could cause the spread of contamination in areas that are accessible to members of the public;

(b) Measures for protection and safety are implemented for restricting public exposure due to contamination in areas within a facility that are accessible to members of the public.

RS-G 1.3

A.4. … Sometimes, however, the contamination persists or is initially very high, and some estimation of equivalent dose becomes necessary. In such cases the dose should be averaged over an area of 1 cm2 which includes the contamination…

… However, where an estimate of equivalent dose is made that exceeds one-tenth of the appropriate equivalent dose limit, it should be included in the individual's personal record. Some of the contamination may also be transferred into the body, causing internal exposure. Monitoring for any associated intake of radioactive material into the body is discussed in the related Safety Guide on internal dose assessment [4].

A.5. Situations may arise in which exposure to 'hot particles' is possible. This can lead to spatially non-uniform exposure from discrete radioactive sources with dimensions of up to 1 mm. While compliance with dose limits is a principal objective, the ICRP has noted [37] that acute ulceration is a particular endpoint to be prevented.

This implies that the average dose delivered within a few hours over a skin area of 1 cm^2, measured at depths of 10–15 mg/cm^2, should be restricted to 1 Sv. Detection of hot particles within an ambient radiation field in a workplace can be difficult, because of the very localized nature of the radiation from the particle. Emphasis should be given to identifying and controlling those operations which could give rise to such particles.

Plant Response/Action:

To strengthen its contamination control practices so as to effectively prevent the spread of contamination and protect its workers against possible contamination-induced doses, the plant is working on several focus areas:

- First, a communications campaign was conducted in 2016 to remind field workers of the importance of using the contamination meters installed at various points within the radiation controlled area (RCA). This campaign also highlighted the need to perform self-checks as close to the worksite exit as possible, to ensure rapid detection of any contamination particles. To help field workers, maps indicating trolley locations have been introduced in strategic positions inside the reactor building. For 2017, the plant is considering how to include the contamination checkpoints in this measure.

- Zone Managers - a position introduced in 2015 for outages - provide work leads with support and guidance at their worksites, specifically in relation to radiation protection. They ensure that dressing and undressing practices are properly observed. In addition, they undertake regulatory mapping and contamination checks by sampling to ensure radiological cleanliness of worksites and traffic flow areas.

- The plant is also working on field worker checks upstream of the C1 portal monitors. Contamination meters should allow workers to self-check ahead of every C1 portal monitor. 10 new contamination meters (MIP 10) were purchased in 2016 with a view to updating our equipment. Signs displayed close to the MIP 10s and in the C1 portal monitors remind workers of the need to self-check before going through the monitors. Signs have been displayed to remind workers of the procedure to be followed if contamination is detected by the monitors, particularly if no RCA supervisor is present. Checks will be conducted to ensure that communication methods are available ahead of each of these checkpoints; if necessary, telephones will be installed.

An assessment of our contamination events has shown that contamination is most commonly found on the hands. The rules on wearing gloves have consequently been made clearer. These rules should be communicated again prior to the outage. Furthermore, hand and feet monitors have been installed in the nuclear auxiliary building changerooms, to ensure that workers have not contaminated their hands or feet as a result of their undressing practices.

Work has also been undertaken with the RCA changeroom supervisors following the re-activation of showers in the changerooms. Further clarification has been provided on the procedure to follow if radioactive particles in excess of 3000 Bq are detected. The monitor would detect any such contamination using a COMO device, and a user's guide for this device will be updated for RCA changeroom supervisors. Monitors have been provided with kits so that samples can be taken as early as possible in cases of one-off contamination. Reminders will be provided on the process in place and on how these kits are to be used. For cases of contamination below 3000 Bq or below the chin, showers now allow RCA supervisors to deal with workers directly inside the RCA. For other cases, the medical department has to be called. Where contamination is detected, Zone Managers support supervisors in identifying causes.

Lastly, tools will be introduced by the medical organisation to ensure that results are provided in the same units as those given for the C2 portal monitors, to allow for comparisons to be drawn. In addition, the Occupational Health Department is currently working on case management forms for contaminated individuals.

IAEA comments:

The plant undertook several steps to resolve the issue. This included administrative actions, enhancement of safety culture and upgrading facilities to enable better contamination control. The status of implementation of those activities was reviewed during the follow-up mission and found to be as follows:

- Zone managers have been introduced and assigned to supervise RP practices at the worksites and to perform mapping and contamination checks.
- The rules on wearing gloves are being revised and will be implemented from the next outage.
- As part of an information campaign workers were reminded about their personal

contamination measurement duties and also about the location of contamination instrumentation. However, not all the C1 portal contamination monitors have telephones nearby to directly call for radiation protection assistance in the event of contamination. The station plans to install these telephones in near future.

- The plant continues in its effort to ensure workers systematically use the friskers before the (C1) portal monitors located in front of the hot change rooms. However, during the plant visit, some workers were observed not following all the self-check steps using the friskers; one out of 10 workers observed completely avoided the frisker control point.
- New contamination meters were purchased and signs are now displayed to remind workers of the need to self-check before going through the monitors and what to do if a contamination alarm is triggered. The effectiveness of implemented measures will be further checked by the plant.
- The procedures dealing with personal contamination above or below the 3000 Bq have been updated, and are pending administrative approval.
- The showers were reactivated in the change rooms to facilitate personal decontamination for male workers. However, the reactivation of the female's showers is not yet completed.
- Further activities continue on measuring instruments to ensure that results from medical department will be provided in the same units as those given for the C2 portal monitors so that values could be comparable. In addition, forms for contaminated individuals are being revised to improve the recording of personal contamination and the precision of dose calculation.

The follow-up mission found actions taken by the plant to resolve the issue and progress made adequate, however time is needed to fully complete some of the actions and to demonstrate that sustainable results are achieved.

Conclusions: Satisfactory progress to date

8. CHEMISTRY

8.1. ORGANIZATION AND FUNCTIONS

Important information related to chemistry is well communicated across the plant departments. There is a set of environment data available on website. The Chemistry department publishes two kinds of bulletins. A Safety bulletin is issued every 2 months for strengthening safety culture in the chemistry department and an Information bulletin every 6 months about chemistry activities on the plant. The team recognizes this as a good performance.

8.2. CHEMISTRY PROGRAMME

The use of Chemistry Performance Indicator (IPC) across the EDF fleet allows fast and comprehensive review of plant chemistry parameters and trending of the results. The indicator is automatically compiled from the comprehensive plant data recorded in"Merlin" software database. The IPC can be easy to trend and so can be used to evaluate the effectiveness of any corrective actions. The team considers this as a good performance.

Ammonia recovery from the air mass of the condenser is both economically advantageous and a benefit to the environment. The team recognized this as a good performance.

The current primary circuit chemical surveillance programme may not be sufficient to cover all corrosion processes and it misses out the continual or frequent measurement of oxygen when the reactor is at power and the measurement of corrosion products such as oxides of the most used metals and sulfates. Action levels are not systematically applied to all chemistry parameters. Recently, EDF has prepared an analytical programme comprising relevant species such as iron, nickel, cobalt and chromium, that will be implemented in the chemical specifications and deployed to the whole fleet. The team encourages the plant to ensure timely implementation of the new primary circuit chemistry surveillance programme and monitor its effectiveness.

The team observed some deficiencies in quality control, storage management and labelling of chemicals. The team made a suggestion in this area.

The expectations of using PPE are not sufficiently comprehensive to cover all the risks incurred by the activities carried out in the chemistry laboratories. The team observed some examples of lack of use of PPE. The team encourages the plant to strengthen its industrial safety control in all the chemistry-related activities.

8.4. CONTROL OF PLANT CONFIGURATION

The demineralisation water treatment equipment is of the original design (as of 1981) without any modernisation. Due to apparent aging degradation, the team encourages the plant to analyse the status of demineralization water treatment equipment with regard to its impact on reliable supply of demineralised water and waste management.

DETAILED CHEMISTRY FINDINGS

8.2. CHEMISTRY PROGRAMME

8.2(1) Issue: The quality control, storage management and labelling of chemicals and other substances do not consistently ensure their appropriate and safe use.

The team noted the following:

- There was no approved analysis of the quality of the chemical agents before discharging caustic soda from a trailer to storage. There was only a pH test.
- There is no quality checking of chemicals when delivered to the plant additional to that which is performed by EDF corporate.
- Not all chemicals (i.e., ERAKLIN, CASORER CN) used on plant have PMUC (chemical approved for use in NPPs) labels.
- Oils in the oil store do not consistently have expiry date labels.
- There is no expiry date labeling of transport containers filled at the oil store.
- If chemical expiry date is not specified by a producer, an expiry date will not be assigned by the plant (e.g., NaOH 30% containers in storage area).
- Nitric acid containers are placed on metal catchment trays which is not appropriate given that nitric acid reacts quickly with metal.
- Different kinds of chemicals (acids, flammable, alkalis, etc.) are stored in close proximity in the same storage facility.
- A used diesel tank near the transport receiving building (BCTR) did not have any hazard and content labeling.

