Operational
Safety Review
Team

IAEA OSART

REPORT

OF THE

OPERATIONAL SAFETY REVIEW TEAM

(OSART)

TO THE

BELLEVILLE

NUCLEAR POWER PLANT

FRANCE

15 NOVEMBER – 2 DECEMBER 2021

FOLLOW-UP MISSION

22-26 MAY 2023

DIVISION OF NUCLEAR INSTALLATION SAFETY
OPERATIONAL SAFETY REVIEW MISSION
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PREAMBLE

This report presents the results of the IAEA Operational Safety Review Team (OSART) review of the Belleville Nuclear Power Plant, France. It includes recommendations and suggestions 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 Pre-OSART follow-up visit which took place 18 months later. The inputs resulting from the follow-up mission can be found in the following chapters: last paragraph in the Executive Summary, self-assessment for the follow-up mission by the host organization and follow-up main conclusions by the IAEA follow-up team in the Introduction and Main Conclusions. In addition, the plant response/action and IAEA comments and Conclusion are under each Recommendation and Suggestion. The status of each issue is in the Summary of Status of Recommendations and Suggestions table, and the Follow-up team composition can be found at the end of the report.
The purpose of the follow-up visit was to determine the status of all proposals for improvement, to comment on the appropriateness of the actions taken and to make judgements on the degree of progress achieved.

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

FOREWORD by the

Director General

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

An OSART mission, carried out only at the request of the relevant Member State, is directed towards a review of items essential to operational safety. The mission can be tailored to the particular needs of a plant. A full scope review would cover eleven operational areas: Leadership and Management for Safety; Training and Qualification; Operations; Maintenance; Technical Support; Operating Experience Feedback; Radiation Protection; Chemistry; Emergency Preparedness and Response, Accident Management, and Human-Technology-Organization Interactions. 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 the IAEA Safety Standards 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.

EXECUTIVE SUMMARY

This report describes the results of the OSART mission conducted for Belleville Nuclear Power Plant in France, from 15 November to 2 December 2021.

The purpose of an OSART mission is to review the operational safety performance of a nuclear power plant against the IAEA safety standards, make recommendations and suggestions for further improvement and identify good practices that can be shared with NPPs around the world.

This OSART mission reviewed eleven areas: Leadership and Management for Safety; Training and Qualification; Operations; Maintenance; Technical Support; Operating Experience Feedback; Radiation Protection; Chemistry; Emergency Preparedness and Response; Accident Management; and Human-Technology-Organization Interaction.

The mission was coordinated by an IAEA Team Leader and Deputy Team Leader and the team was composed of experts from Belgium, Canada, Czech Republic, Finland, Hungary, Romania, Slovakia, South Africa, United Kingdom, United States of America, and the IAEA staff members. The collective nuclear power experience of the team was approximately 400 years.

The team identified 16 issues, six were recommendations and 10 were suggestions. Five good practices were also identified.

Several areas of good performance were noted:

- The plant used a main control board layover plaque in the control room to increase awareness and high visibility on control rods status.
- The plant implemented the Human Performance Tool refresher training using the virtual ‘escape game’ approach at an on-site training facility.
- The plant developed an approach to identify essential equipment necessary to re-establish core cooling in extremely difficult situations with fluorescent tags.

The most significant issues identified were:

- Managers and supervisors should actively promote excellent performance in all activities important to safety.
- The plant should improve the control and implementation of reactivity manipulations to ensure precise plant control.
- The plant should improve the timeliness of corrective actions development and implementation and improve their quality and effectiveness to prevent recurrence of events.

Belleville NPP management expressed their commitment to address the issues identified and invited a follow up visit in about eighteen months to review the progress.

At the time of the follow-up mission in May 2023, some 18 months after the OSART mission, 44% of issues had been resolved, 56% of issues made satisfactory progress, and no issue made insufficient progress.

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INTRODUCTION AND MAIN CONCLUSIONS

INTRODUCTION

At the request of the government of France, an IAEA Operational Safety Review Team (OSART) of international experts visited the Belleville Nuclear Power Plant from 15 November to 2 December 2021. 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 Preparedness and Response; Accident Management; and Human-Technology-Organization Interaction. 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 Belleville OSART mission was the 213th in the programme, which began in 1982. The team was composed of experts from Belgium, Canada, Czech Republic, Finland, Hungary, Romania, Slovakia, South Africa, United Kingdom, United States of America, and the IAEA staff members. The collective nuclear power experience of the team was approximately 400 years.

Before visiting the plant, the team studied information provided by the IAEA and the Belleville Nuclear Power 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 Belleville NPP are committed to improving the operational safety and reliability of their plant.

The team found good areas of performance, including the following:

- The plant used a main control board layover plaque in the control room to increase awareness and high visibility on control rods status.
- The plant implemented the Human Performance Tool refresher training using the virtual 'escape game' approach at an on-site training facility.
- The plant developed an approach to identify essential equipment necessary to re-establish core cooling in extremely difficult situations with fluorescent tags.

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

- Managers and supervisors should actively promote excellent performance in all activities important to safety.

– The plant should improve the control and implementation of reactivity manipulations to ensure precise plant control.
– The plant should improve the timeliness of corrective action development and implementation and improve their quality and effectiveness to prevent recurrence of events.

Belleville 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.

BELLEVILLE NPP SELF-ASSESSMENT FOR THE FOLLOW-UP MISSION

The senior management team of Belleville sur Loire NPP would like to thank the IAEA OSART team members for the relevance of the remarks they made during their visit from 15 November to 2 December 2021. We appreciated the goodwill and the expectations of the OSART team, with their focus on continuous improvement. The 6 recommendations and 10 suggestions have helped Belleville sur Loire NPP to improve and embed our practices in terms of nuclear safety and performance management.

Following the OSART mission, the plant teams analysed the root causes of the recommendations and suggestions so that the appropriate action plans could be developed to help us improve our practices.
Since the OSART visit, the teams at Belleville sur Loire NPP have been focusing on 3 key pillars:

- Become a benchmark for our maintenance and operations quality which guarantees a high level of nuclear safety and industrial safety,
- Control our industrial programme with the accent on a good outage success rate,
- Facilitate, empower employees and collaborate so that we work together.

By aligning the plant with these 3 priorities, performance at Belleville-sur-Loire NPP has started to improve.

Some of the highlights of improvements made at Belleville sur Loire NPP include:

- The plant's management system has been thoroughly reviewed to introduce a daily performance review at each level with an escalation mechanism, while leadership, networks and independent oversight continue to be developed. Several performance indicators are improving.
- The main expectations concerning industrial safety have been posted at the site access points and communicated to employees and managers and a phased approach has been designed to clarify the management line response to industrial safety deviations. Frequent industrial safety events have been jointly set up with our contractors and a dedicated telephone number has been set up to report dangerous situations. The accident frequency rate is improving.
- Various actions have been taken to provide a better framework for the roles of shadow coaches and tutors at the plant. The subject of training skills and practices has been treated with actions to improve coherence in training and a technical solution to render our simulators even more efficient and realistic is under development.
- A Reactivity Management roadmap has been deployed to provide a framework for and develop the role of the supervisor in the main control room and to develop the identification of activities in the schedule. The number of significant reactivity management events has distinctly decreased.
- Regarding the improvement of work practices, the management line response has been aligned along with more focus in the field. The active method of simplifying certain rules

(lifting and rigging, storage of objects, access, etc.) has helped to improve compliance. The maintenance quality control approach has continued with the launch of specific refresher training with the active participation of our industrial partners. The implementation of daily performance reviews has helped to improve work management and, as such, the number of Foreign Material Exclusion (FME) events and schedule reliability is improving.

- The main action tracking tool used at the plant now centralises data (recommendations, commitments, decisions, improvement actions, etc.) and a framework has been provided for capturing and prioritising actions. Analysis of Low Level Events, at station level now includes targeted thematic analyses and uses data from several sources (internal controls, audits, Manager-in-Field (MIF), Action Plans, etc.). Findings from monitoring are analysed after each outage. The independent safety branch (oversight) has set up regular observatories based on low-level observations. Root cause analysis of events has been reinforced and the validation meeting was refocused on facts, causes and actions. The number of overdue Priority 1 and Priority 2 actions is decreasing.
- A general action plan on radiation protection management was deployed (91% completed at the end of 2022), developing awareness of the subject, MIF observations or radiological checks. In addition, a specific plan on contamination control was also implemented (60% completed at the end of 2022), to improve the control of all step-over barriers. Some actions still need to be taken, particularly for equipment, but there is no more road contamination or triggering of vehicle exit gantries and still a very low number of personal contamination cases.
- A diagnosis was carried out by the association of industrial partners to understand the weaknesses. The expectations were displayed and communicated to the contractors, with discussions twice a week during outage. Several systems to track reported information have been set up (monitoring, non-compliance, industrial safety proposals, etc.) and our industrial partners are closely involved in the maintenance quality control approach.