Without strict quality control, storage management and labelling of chemicals and other substances, their appropriate and safe use is not ensured.

Suggestion: The plant should consider enhancing the quality control, storage management and the use of labelling of chemicals and other substances to ensure their appropriate and safe use.

IAEA Bases:

SSR-2/2

7.17. The use of chemicals in the plant, including chemicals brought in by contractors, shall be kept under close control. The appropriate control measures shall be put in place to ensure that the use of chemical substances and reagents does not adversely affect equipment or lead to its degradation.

No. SSG-13

5.5. The chemistry control programme should support the production of high quality water and should include the following:

(d) Quality management of the chemicals used in the coolant systems and hence avoidance of detrimental effects from pollutants.

9.1. A policy should be established to prevent the use of chemicals or other substances that could introduce potentially harmful impurities into plant areas or circuits, thereby affecting the coolant, auxiliary and safety systems, or other external surfaces. The responsibility for coordinating the control of chemicals and other substances on-site should also be clearly established in accordance with the requirements established in Ref. [7].

9.5. The reagents and ion exchange resins used for any safety related system should be within the required specifications with regard to impurities and this should be verified before their use.

9.8. When receiving chemicals, the specified quality should be verified by chemical analysis and/or by a certificate and a chemical identification test.

9.9. Chemicals and substances should be labelled according to the area in which they are permitted to be used, so that they can be clearly identified. The label should indicate the shelf life of the material.

9.10. When a chemical is transferred from a stock container to a smaller container, the latter should be labelled with the name of the chemical, the date of transfer and pictograms to indicate the risk and application area. The contents of the smaller container should not be transferred back into the stock container. Residues of chemicals and substances should be disposed of in accordance with plant procedures. The quality of chemicals in open stock containers should be checked periodically.

9.15. Chemicals should only be stored in an appropriate store that is fire protected and captures spillages and which is equipped with a safety shower, as required. Oxidizing and reducing chemicals, flammable solvents and concentrated acid and alkali solutions should be stored separately. Tanks containing chemicals should be appropriately labelled. Reasonably small amounts of chemicals can be stored in other controlled environments in the workshops or operational department.

9.17. A procedure should be established to define the proper quality of all oils used for each component important to safety and used for the availability of systems important to safety.

9.18. Lubricants and hydraulic oils from systems important to safety and/or the availability of systems important to safety should be regularly analysed to check control parameters that characterize the condition of the lubricant.

Plant Response/Action:

This action plan is designed to address the findings that led the IAEA to issue a suggestion on the control, labelling and storage of chemical products used in our facilities and laboratories.

Before setting out the action plan, it should be borne in mind that – in a drive to avoid the bringing in any chemicals and other substances that could introduce potentially harmful impurities into primary, secondary, auxiliary and emergency circuits – the DPN (Nuclear Generation Division) established a risk prevention policy for conditioning products. This initiative – which defines products and equipment suitable for use in a nuclear facility (PMUC) – deals with a number of potential hazards (corrosion, flow acceleration, etc.) by issuing supplier specifications that clearly define the expected compositions and maximum authorised concentrations of the most harmful impurities. Authorised limits are consistent with the reference procurement specification stipulated in EPRI 1022558.

This organisation ensures that the DPN’s operators have chemical products (decontaminants, lubricants, conditioning products, sealing agents, etc.) with compositions that are guaranteed by suppliers and by periodic checks conducted at corporate level. This dispenses the station from performing any additional analyses on site. The composition of these different compounds can be retrieved from the corporate PMUC database. The expiry dates and/or the shelf lives of products are recorded on the containers. The storehouse has been reorganised so that the products that must be used as quickly as possible have special markings. All products that have expired are withdrawn and therefore not at risk of being inadvertently used. And to control the risks associated with using chemical products on site, limits are placed on the quantities of products that are allowed in the plant and in laboratories.

As regards the labelling and storage of chemicals, the storehouse and oil-store in charge of overseeing chemicals and hydrocarbons have organised the systematic recovery of containers. PMUC labels are posted on all stock containers that require such markings. For products that are transferred into smaller containers, labels are available to customers so that they can note the type of product, the hazards and the expiry date, including an expiry date after opening. Concerning storage conditions, the OSART findings have been addressed, and regular checks are made both in the storehouse and in the oil-store to ensure compliance with the rules in force.

This organisation was presented to all persons in charge of chemicals in the storehouse and in the oil-store. All the departments’ industrial safety leads were also told of these arrangements via the Committee for the Control of Industrial Risks, and were also shown the new chemical compatibility chart drawn up by EDF. This presentation was an opportunity to issue reminders of responsibilities for controlling chemicals, of storage rules, and of the guidelines for using the station’s product safety data sheets.

In light of the risks associated with mixing acids and bases, special analyses are carried out in the demineralisation production plant before authorisation is given to transfer these products to the demineralised water production plant. These analyses consist exclusively in measuring pH and density. There is no analysis of impurities for those products used for the regeneration of demineralisation lines, for the neutralisation of effluents from the demineralised water production plant, or for raw water treatment. The quality of water derived from the demineralised water production plant – which is injected into plant circuits – is analysed and measured in order to guarantee that it meets chemistry specifications.

IAEA comments:

The plant has established a procedure to conduct on site checks and analyses of chemicals used at the water treatment plant upon reception. Checks and analyses of other chemicals (decontaminants, lubricants, conditioning products and chemical seals) are conducted by external laboratories according to a corporate organization on a centralized basis, and the results are readily available in the corporate PMUC database.

New labels have been developed for oil transport containers and chemicals in the chemical laboratories, with clear indication of expire date, content and other necessary information.

Chemical stores have been re-organized to take into account the compatibility of different chemicals store in close aproximaty. A new chemical compatibility chart has been adopted and posted in the plant chemical stores to provide in-situ reminders and to allow checks. The detailed information regarding the chemicals in the store is posted in the vicinity of the chemicals. Maximum capacity for chemical storage on the catchment trays is specified and posted, and catchment trays are arranged accordingly.

A field visit to the chemical stores, storage cabinets and water treatment plant indicated that these improvement actions have been implemented in the field.

Conclusion: Issue resolved

9. EMERGENCY PREPAREDNESS AND RESPONSE

9.1. ORGANIZATION AND FUNCTIONS

The team observed that the plant has established a robust emergency response framework. Nevertheless, the team made some observations regarding response process. In case of emergency, if the emergency senior manager on duty (PCD1) is not reachable, the shift manager cannot authorise the administration of iodine tablets to site personnel without the approval of the PCD1. During a multi-unit accident, there is no instruction stipulating which shift manager takes the role of the PCD1. The team encourages the plant to improve the clarity of role for the shift manager.

The corporate level emergency response is detailed and well organized. Within two hours of notifications by the plant, it is possible to establish and deploy Support Centres and contractors needed to ensure that the power plant receives the assistance it needs. In addition, there is good coordination between the plant, corporate level, the national nuclear regulator and regional authorities in the field of emergency preparedness. Emergency response members from the plant assist the off-site regional emergency commission. Additionally, these organisations have regular meetings to improve tasks related to emergency preparedness. The team considers this a good performance.

In order to have a permanent operational facility, the Dampierre and Belleville NPPs (located within 30 km of each other) decided to share their emergency preparedness facilities. As a result, the potentially impacted plant will have the possibility to evacuate its staff to the partner site. The team recognises this partnership as a good practice.

9.2. EMERGENCY RESPONSE

The team made observations regarding the effectiveness of reporting by emergency preparedness staff outside of normal working hours. There are no clear instructions on how to manage staff replacements and how to update the database which manages emergency response members on duty. A procedure exists for testing the notification system but there is no clear instruction on how to check the availability of members who did not acknowledge the alert. Therefore the team encourages the plant to improve these processes.

The procedure for volunteers has no formalised process for adding other workers to the existing list. Furthermore, the procedure for searching for missing persons on the site is not clear. The team encourages the plant to improve these procedures.

9.3. EMERGENCY PREPAREDNESS

The team observed several shortfalls, such as: the workers who perform emergency response activities in the plant may be exposed to radiological contamination but some emergency facilities do not have comprehensive screening and decontamination processes; equipment is available to measure and decontaminate people entering the emergency command posts bunker, however, this process is not fully formalized; there is no off-site back-up emergency control centre for emergency response members; and muster points are not fully equipped. The team made a suggestion in this area.

Drills and exercises are not always performed and evaluated to ensure their effectiveness. In the emergency preparedness Action Plan for 23/01/2015-17/03/2015, there is no evidence that 13 corrective actions (out of 23 in total) have been completed. There is no general procedure on how to organise local exercises. There is no exercise for shift managers during which PCD1 is unavailable. The team made a suggestion in this area.

The plant has a computerised logbook in various emergency response command posts and in the main control room. It enables prompt sharing of information and can be projected for easy viewing. The main benefits include tracking actions launched by each command post, as well as recording and assessing the timeline of actions in the longer term. The team has identified this as a good performance.

DETAILED EMERGENCY PREPAREDNESS AND RESPONSE

9.1. ORGANIZATION AND FUNCTIONS

9.1(a) Good Practice: Partnership between Dampierre NPP and Belleville NPP to take care of each other's potentially contaminated staff in case of an accident.

Dampierre NPP and Belleville NPP are located near each other (about 30 km).

Through this partnership between the two sites, the emergency preparedness organisation can take care of each other's staff in the event of an accident. This arrangement ensures that potentially contaminated persons are taken care of.

In order to have a permanent operational facility, the Dampierre and Belleville NPPs decided to share their emergency preparedness organisations. As a result, the affected plant will be able to evacuate its staff to the partner site. Evacuated staff will therefore be placed under the responsibility of the partner site. This may include the management of potentially contaminated people.

Once a year, during an emergency exercise, each site tests this arrangement in order to make sure that each partner has the capacity to manage personnel. In 2015, Dampierre and Belleville both took the opportunity during their own on-site emergency plan - radiological safety (PUI SR) exercise in March - to transfer their employees by bus to the partner site. So far, no deviations have challenged the practicability of this arrangement.

The main benefits of this partnership are:

– Use of the partner site's facilities, therefore easier maintenance because they are used every day by the partner site.
– The partner site is placed in charge of managing transfered staff, therefore simplifying management of the emergency response and implementation of protective actions of impacted plant;
– Access to the partner site's facilities for decontaminating persons, etc.
– The on-duty emergency preparedness system of the partner site can be used (remotely) by the impacted site to take care of staff.

9.3. EMERGENCY PREPAREDNESS

9.3(1) Issue: The readiness of emergency facilities and equipment is not always ensured.

Although the plant has a procedure for the surveillance and maintenance of emergency facilities and equipment, the following observations were made:

- Bunker and command posts:
  - There is no off-site back-up emergency control centre for emergency response members.
  - On the plant, there is no specific procedure with criteria to be used by PCD1 to instruct duty emergency workers who cannot enter the plant's emergency facilities.
  - There is only one toilet available for all emergency response team members.
  - There is no list of all documents that are required.
  - There are two equipment cupboards with emergency equipment such as personal protective equipment. Nevertheless, some shortfalls were found. For example, a manual for an RP contamination meter had no official approval.
  - Equipment is available to measure and decontaminate people entering the bunker. However, this process is not fully formalized.

- Muster points:
  - Protection kits (coveralls, paper hats, gloves, overshoes) and iodine tablets are available but respiratory masks are not provided. There are only 10 protection kits in each muster point. Additional respiratory masks and protection kits are stored in an emergency storage tent away from the muster points, which would be insufficient to fully protect personnel in a timely manner.
  - The muster point identification number is not visible on the muster point panel. However, muster points with reference numbers appear on the general site map.
  - A walkdown of the muster points in the administration building and training centre identified that there was no inventory list of equipment that should be present, no list of the documents that should be contained in the muster point folder, and no jacket to identify the muster point coordinator.

- Others:
  - A walkdown of two emergency mobile trucks (PCOM, VE2I) revealed that there was no separate inventory of the equipment in each truck, only one common list for both trucks, without clear identification of which equipment should be in PCOM and which in VE2I. In PCOM, there was no inventory of the documents that should be present, no personal protective equipment, and one coverall which was not listed in the common list. In VE2I, there was no quality assurance process implemented for the dosimetry logbook.
  - Forms recording important data, and used by emergency command posts - such as the main control room (PCL), the management command post (PCD) - are sent by fax and are handwritten. There is no computerized form used to share information, except the one used for communicating with off-site authorities.
  - The plant has a dedicated tent for storing new emergency equipment, which is protected against seismic hazards. Nevertheless, there are some concerns: even though the tent is equipped with an automatic heating and ventilation system, there is no clear instruction to check the temperature on a regular basis under extreme weather conditions.

– The reference code (MLC) used to determine the status of emergency equipment from the main control room was not updated in the electronic logbook for one item of emergency equipment (DG LLC 682 GE).

Without full readiness of the emergency facilities and equipment, the effective management and implementation of emergency operations and protective actions might be jeopardized in an event of emergency.

Suggestion: The plant should consider improving the readiness of its emergency facilities and equipment.

IAEA Bases:

SSR 2/2:

5.7. Facilities, instruments, tools, equipment, documentation and communication systems to be used in an emergency shall be kept available and shall be maintained in good operational condition in such a manner that they are unlikely to be affected by, or made unavailable by, accident conditions.

GS-R-2

5.2 (7) An inventory of the emergency equipment to be kept in readiness at specified locations;….

5.21. The operating and response organizations shall develop the necessary procedures, analytical tools and computer programmes in order to be able to perform the functions specified to meet the requirements for emergency response established…

5.25. Adequate tools, instruments, supplies, equipment, communication systems, facilities and documentation (such as procedures, checklists, telephone numbers and manuals) shall be provided for performing the functions…. These items and facilities shall be selected or designed to be operational under the postulated conditions (such as the radiological, working and environmental conditions) that may be encountered in the emergency response, and to be compatible with other procedures and equipment for the response (such as the communication frequencies of other response organizations), as appropriate. These support items shall be located or provided in a manner that allows their effective use under postulated emergency conditions.

5.26. …. These emergency facilities shall be suitably located and/or protected so as to enable the exposure of emergency workers to be managed in accordance with international standards.

5.27 …. Appropriate measures shall be taken to protect the occupants for a protracted time against hazards resulting from a severe accident.

Plant Response/Action:
As a first step, the findings raised by the IAEA were analysed in a search for the root causes that could explain the types of deviations that had led to suggestions 9.3 (1) and 9.3 (2).

This analysis highlighted that the station's emergency organisation relied on the stewardship of two Internal Emergency Plan (IEP) Engineers, based in the Safety-Quality department. Their mission since 2011 had been to prepare and implement (by the end of 2015) the organisational and documentation changes derived from Fukushima operating experience feedback, and to coordinate skills development within the IEP team, in light of these new standards.

Considerable work was done in 2014 and 2015 to improve both documentation and organisation, while continuing to run exercises and to process operating experience, in order to guarantee the operability of the emergency organisation. From 2016 onwards, the chosen strategy was therefore to transfer the management of the emergency organisation to an Emergency Branch created within the Dampierre Regional Office of the Rapid Response Nuclear Taskforce (FARN). This decision was taken in 2014 and was underpinned by the IAEA's findings.

Emergency arrangements are therefore now in the hands of 6 employees, 50% of whom belong to the FARN, tasked with improving the workability of the emergency organisation, drawing on synergies between the FARN's mission to respond to severe accidents – requiring complete control of equipment, procedures and professional skills – and the effectiveness of the NPP's emergency arrangements (or IEP).

The following organisation – which should help further improve the reliability of emergency equipment, organisations and responders – was therefore set up:

Succession planning (GPEC) for the Emergency Branch has been incorporated into the multi-year succession planning carried out by the FARN Department Head.
As from 1 September 2016, the FARN Department set up the following organisation, comprising 6 individuals assigned to managing the IEP, and dedicating 50% of their time to FARN and 50% to the emergency response organisation.

As regards resources and distribution of roles:

(1) 1 IEP Lead;
(2) 1 DI115 Lead (site emergency equipment) (DI: corporate directive);
(3) 1 Lead for Control of Threats;
(4) 1 Emergency Exercise Lead;
(5) 1 Cross-functional Support Officer (SOER 2013-2 Post-Fukushima, monitoring actions);
(6) 1 Operational Lead for the Emergency Branch.

Job profiles (5) and (6) are assigned to cross-functional duties, providing back-up to the missions carried out by (1), (2), (3) and (4).

The resources available in 2016 are those detailed in (1), (2), (3), (4), (6), amounting to 2.5 FTE (full-time employment) positions. Resource (5) will return from maternity leave in February 2017, bringing that figure back up to 3 FTE units.

Moreover, in an effort to take account of the 0.5 FTE unit each resource allocates to emergency preparedness, all 6 resources will be spread out equally across the 5 FARN response crews, so as to guarantee the presence of one emergency response interface, during the time the person is not within FARN.