Belleville sur Loire NPP is pleased to welcome the IAEA team members once again for the 2023 OSART Follow-Up mission to show them the progress made in the areas they observed before. Belleville sur Loire NPP is committed to continuing its actions for continuous improvement while reaffirming that giving priority to nuclear safety and industrial safety is part of its DNA. As such:In 2023, Belleville NPP was very proud to receive, based on the 2022 performance, the prize for the 1st place on the French nuclear fleet in “Risk Prevention” and the prize for 2nd place on the French nuclear fleet in “Nuclear Safety”.

FOLLOW-UP MAIN CONCLUSIONS

An IAEA OSART follow-up team visited Belleville Nuclear Power Plant from 22 to 26 May 2023. There was clear evidence that the plant had gained significant benefit from the OSART process. The IAEA Safety Standards and benchmarking activities with other NPPs were used by the NPP during the preparation and implementation of their corrective action plans.

The plant thoroughly analysed the OSART recommendations and suggestions and developed appropriate corrective action plans. In some instances, these corrective actions covered a broader scope than the original OSART recommendations and suggestions. The willingness and motivation of plant management to consider new ideas and implement a comprehensive safety improvement programme was evident and were a clear indicator of the leadership team’s commitment to further improve the operational safety of the plant.

The plant had fully resolved issues regarding: operator behaviours for some main control room activities; operational practices to prevent potential impact on seismically qualified equipment; low level event trending and analysis; quality of corrective actions; contamination control; training on severe accidement management; and management and control of contractor worker performance.

Issues where satisfactory progress towards resolution has been made but further work is necessary are as follows:

Regarding managers and supervisors not always promoting a commitment to excellent performance in all activities important to safety, the plant has restructured the management system to increase focus on performance in a bottom-up manner as opposed to a top-down manner and has continued implementation of a leadership roadmap with increased focus on excellence in performance. The number of significant safety events involving control of reactivity per unit has improved and performance indicators have shown improvement in timely completion of actions. Some of the initiatives have been completed recently and additional time is required to show sustained improvement. Several actions are still planned to be performed including use of international indicators and finalising the transition of the teams to the new performance management model.

Regarding plant activities not always being performed and controlled in a manner that ensures personnel safety, the plant has taken actions to clarify expectations by defining and communicating expected standards for safety behaviours. The plant has also implemented the principles of a just culture model to establish a graded approach and consistency in response to issues, errors and violations and has increased manager in-field-education, oversight and coaching. The accident rate and the number of lost time accidents per million hours worked have decreased. Some of the actions taken have been completed recently so additional time is required to show sustained improvement towards excellent performance. Several actions are outstanding including completion of work quality training to improve skills around risk assessment and implementation of safety standards into the handbook for plant staff.

Regarding plant standards in the implementation of operations training, the plant has initiated training for mentors, identified, appointed, and issued formal job documents to all the in-plant coaches and qualified all the Shift Managers to perform management evaluations. The plant has also established an operations training lead that works closely with the operations and training departments to ensure consistency among the coaches. Outstanding actions remain regarding completion of the training for mentors, conduct of refresher training for simulator instructors, implementation of changes in simulator capability and establishment of monitoring for performance improvement.

Regarding the issue on reactivity manipulation control, the plant has taken actions to develop, revise and optimize relevant documents on reactivity management. Training has been enhanced for the operators with each operator receiving an annual one-day classroom training on reactivity management. Plant and operation managers are putting more focus on the reactivity manipulation and management in their routine observations. The number of significant safety events related to reactivity management decreased from 1 to 0 from 2021 to 2022, and the number of safety events related to reactivity management decreased from 8 to 3 from 2021 to 2022. 60% of the planned actions have been completed and some of the actions were completed recently. It will require more time to demonstrate the sustainability of these actions.