The arrival of resource (6) on 01/09/16 provided an opportunity to review management strategies with the IEP Strategic Lead. This practice has now been adopted, and since September 2016, a meeting has been taking place twice a week between IEP stakeholders.

The task of organising the Emergency Branch on a daily basis (short, medium and long-term strategy, local and nationwide interfaces) is the joint responsibility of resource (6) and the Strategic Lead.

This organisation – which required a significant investment in terms of training during 2016, to upskill a number of FARN employees regarding emergency preparedness and control of threats, and to upskill an IEP Engineer regarding the FARN's activities – has been in place since the autumn of 2016, and has made it possible to regain control of improvement actions.

Regarding equipment:

Dampierre NPP's emergency response organisation is in line with EDF's overall organisation and that of the public authorities. In this perspective, a new bunker and command post – referred to as the site Emergency Response Centre (CCL) – is scheduled for completion within a corporate timetable. This centre will be set up at Dampierre in 2021.

Meanwhile, the existing emergency bunker BDS meets all emergency requirements. It is equipped with the means of communication and technical hardware needed to support an emergency response in coordination with EDF corporate departments and government services.

A number of improvements have been set in motion to address the weaknesses identified by the IAEA.

A list itemising all the documents stored in the BDS has been produced and is available in the BDS.

Likewise, a decontamination process at the entrance to the BDS is being finalised for implementation.

Since 2016, the PCD1 Emergency Director roleholder has had the tools (action sheets) to manage an emergency without having to gather personnel in the BDS, but instead relying on conference calls and on- or off-site means of communication. This arrangement is designed to be used in the event of the activation of an IEP for toxic releases (PUI TOX), where a toxic cloud on site prevents responders from reaching their emergency stations, or in the event of a terrorist attack ('PSP' nuclear safety and site security alert).
Towards the end of 2016, studies were underway to examine extending this arrangement to other scenarios that would make the BDS unusable, notably with the creation of a guidesheet for the PCD1 to follow to define the other emergency response locations that are out of action. By the end of 2016, the following facilities had been identified: the Simulator Emergency Technical Centre (to the East of the site), the Support Command Centre (except for a 'PSP' nuclear safety and site security alert) located on the West side, and the emergency meeting room of the civil nuclear constabulary PSPG (located off-site).
These measures must be tested. A PUI TOX emergency exercise is scheduled for 08/02/2017. A PSP table-top exercise – conducted via conference calls – was deployed in 2016.

For most events that require a response, the NPP's facilities are accessible from the outside without radiological impact, thus allowing emergency responders to use the amenities on site and in neighbouring buildings (water, toilets, showers). Should an event occur where movement on site is no longer possible for radiological reasons, EDF support capability – which includes the FARN and surrounding NPPs (Belleville and Saint-Laurent initially, under a formal agreement, and other NPPs on the initiative of EDF) – can be mobilised to help the NPP and deploy the necessary measures to manage the situation.

- **Muster points:**

Personal protection kits and iodine tablets are available at the muster points but separate stocks are also available for distribution if needed. It is the local Prefect who decides when iodine tablets must be taken by the population. The station is organised to muster personnel, and do a headcount using the KKR security badge readers, and can therefore distribute iodine tablets at these points, as personnel are initially kept at muster points.

An inventory list of essential equipment will be added to each muster point, so that checks can be made.

- **Other areas for improvement:**

  - Local Command Post (PCL) and Management Command Post (PCD) forms are handwritten and sent by facsimile. No electronic system for sharing information (except for exchanges with the public authorities off-site).
  - In 2016, within the framework of the corporate emergency response organisation, the site rolled out a collaborative information system, with an electronic logbook that can be used to share information between local and national command posts. This information system will be finetuned in 2017, and will ultimately replace all printed documents.

  - The tent containing emergency mitigation equipment (MLC) is seismically qualified and is fitted with heating and ventilation systems. But there are no instructions to check the temperature on a regular basis in the event of extreme weather conditions.
  - Walkdowns by site security personnel will be put in place in 2017, as part of a wider project by security teams to adjust their rounds in response to vulnerabilities. These rounds will be used to check temperature conditions inside the tent, and alert the FARN in the event of heating problems. The walkdowns will be triggered by weather conditions.

  - Emergency vehicles PCOM and VE2I: there is one single inventory list of equipment for both vehicles. For mobile command post vehicle PCOM: no inventory required, no PPE. For emergency vehicle VE2I: no quality assurance process for the dosimetry logbook.
  - VE2I is not designed to carry documentation. Documents are available in PCOM, including an inventory list of applicable documents, as is the case for the BDS or LTC (emergency technical centre).

IAEA comments:

To resolve the issue concerning the readiness of emergency facilities and equipment, the plant has undertaken the following actions:

- Documentation and organisation of emergency preparedness have been improved: the management of the emergency preparedness was transferred to a dedicated Emergency Branch created within the Dampierre Regional Office of the Rapid Response Nuclear Taskforce (FARN).
- The decontamination process at the entrance to the emergency response centre (BDS) has been improved and respiratory masks have are now available at the muster points. However, additional protection kits remain to be distributed across the station's muster points and the inventory lists still have to be updated.
- An analysis was carried out on the unavailability of the emergency response centre (BDS). The plant identified the availability of other facilities on site, namely the Simulator Emergency Technical Centre, the Support Command Centre, as well as an off-site facility: the emergency meeting room of the local Dampierre police force. However, the procedure with specific criteria to evaluate the accessibility of the emergency response centre (BDS) is still under development. The PCD1 uses this procedure to define which other emergency response location can be used in case of BDS unavailability.
- The plant started to implement a new information system with an electronic logbook in 2016 to share information between local and national command posts, with a view to ultimately replace all printed documents. Implementation is currently in progress.
- A new bunker and command post – referred to as the site Emergency Response Centre (CCL) – is scheduled for completion at the NPP by 2021, according to the corporate schedule.

Conclusion: Satisfactory progress to date

9.3 (2) Issue: The drills and exercises are not always performed and evaluated in a way to ensure their effectiveness.

Although the plant has a detailed one-year exercise/drill schedule, with an evaluation process, the following observations were made:

- Exercise methodology:
  - In the emergency preparedness Action Plan for 23/01/2015-17/03/2015, there is no evidence that 13 corrective actions (out of 23 in total) have been completed.
  - Criteria are used to evaluate specific roles in the emergency centres. One of the ratings is defined as “not fully implemented” but without any explanation. Additionally, the timing of emergency actions is not rated.
  - Two general guidelines exist for EDF corporate exercises (D4550.34-12/5159) and general exercises with off-site authorities (D4550.34-13/0585), but there is no general procedure on how to organize local exercises.
  - There is no deadline for finalizing the exercise evaluation reports; the reports from the last exercises on 11/06/2015 and 24/06/2015 are not yet finalized.
  - If a shift manager is involved in an emergency exercise, his observations are not included in the evaluation report.

- Scope of exercise:
  - There is no exercise for shift managers during which PCD1 is unavailable.
  - The on-site emergency exercise includes an annual personnel muster. However, only a partial evacuation (one bus load) is exercised, and only every three years.
  - There is no exercise for emergency control centres involving use of personal protective equipment and personal dosimeters.
  - An exercise was carried out outside of normal working hours. The availability of personal protective equipment for the duty emergency response workers coming to the plant was not checked.
  - “Soft skills” training (such as cognitive skills, interpersonal skills, and work–related competencies) has not been delivered to the emergency response organisation’s key members to improve personal behaviours during emergencies.
  - No scenario has yet been exercised to cover:
    - multi-unit events (planned for the end of 2015);
    - implementation of the procedure for use of voluntary emergency workers in case of a radiation emergency event;
    - implementation of the procedure for searching for missing persons in case of emergency plan (PUI, PAM) initiation; and
    - evacuation of personnel from command posts due to severe radiological consequences.

- During the observation of one exercise:
  - The bunker’s badge reader was not operational, so that no computerised man-count was available.
  - Several people entered the bunker without registering in the security control system, even though they should systematically register when entering the bunker.
  - Some of the emergency workers did not fill in all the necessary steps of their action sheets.

– Only one exercise observer was appointed for the exercise, for all the command posts in the bunker, without specific criteria to follow for the evaluation.
– One of the four trainees wore an observer's vest during the exercise.
– Inside the bunker, no internal broadcast system was used by PCD1 to send out direct messages to personnel and avoid misunderstandings and delays.

Without efficient drills and exercises and their evaluation, the effectiveness of the emergency response organisation might be adversely impacted.

Suggestion: The plant should consider improving the rigor with which drills and exercises are performed and evaluated.

IAEA Bases:

SSR.2/2

5.6 The emergency plan shall be tested in exercises before the commencement of fuel loading. Emergency preparedness exercises shall be planned and conducted at suitable intervals, to evaluate the preparedness of plant staff and staff from external response organizations to perform their tasks, and to evaluate their cooperation in coping with an emergency and in improving the efficiency of the response.

GS-R.2

5.33. Exercise programmes shall be conducted to ensure that all specified functions required to be performed for emergency response and all organizational interfaces for facilities …..

5.34**.** The staff responsible for critical response functions for a facility in threat category I, II or III shall participate in a training exercise or drill at least once every year…..

5.36**.** The performance of exercises at facilities in threat category I, II or III shall be evaluated against established response objectives that demonstrate that identification, notification, activation and other initial response actions can be performed in time to achieve the practical goals of emergency response

EPR-METHOD (2003)

B6.3 Conduct drill and exercise programmes for specified functions required to be performed for emergency response and all organizational interfaces and the national level programmes at suitable intervals. Include the participation of as many as possible of the organizations concerned. Arrange for the exercises to be systematically evaluated and for some to be evaluated by the regulatory body. Ensure ongoing review and updating of the programmes

Plant Response/Action:

As a first step, the findings raised by the IAEA were analysed in a search for the root causes that could explain the types of deviations that had led to suggestions 9.3 (1) and 9.3 (2).

This analysis highlighted that the station's emergency organisation relied on the stewardship of two Internal Emergency Plan (IEP) Engineers, based in the Safety-Quality department.

Their mission since 2011 had been to prepare and implement (by the end of 2015) the organisational and documentation changes derived from Fukushima operating experience feedback, and to coordinate skills development within the IEP team, in light of these new standards.

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As regards resources and distribution of roles:

In terms of human resources and task distribution:
(1) 1 On-site Emergency Plan Lead
(2) 1 DI 115 (On-site emergency response equipment) Lead
(3) 1 Hazard Risk Management Lead
(4) 1 Emergency Management Training Exercise Lead;
(5) 1 Cross-Functional Advisor (SOER 2013-2 Post-Fukushima, action monitoring)
(6) 1 Emergency Section Operational Coordinator.

Roles (5) and (6) are cross-functional in nature, serving to support roles (1), (2), (3) and (4).

The resources available in 2016 are those detailed in (1), (2), (3), (4), (6), amounting to 2.5 FTE (full-time employment) positions. Resource (5) will return from maternity leave in February 2017, bringing that figure back up to 3 FTE units.

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Towards the end of 2016, studies were underway to examine extending this arrangement to other scenarios that would make the BDS unusable, notably with the creation of a guidesheet for the PCD1 to follow to define the other emergency response locations that are out of action. By the end of 2016, the following facilities had been identified: the Simulator Emergency Technical Centre (to the East of the site), the Support Command Centre (except for a 'PSP' nuclear safety and site security alert) located on the West side, and the emergency meeting room of the civil nuclear constabulary PSPG (located off-site).

These measures must be tested. A PUI TOX emergency exercise is scheduled for 08/02/2017. A PSP table-top exercise – conducted via conference calls – was deployed in 2016.

For most events that require a response, the NPP's facilities are accessible from the outside without radiological impact, thus allowing emergency responders to use the amenities on site and in neighbouring buildings (water, toilets, showers). Should an event occur where movement on site is no longer possible for radiological reasons, EDF support capability – which includes the FARN and surrounding NPPs (Belleville and Saint-Laurent initially, under a formal agreement, and other NPPs on the initiative of EDF) – can be mobilised to help the NPP and deploy the necessary measures to manage the situation.

- **Muster points:**

Personal protection kits and iodine tablets are available at the muster points but separate stocks are also available for distribution if needed. It is the local Prefect who decides when iodine tablets must be taken by the population. The station is organised to muster personnel, and do a headcount using the KKR security badge readers, and can therefore distribute iodine tablets at these points, as personnel are initially kept at muster points.

An inventory list of essential equipment will be added to each muster point, so that checks can be made.

- **Other areas for improvement:**

  - Local Command Post (PCL) and Management Command Post (PCD) forms are handwritten and sent by facsimile. No electronic system for sharing information (except for exchanges with the public authorities off-site).
  - In 2016, within the framework of the corporate emergency response organisation, the site rolled out a collaborative information system, with an electronic logbook that can be used to share information between local and national command posts. This information system will be finetuned in 2017, and will ultimately replace all printed documents.

  - The tent containing emergency mitigation equipment (MLC) is seismically qualified and is fitted with heating and ventilation systems. But there are no instructions to check the temperature on a regular basis in the event of extreme weather conditions.
  - Walkdowns by site security personnel will be put in place in 2017, as part of a wider project by security teams to adjust their rounds in response to vulnerabilities. These rounds will be used to check temperature conditions inside the tent, and alert the FARN in the event of heating problems. The walkdowns will be triggered by weather conditions.

  - Emergency vehicles PCOM and VE2I: there is one single inventory list of equipment for both vehicles. For mobile command post vehicle PCOM: no inventory required, no PPE. For emergency vehicle VE2I: no quality assurance process for the dosimetry logbook.
  - VE2I is not designed to carry documentation. Documents are available in PCOM, including an inventory list of applicable documents, as is the case for the BDS or LTC (emergency technical centre).

IAEA comments:

The plant has taken the following actions to improve the performance of drills and exercises and their evaluation:

- Since 2016 the emergency management structure has been modified by increasing the personnel capacity to better cope with emergency planning tasks, including training, drills and exercises.
- To formalise the structure of local on-site training exercise management, including requirements and rules, a methodology memo has been drafted and is pending approval.
- Changes have already been made in training scenarios to enhance topics such as multi-unit on-site emergency, simulating the unavailability of the head of the on-site emergency response team (PCD1). Since 2015, and depending on the scenario, on-site emergency response equipment is systematically planned and deployed for exercises.
- Observation forms have been introduced for observers, in addition to a standardised debriefing form in order to make exercise-based observations more specific. These observations have been mandatory since the beginning of 2017.
- Concerning the soft skills of emergency personnel, stress management training has been rolled out in test phase. The training is being adapted to suit emergency planning requirements and will be deployed according to a corporate schedule.
- During the OSART follow-up mission, station senior management demonstrated commitment to increase the frequency of exercises involving the evacuation of personnel from muster points with more buses than are currently used. Increasing the frequency of evacuation exercises (currently conducted every 3 years) is also under consideration.

The plant has systematically improved the process for preparation, setting the scope and evaluation of results from drills and exercises. All reviewed documentation was found to be well revised and amended.

Conclusion: Issue resolved

10. ACCIDENT MANAGEMENT

10.1. DEVELOPMENT OF SEVERE ACCIDENT MANAGEMENT STRATEGIES

The plant has implemented a number of modifications to reduce the risk of a severe accident and EDF has also completed Phase 1 for the establishment of the Fast Action Response Team (FARN) which can assist in the prevention and mitigation of severe accidents on more than one unit at any of the French NPPs sites.. However, the scope of the on-site severe accident management guidance does not address multi-unit accidents, accidents occurring in reactor shutdown states and spent fuel pool accidents. The team made a suggestion is this area.

10.5. ACCIDENT MANAGEMENT

The plant introduced systematic demarcation of zones where satellite telephone signal is available. This results in a reduced risk of a severe accident since this assists in facilitating coordination of accident management activities and also results in less exposure to radiation by minimizing the exposure period. The team recognized this as a good practice.

During the third ten-yearly outages from 2011 to 2014, the plant installed metal nets to protect nuclear safety equipment from extreme winds and associated missiles. The Emergency Diesel Generator radiators have additional concrete protection from falling objects. This reduces the vulnerability of important nuclear safety equipment such as the emergency diesel generator and the ultimate heat sink from extreme winds and associated missiles. The team recognized this as a good practice.

10.7. CONTROL OF PLANT CONFIGURATION

The processes for managing severe accident related modifications, equipment, procedures and training are not always effective at avoiding discrepancies. It was observed that the severe accident procedures do not yet incorporate all the modifications from the third 10-yearly outage from 2011 to 2014 and that the severe accident refresher training for some personnel involved in accident mitigation had been missed. Further, the availability of some equipment that could have been used in accident mitigation was not consistently ensured. The team made a suggestion is this area.

DETAILED ACCIDENT MANAGEMENT FINDINGS

10.1. DEVELOPMENT OF SEVERE ACCIDENT MANAGEMENT STRATEGIES

10.1(1) Issue: The scope of the severe accident management guidance does not systematically address accidents involving multiple units, accidents occurring in reactor shutdown states and spent fuel pool accidents.