Regarding the issue related to on-line work management, the plant has established a daily review mechanism of maintenance schedule performance at all levels. Departmental commitments in completing activities on time are obtained by their participation in the daily review meeting with the plant director and their direct reports. The plant has also improved the spare part availability review process by conducting weekly meetings with relevant departments for their needs of spare parts. Training is delivered to the maintenance staff on how to properly request spare parts. However, the maintenance backlog remained essentially unchanged for the past year. It will require more time to show the effectiveness of the actions taken and its sustainability.

Concerning the issue on control of maintenance activities, the plant published clear expectations on intolerable behaviours, covering key aspects in the safe operation of the plant, aligned with the plant priorities. The intolerable behaviours are classified, and clear reward/recognition and sanctions are defined. These expectations were also widely disseminated and communicated to plant and contractor staff via postings in different plant areas, which are accessed frequently by large number of plant staff. The manager-in-field programme was improved with dedicated observation teams during outage and on-line operation period. Plant contractors now have access to important plant training, such as Foreign Material Exclusion (FME), which ensures that contractors are following the same standards and expectations. The relevant plant performance indicator is showing sign of improvement; however, it will require more time to demonstrate the sustainability of these actions.

Regarding the issue on handling, labelling and use of chemical substances, the plant performed an analysis of the on-site work practices concerning the management, labelling and use of chemicals and identified the causes such as: a lack of worker knowledge of the existing plant expectations for the management and storage of chemicals, degraded equipment conditions for the storage of chemicals and insufficient arrangements for managers presence in the field and related observations and checks. An action plan was implemented to correct the plant procedures and practices in this area. Some activities within the action plan were completed, however, several activities are still to be completed. Although the management of chemical storage cabinets shows improvements, it remains an area of weakness identified during the MIF observations in 2022.

As for the issue on plant arrangements for protective and response actions for emergencies, the plant team analyzed the suggestion and identified the causes such as: insufficient equipment and ergonomics of the Emergency Control Center (BDS), uncertainty in managing the unavailability of the BDS due to lack of habitability, outdated visual supports and lack of visual support in the BDS decontamination room. The plant adopted an action plan to address the issue, which resulted in several activities involving the development of a three-year action plan for the optimisation of displays, procedures, and protocols for the protection of personnel within the emergency response premises, and the application of corporate-level updated provisions to manage unavailability/inhabitability of the BDS. However, modifications to the BDS are still to be completed pending commission of a new Emergency Control Center expected in 2025.

Regarding the issue on severe accident management, EDF Corporate organization did not envisage providing Severe Accident Management guidance for the Spent Fuel Pools with the justification being that the risk of fuel meltdown in the Spent Fuel Pools was not sufficient to warrant such formalized guidance. The plant undertakes a modification programme to afford the plant additional make-up capabilities and automatic isolation to limit the drainage of the spent fuel pool and reactor cavity during an outage. To respond to a two-unit severe accident, the plant uses the existing on-site emergency plan organisation in addition to the nuclear rapid-response taskforce (FARN) which is calibrated to respond to severe accidents on two units simultaneously. However, the EDF corporate organization will begin to study potential organizational and technical improvements in 2024 - 2025 that could improve the severe accident management programme by considering simultaneous multiple unit severe accidents and ensuring that trained and experienced personnel, equipment, supplies and external support shall be made available for coping with concurrent severe accidents.

In 2021, the original OSART team developed 6 recommendations and 10 suggestions to further improve operational safety of the plant. At the time of the follow-up mission in May 2023, some 18 months after the OSART mission, 44% of issues had been resolved, 56% of issues made satisfactory progress, and no issue made insufficient progress.

The team received full cooperation from the Belleville NPP management and staff and was impressed with the actions taken to analyse and resolve the findings of the original mission. The team was able to verify all information considered relevant to its review. In addition, the team concluded that the managers and staff were very open and frank in their discussions on all issues. This open discussion made a significant contribution to the success of the review and the quality of the report.

1. LEADERSHIP AND MANAGEMENT FOR SAFETY

1.1. LEADERSHIP FOR SAFETY

The plant has an organization designed in a matrix structure with 13 departments and nine macro-process areas. Department heads are responsible for the staff in their area and the macro-process owners are responsible for the coordination and oversight of the processes.