The team observed the following:

- Multi-unit severe accidents are not considered within the severe accident procedures (GIAG) and no multi-unit severe accident exercises are planned.
- The on-site accident procedures for shutdown plant states where the primary circuit is open (e.g., SPE-O) do not currently link to the severe accident procedures and there are no on-site severe accident procedures specifically addressing shutdown states.
- The accident procedures for loss of spent fuel pool cooling (e.g., I.PTR) do not address severe accident conditions.
- The Emergency senior managers on duty (PCD1) and the Technical Support Centre (LTC) personnel receive no specific training for multi-unit severe accidents.
- Certain equipment that could be used to mitigate severe accidents (e.g., GUS generator, EAS 004 PO & Containment Filtered Vent) are shared between units.

The mitigation of a severe accident could be challenged without an accident management programme that comprehensively addresses all severe accident scenarios.

Suggestion: The plant should consider increasing the scope of the guidance provided to the plant staff to mitigate severe accidents; including multi-unit accidents, accidents occurring in reactor shutdown states and spent fuel pool accidents.

IAEA Bases:

SSR-2/2

Requirement 19: Accident management programme.
The operating organization shall establish, and shall periodically review and as necessary revise an accident management programme.

NS-G-2.15

2.12. In view of the uncertainties involved in severe accidents, severe accident management guidance should be developed for all physically identifiable challenge mechanisms for which the development of severe accident management guidance is feasible; severe accident management guidance should be developed irrespective of predicted frequencies of occurrence of the challenge.

2.16. Severe accidents may also occur when the plant is in the shutdown state. In the severe accident management guidance, consideration should be given to any specific challenges posed by shutdown plant configurations and large scale maintenance, such as an open containment equipment hatch. The potential damage of spent fuel both in the reactor vessel and in the spent fuel pool or in storage should also be considered in the accident management guidance. As large scale maintenance is frequently carried out during planned shutdown states, the first concern of accident management guidance should be the safety of the workforce.

2.17. Severe accident management should cover all modes of plant operation and also appropriately selected external events, such as fires, floods, seismic events and extreme weather conditions (e.g. high winds, extremely high or low temperatures, droughts) that could damage large parts of the plant. In the severe accident management guidance, consideration should be given to specific challenges posed by external events, such as loss of the power supply, loss of the control room or switchgear room and reduced access to systems and components.

Plant Response/Action:

A significant change has been made to the reference documents (severe accident management guide) used to manage severe accidents, with the inclusion of the Severe Accident Nuclear Safety Temporary Instruction (ITS). This temporary instruction, which is close to full implementation at Dampierre NPP, includes the following changes:

- Adjustment to ITS D455034090865 for PNXX1721 (error reduction in SEBIM valve opening) post-SOH and FKS
- PNPP1754 (Resupply of control room air conditioning system by fixed emergency supply system (LLS) diesel-generator set or by Nuclear Rapid Response Task Force diesel-generator set)
- PNPP1682 (Electrical resupply by emergency supply system (LLS) diesel-generator set)
- PNPP1746 (Detection of vessel break and operation of containment atmosphere monitoring system H2 recombiners)
- PNPP1702 (U5 pre-heating resupply by Nuclear Rapid Response Task Force diesel-generator set)
- Fuel building monitoring and post-Fukushima nuclear safety temporary instruction on reactor cavity and spent fuel pit cooling and treatment system
- Open states

This temporary instruction means that the scope of the severe accident management guide can be extended to include open states (where the reactor is shut down), and also allows for the inclusion of monitoring and management of the fuel building in severe accident management, which are directly included in the NPP's site procedures. The plant can therefore take immediate action, independently and without delay, as the involvement of the national teams is not compulsory when such actions are undertaken. This is in line with the suggestion made by the inspectors above.

The severe accident management guide is used to manage the operation of a unit, in the same way that the State-Based Approach instructions (APE, Chapter VI) are used to manage a unit in the event of an incident/accident. The implementation of multi-unit accident management actions is then ensured by the plant-level structure, thanks in particular to the implementation of the Integrated Climate and Environmental Safety On-Site Emergency Plan (PUI SACA). Consequently, this structure is not included in the severe accident management guide; instead, it is set out in the action plans of the various stand-by teams.

The question of organising a multi-unit severe accident management exercise will be put to the central departments, to establish what their scheduling may be in this respect.

IAEA comments:

In 2015/2016 the plant implemented significant changes to the procedures and documents addressing severe accidents. The Severe Accident Nuclear Safety Temporary Instruction (ITS- AG) was updated and included in the plant specific Severe Accident Management Guidelines (GIAG). The new GIAG version now covers severe accidents at shutdown states and severe accident conditions for spent fuel pool. However, entry points to GIAG from relevant EOPs (eg. SPE-O and procedure addressing loss of spent fuel cooling). These will be specified early in 2017.

Development of GIAG for multi-unit severe accidents is not currently considered. The management of multi-unit accidents on the site is governed by D5140NT/PUI/A2.0/LOIC procedure ‘Guide for initial orientation and multiple events’, however no specific training or exercises have been implemented to demonstrate the adequacy of multiple-unit severe accident management. In May 2016, an emergency exercise took place which covered a severe accident scenario for one of the unit and design basis accident scenario for a second unit. Further multi-unit accidents (including severe accident scenarios) exercises are planned on a regular basis.

The Emergency senior managers on duty (PCD1) and the Technical Support Centre (LTC) personnel have not yet received specific training on multi-unit severe accidents, however the plant is planning to perform such a training by the end of 2017.

Conclusion: Satisfactory progress to date

10.5. ACCIDENT MANAGEMENT

10.5(1) Good Practice: Demarcation of signal zones for Irridium satellite telephones.

The plant introduced systematic demarcation of zones where an Irridium satellite telephone signal is available. These areas are specifically located where signal interference from the cooling towers and buildings is minimised and has been tested by telecommunication experts. These areas are clearly sign posted so that response teams do not lose time searching for them during an extreme event.

Benefits:
- Reduced risk of a severe accident since this communication facilitates coordination of accident mitigation activities and
- Less exposure to radiation in the event of airborne contamination or ionizing radiation by minimising the exposure period.

10.5(2) Good Practice: Protection against extreme winds and associated missiles.

During the third ten-yearly outages from 2011 to 2014, the plant installed metal nets to protect nuclear safety equipment from extreme winds and associated missiles. The Emergency Diesel Generator radiators have additional concrete protection from falling objects.

Benefits:

– Reduced vulnerability of important nuclear safety equipment, such as the emergency diesel generator and ultimate heat sink, from extreme winds and associated missiles,
– Reduced risk of a severe accident by reducing the probability of loss of all AC Power and the ultimate heat sink.

10.7. CONTROL OF PLANT CONFIGURATION

10.7(1) Issue: The processes for managing severe accident related modifications, equipment, procedures and training are not always effective at avoiding inconsistencies.

The team observed the following:

– The plant modification control process does not require severe accident procedures to be updated since these procedures are not part of the General Operating Rules (GOR).

– Some severe accident related modifications (installed as part of the third 10-yearly outage, VD3) such as those for vessel failure indication and hydrogen recombination indication that were implemented in 2011 (Unit 1) to 2014 (Unit 4) are not currently reflected in the severe accident management procedures. A Temporary Operating Instruction (ITS-AG) for these VD3 severe accident modifications is planned to be issued by the end of 2015 while the permanent update to the GIAG (SAD) is only expected around the middle of 2017.

– The severe accident modifications implemented as part of the third 10-yearly outage VD3 (e.g., vessel failure indication and hydrogen recombination indication) do not appear in Operating Technical Specifications (STE) under the attachment for complementary safety equipment (MDC) and so their availability is not controlled by STE.

– The radiological sensor used in the procedure to mitigate loss of Spent Fuel Pool cooling (I.PTR) was unavailable at least from February 2015 to September 2015 which was a violation of National Directive DI115 Revision 1 issued in November 2014 which specifies a repair time of 1 month.

– Two Emergency senior manager on duty (PCD1), one Technical Support leader (ELC1) and three Deputy Technical Support leaders (ELC2) have not received the severe accident requalification training within the required timeframe in a document issued in May 2014. Similarly, there are Main Control Room operators who have not completed their severe accident requalification training within the required timeframe.

The mitigation of a severe accident could be challenged without procedures configured to the physical plant, the availability of equipment specified in procedures and up-to-date training.

Suggestion: The plant should consider increasing its focus on severe accident management to ensure the training requirements are met and procedures incorporate the most recent plant modifications.

IAEA Bases:

SSR-2/2

5.8. An accident management programme shall be established that covers the preparatory measures, procedures and guidelines and equipment that are necessary for preventing the progression of accidents dealing with beyond design basis accidents, including accidents more severe than the design basis accidents, and for mitigating their consequences if they do occur. The accident management programme shall be documented and shall be periodically reviewed and revised as necessary.

4.19. A suitable training programme shall be established and maintained for the training of personnel before their assignment to safety related duties. The training programme shall include provision for periodic confirmation of the competence of personnel and for refresher training on a regular basis.

Requirement 10: Control of plant configuration.

The operating organization shall establish and implement a system for plant configuration management to ensure consistency between design requirements, physical configuration and plant documentation.

NS-G-2.3

11.1. The following should be ensured by means of the document management system: That all relevant documents affected by the modification are identified and updated, and remain consistent with the plant specific design requirements, and that they accurately reflect the modified plant configuration;

NS-G-2.8

4.30. For operators, continuing training should be provided at appropriate intervals to ensure that the knowledge and understanding essential to safe and efficient plant operation are retained and refreshed, in particular for dealing with abnormal and accident conditions.

NS-G-2.15

2.11. For any change in the plant configuration or if new results from research on physical phenomena become available, the implications for accident management guidance should be checked and, if necessary, a revision of the accident management guidance should be made.

2.38. Appropriate levels of training should be provided to members of the emergency response organization; training should be commensurate with their responsibilities in the preventive and mitigatory domains.

3.111. For any change in plant configuration, the effect on EOPs and SAMGs as well as on organizational aspects of accident management should be checked. A revision of the documents should be made if it is found that there is an effect on these procedures and guidelines.

Plant Response/Action:

As mentioned under suggestion 10.1 (GIAG, or Severe Accident Management Guide), a significant change has been made to the reference documents [GIAG] used to manage severe accidents, with the inclusion of the Severe Accident Nuclear Safety Temporary Instruction (ITS). This temporary instruction, which is close to full implementation at Dampierre NPP, comprises the following changes:

- Adjustment to ITS D455034090865 for PNXX1721 (error reduction in SEBIM valve opening) post-SOH and FKS

- PNPP1754 (Resupply of control room air conditioning system by fixed emergency supply system (LLS) diesel-generator set or by Nuclear Rapid Response Task Force (FARN) diesel-generator set)
- PNPP1682 (Electrical resupply by emergency supply system (LLS) diesel-generator set)
- PNPP1746 (Detection of vessel break and operation of containment atmosphere monitoring system H2 recombiners)
- PNPP1702 (U5 pre-heating resupply by Nuclear Rapid Response Task Force diesel-generator set)
- Fuel building monitoring and post-Fukushima nuclear safety temporary instruction on reactor cavity and spent fuel pit cooling and treatment system
- Open states

This update has allowed for the incorporation of several equipment modifications that have a direct impact on the management of severe accidents, and has allowed us to benefit from on-site documentation that reflects the equipment modifications that are physically in place on the unit in question. The ITS has been partially incorporated, in line with the incorporation of equipment modifications. All that remains for incorporation is PNPP 1702 on Units 2 and 4, which will take place in 2018.

Document-based updates to the Severe Accident Management Guide are coordinated and carried out by the Quality Assurance and Nuclear Safety Department (SQS), in collaboration (information sharing) with the Joint Section (IPE), which is responsible for the implementation of equipment modifications on the installation.

The deployment of on-site emergency response equipment has been finalised (DI 115) and there are no deficiencies in relation to this equipment (the sensors used in the fuel pool loss of coolant management procedure (I.PTR) are available). An annual assessment of the availability of all on-site emergency response equipment is conducted, and the deployment of on-site emergency response equipment is performed during on-site emergency plan training exercises.

In terms of training, numerous refresher and initial training sessions were delivered in 2016 (to 129 workers as of end November 2016). A starting-point review will be undertaken by mid-January 2017 in order to identify whether there are still gaps in training, particularly in terms of observing refresher training timeframes.
The training requirements of department workers are tracked using a “training survey”, carried out by the department’s management team. Training requirements are therefore established to reflect the varying needs of a department’s workers, specifically for refresher training, depending on their qualification levels.

In 2017, an evaluation of Severe Accident training and the needs of on-site emergency plan team members will be conducted, with a view to creating training and refresher training sessions that are tailored to the needs of the relevant groups. Depending on the complexity of creating training sessions for these workers, which explains the inherent challenge of providing such training, e-learning options will be studied and implemented. This will be undertaken in 2017 for rollout no later than 2018.

IAEA comments:

The plant has analysed the issue and has undertaken systematic action to ensure that the processes for managing severe accident related modifications, equipment, procedures and training are effective to ensure plant configuration control.

The severe accident management procedures (GIAG) are referred to in chapter 6 of the General Operating Rules and thus the plant modification control process will initiate the update GIAG, as necessary. In 2016 the plant has updated the plant specific GIAG with the inclusion of the Severe Accident Nuclear Safety Temporary Instruction (ITS-AG) D455015052000 developed by EdF Corporate. Severe accident-related modifications (installed as part of the third 10-yearly outage, VD3) such as those for vessel failure indication and hydrogen recombination indication are now reflected in the severe accident management procedures. The unavailable equipment used in the procedures for mitigation of loss of spent fuel pool cooling, was repaired.

The plant has taken a systematic approach to enhance the training on severe accident management for relevant plant staff. Initial and refresher training sessions were delivered to 129 plant staff members in 2016. The training covering PCD1 positions is not yet completed, however the plant has developed a well structured approach to use initial e-learning modules to define the requested specific scope and needs for GIAG related training for PCD1. The actual training is planned for 2017.

Availability of the equipment used for severe accident management is partially controlled by Operating Technical Specifications (STE) for some equipment, or by other documents, e.g D514/RGE/CH3/COM.T1. Plant management is committed to define, specify and document the requirements for control of availability of all severe accident management related equipment and complete this process by the end of 2017.

Conclusion: Issue resolved

SUMMARY OF STATUS OF RECOMMENDATIONS AND SUGGESTIONS OF THE OSART FOLLOW-UP MISSION TO DAMPIERRE NPP

	RESOLVED	SATISFACTORY PROGRESS	INSUFFICIENT PROGRESS	TOTAL
Training& Qualification				
S 2.2 (1)		x		
Operations				
R 3.4 (1)		x		
R 3.4 (2)		x		
Maintenance				
S 4.5 (1)			x	
S 4.6 (1)		x		
R 4.6 (2)	x			
Technical Support				
S 5.2 (1)		x		
S 5.7 (1)	x			
Operating Experience Feedback				
R 6.5 (1)		x		
Radiation Protection				
S 7.4 (1)		x		
S 7.4 (2)		x		
Chemistry				
S 8.2 (1)	x			
Emergency Preparedness& Response				
S 9.3 (1)		x		

S 9.3 (2)	x			
Severe Accident Management				
S 10.1 (1)		x		
S 10.7 (1)	x			
TOTAL R				
TOTAL S				
TOTAL	5(31%)	10(63%)	1(6%)	16

DEFINITIONS

DEFINITIONS – OSART MISSION

Recommendation

A recommendation is advice on what improvements in operational safety should be made in that activity or programme that has been evaluated. It is based on IAEA Safety Standards or proven, good international practices and addresses the root causes rather than the symptoms of the identified concern. It very often illustrates a proven method of striving for excellence, which reaches beyond minimum requirements. Recommendations are specific, realistic and designed to result in tangible improvements. Absence of recommendations can be interpreted as performance corresponding with proven international practices.

Suggestion

A suggestion is either an additional proposal in conjunction with a recommendation or may stand on its own following a discussion of the pertinent background. It may indirectly contribute to improvements in operational safety but is primarily intended to make a good performance more effective, to indicate useful expansions to existing programmes and to point out possible superior alternatives to ongoing work. In general, it is designed to stimulate the plant management and supporting staff to continue to consider ways and means for enhancing performance.

Note: if an item is not well based enough to meet the criteria of a 'suggestion', but the expert or the team feels that mentioning it is still desirable, the given topic may be described in the text of the report using the phrase 'encouragement' (e.g. The team encouraged the plant to…).

Good practice

A good practice is an outstanding and proven performance, programme, activity or equipment in use that contributes directly or indirectly to operational safety and sustained good performance. A good practice is markedly superior to that observed elsewhere, not just the fulfilment of current requirements or expectations. It should be superior enough and have broad application to be brought to the attention of other nuclear power plants and be worthy of their consideration in the general drive for excellence. A good practice has the following characteristics:

- novel;
- has a proven benefit;
- replicable (it can be used at other plants);
- does not contradict an issue.

The attributes of a given 'good practice' (e.g. whether it is well implemented, or cost effective, or creative, or it has good results) should be explicitly stated in the description of the 'good practice'.

Note: An item may not meet all the criteria of a 'good practice', but still be worthy to take note of. In this case it may be referred as a 'good performance', and may be documented in the text of the report. A good performance is a superior objective that has been achieved or a good technique or programme that contributes directly or indirectly to operational safety and sustained good performance, that works well at the plant. However, it might not be necessary to recommend its adoption by other nuclear power plants, because of financial considerations, differences in design or other reasons.

DEFINITIONS - FOLLOW-UP MISSION

Issue resolved - Recommendation

All necessary actions have been taken to deal with the root causes of the issue rather than to just eliminate the examples identified by the team. Management review has been carried out to ensure that actions taken have eliminated the issue. Actions have also been taken to check that it does not recur. Alternatively, the issue is no longer valid due to, for example, changes in the plant organization.

Satisfactory progress to date - Recommendation

Actions have been taken, including root cause determination, which lead to a high level of confidence that the issue will be resolved in a reasonable time frame. These actions might include budget commitments, staffing, document preparation, increased or modified training, equipment purchase etc. This category implies that the recommendation could not reasonably have been resolved prior to the follow up visit, either due to its complexity or the need for long term actions to resolve it. This category also includes recommendations which have been resolved using temporary or informal methods, or when their resolution has only recently taken place and its effectiveness has not been fully assessed.

Insufficient progress to date - Recommendation

Actions taken or planned do not lead to the conclusion that the issue will be resolved in a reasonable time frame. This category includes recommendations on which no action has been taken, unless this recommendation has been withdrawn.

Withdrawn - Recommendation

The recommendation is not appropriate due, for example, to poor or incorrect definition of the original finding or its having minimal impact on safety.

Issue resolved - Suggestion

Consideration of the suggestion has been sufficiently thorough. Action plans for improvement have been fully implemented or the plant has rejected the suggestion for reasons acceptable to the follow-up team.

Satisfactory progress to date - Suggestion

Consideration of the suggestion has been sufficiently thorough. Action plans for improvement have been developed but not yet fully implemented.

Insufficient progress to date - Suggestion

Consideration of the suggestion has not been sufficiently thorough. Additional consideration of the suggestion or the strengthening of improvement plans is necessary, as described in the IAEA comment.

Withdrawn - Suggestion

The suggestion is not appropriate due, for example, to poor or incorrect definition of the original suggestion or its having minimal impact on safety.

LIST OF IAEA REFERENCES (BASIS)

Safety Standards

- **SF-1**; Fundamental Safety Principles (Safety Fundamentals)
- **SSR-2/2 Rev.1**; Safety of Nuclear Power Plants: Commissioning and Operation (Specific Safety Requirements)
- **GSR Part 2;** Leadership and Management for Safety (General Safety Requirements)
- **GSR Part 3;** Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards
- **GSR Part 7;** Preparedness and Response for a Nuclear or Radiological Emergency (General Safety Requirements)
- **SSR-2/1 Rev.1**; Safety of Nuclear Power Plants: Design (Specific Safety Requirements)
- **NS-G-1.1**; Software for Computer Based Systems Important to Safety in Nuclear Power Plants (Safety Guide)
- **NS-G-2.1**; Fire Safety in the Operation of Nuclear Power Plans (Safety Guide)
- **NS-G-2.2**; Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants (Safety Guide)
- **NS-G-2.3**; Modifications to Nuclear Power Plants (Safety Guide)
- **NS-G-2.4**; The Operating Organization for Nuclear Power Plants (Safety Guide)
- **NS-G-2.5**; Core Management and Fuel Handling for Nuclear Power Plants (Safety Guide)
- **NS-G-2.6**; Maintenance, Surveillance and In-service Inspection in Nuclear Power Plants (Safety Guide)
- **NS-G-2.7**; Radiation Protection and Radioactive Waste Management in the Operation of Nuclear Power Plants (Safety Guide)
- **NS-G-2.8**; Recruitment, Qualification and Training of Personnel for Nuclear Power Plants (Safety Guide)
- **NS-G-2.9**; Commissioning for Nuclear Power Plants (Safety Guide)
- **NS-G-2.11**; A System for the Feedback of Experience from Events in Nuclear Installations (Safety Guide)
- **NS-G-2.12**; Ageing Management for Nuclear Power Plants (Safety Guide)

- **NS-G-2.13**; Evaluation of Seismic Safety for Existing Nuclear Installations (Safety Guide)
- **NS-G-2.14**; Conduct of Operations at Nuclear Power Plants (Safety Guide)
- **NS-G-2.15**; Severe Accident Management Programmes for Nuclear Power Plants (Safety Guide)
- **SSG-13**; Chemistry Programme for Water Cooled Nuclear Power Plants (Specific Safety Guide)
- **SSG-25**; Periodic Safety Review for Nuclear Power Plants (Specific Safety Guide)
- **GSR Part 1**; Governmental, Legal and Regulatory Framework for Safety (General Safety Requirements)
- **GSR Part 4**; Safety Assessment for Facilities and Activities (General Safety Requirements)
- **GS-G-4.1**; Format and Content of the Safety Analysis report for Nuclear Power Plants (Safety Guide)
- **SSG-2**; Deterministic Safety Analysis for Nuclear Power Plants (Specific Safety Guide)
- **SSG-3**; Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants (Specific Safety Guide)
- **SSG-4**; Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants (Specific Safety Guide)
- **GSR Part 5**; Predisposal Management of Radioactive Waste (General Safety Requirements)
- **GS-G-2.1**; Arrangement for Preparedness for a Nuclear or Radiological Emergency (Safety Guide)
- **GSG-2**; Criteria for Use in Preparedness and Response for a Nuclear and Radiological Emergency (General Safety Guide)
- **GS-G-3.1**; Application of the Management System for Facilities and Activities (Safety Guide)
- **GS-G-3.5**; The Management System for Nuclear Installations (Safety Guide)
- **RS-G-1.1**; Occupational Radiation Protection (Safety Guide)
- **RS-G-1.2**; Assessment of Occupational Exposure Due to Intakes of Radio-nuclides (Safety Guide)
- **RS-G-1.3**; Assessment of Occupational Exposure Due to External Sources of Radiation (Safety Guide)

- **RS-G-1.8**; Environmental and Source Monitoring for Purposes of Radiation Protection (Safety Guide)
- **SSR-5;** Disposal of Radioactive Waste (Specific Safety Requirements)
- **GSG-1** Classification of Radioactive Waste (General Safety Guide)
- **WS-G-6.1**; Storage of Radioactive Waste (Safety Guide)
- **WS-G-2.5**; Predisposal Management of Low and Intermediate Level Radioactive Waste (Safety Guide)

▪ ***INSAG, Safety Report Series***

INSAG-4; Safety Culture

INSAG-10; Defence in Depth in Nuclear Safety

INSAG-12; Basic Safety Principles for Nuclear Power Plants, 75-INSAG-3 Rev.1

INSAG-13; Management of Operational Safety in Nuclear Power Plants

INSAG-14; Safe Management of the Operating Lifetimes of Nuclear Power Plants

INSAG-15; Key Practical Issues In Strengthening Safety Culture

INSAG-16; Maintaining Knowledge, Training and Infrastructure for Research and Development in Nuclear Safety

INSAG-17; Independence in Regulatory Decision Making

INSAG-18; Managing Change in the Nuclear Industry: The Effects on Safety

INSAG-19; Maintaining the Design Integrity of Nuclear Installations throughout their Operating Life

INSAG-20; Stakeholder Involvement in Nuclear Issues

INSAG-23; Improving the International System for Operating Experience Feedback

INSAG-25; A Framework for an Integrated Risk Informed Decision Making Process

Safety Report Series No.11; Developing Safety Culture in Nuclear Activities Practical Suggestions to Assist Progress

Safety Report Series No.21; Optimization of Radiation Protection in the Control of Occupational Exposure

Safety Report Series No.48; Development and Review of Plant Specific Emergency Operating Procedures

Safety Report Series No. 57; Safe Long Term Operation of Nuclear Power Plants

- ***Other IAEA Publications***

  - **IAEA Safety Glossary** Terminology used in nuclear safety and radiation protection 2007 Edition

  - **Services series No.12**; OSART Guidelines

  - **EPR-ENATOM-2002**; Emergency Notification and Assistance Technical Operations Manual

  - **EPR-METHOD-2003**; Method for developing arrangements for response to a nuclear or radiological emergency, (Updating IAEA-TECDOC-953)

  - **EPR-EXERCISE-2005**; Preparation, Conduct and Evaluation of Exercises to Test Preparedness for a Nuclear or Radiological Emergency

  - **EPR-NPP PPA 2013**; Actions to Protect the Public in an Emergency due to Severe Conditions at a Light Water Reactor

- ***International Labour Office publications on industrial safety***

  - **ILO-OSH 2001;** Guidelines on occupational safety and health management systems (ILO guideline)

  - Safety and health in construction (ILO code of practice)

  - Safety in the use of chemicals at work (ILO code of practice)

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