The current plant annual performance contract has a focus on four priority performance indicators which are displayed throughout the plant. These are 19 billion kWh of production, 0 Automatic Reactor Trips and Fires, Housekeeping level 2, and 7.8 Industrial Safety overall accident rate per million hours worked. The plant performance measures are tracked in comparison to the other plants in the fleet.

The plant has integrated an unforeseen events database and record of decision template. This ensures that safety risks are identified and considered throughout the response to unforeseen events. The database is open to all plant employees to share information, analyses and decisions made related to the events. The team recognized this as a good performance.

The team noted that plant managers and supervisors sometimes did not promote a commitment to excellent performance in all activities important to safety. Managers and supervisors did not always challenge inappropriate behaviours and plant standards, deliver on commitments, or take opportunities to engage with plant employees. The team made a recommendation in this area.

1.2. MANAGEMENT SYSTEM

The plant has a well-defined management system that includes nine macro-processes that cover plant management and oversight, generation, nuclear safety and quality, risk prevention, environment, human resources, cost control, equipment reliability and long-term operation, and industrial policy and contractor relations. For each macro process there are sub-processes with associated basic processes each with designated owners to manage the process.

The plant uses annual self-assessments, inputs from the fleet and external assessments to define actions for the upcoming annual business planning cycle. In addition, the plant oversight organization performs independent assessments to provide feedback to plant management on the effectiveness of the plant programmes. The plant is currently developing their strategic plan for the 2021-2025 period and expects to have this in place in January 2022.

The plant has introduced a management approach for teams to engage staff and improve performance using a performance management model EVOLEAN. This has been implemented in two teams at the plant and plans are in place to implement this in at least three additional teams in 2022. Teams within the plant that have been using the model have shown improvement in engagement with other plant groups including operations. The team recognized this as a good performance.

1.3. NON-RADIATION-RELATED SAFETY PROGRAMME

The plant has designed and implemented a long-handled device to detect asbestos in preparation for maintenance activities. This has improved industrial safety by eliminating the need for contact with asbestos samples and the need to work at height for hard-to-reach areas. The team recognized this as a good performance.

The plant has implemented a safety poster at the entry to electrical rooms to prompt workers to check that they meet all the Personal Protective Equipment (PPE) requirements to enter the area. The poster includes a visual depiction of a worker with the required equipment so that workers can review their PPE against the visual aid. The team recognized this as a good performance.

Plant activities were not always performed and controlled in a manner that ensured personnel safety. The team noted gaps in behaviours related to industrial safety, unsafe conditions and facilitation of safe work practices. The team made a recommendation in this area.

DETAILED LEADERSHIP AND MANAGEMENT FOR SAFETY FINDINGS

1.1. LEADERSHIP FOR SAFETY

1.1(1) Issue: Managers and supervisors do not always promote a commitment to excellent performance in all activities important to safety.

The team noted the following:

Challenging behaviours and standards:

- In the Main Control Room (MCR), in a panel below the firefighting system inhibitor panel there were openings which were used to store documents, a radio and other loose paperwork.
- The MCR dining room had a plant on top of an electrical box with a cardboard box underneath. There were plastic bags stored under electrical cables and cardboard boxes on top of lockers. Against the wall opposite the entrance door were multiple cardboard boxes.
- There was material stored on top of cabinets and on the floor in the Shift Manager's office and a maintenance meeting area. These conditions were not challenged by supervisors or managers in the area.
- The Industrial Safety performance accident rate per one million hours worked in October 2021 was 6.2 compared to 7.8 overall target. The plant indicated that this performance was good compared to the fleet. The plant indicated that it was difficult to compare performance with other world regions based on concerns about the reported data. Work to address this comparison of data is in progress with information expected to be available in December 2021. Using the currently available data,
  - The Industrial Safety lost time accident rate per one million hours worked for the 24-month period to June 2021 for the plant was 2.3 and for the fleet is 3.45. For comparison, the comparable Industrial Safety accident rate for a different world region was 0.16.
  - The Industrial Safety lost time accident rate for contractors per one million hours worked for the 24-month period to June 2021 for the plant was 7.64 and for the fleet was 6.06. For comparison, the comparable Industrial Safety accident rate for a different world region was 0.26.
  - Following a loss of spent fuel pool cooling event due to a coupling failure on one of the spent fuel pool cooling pumps, the plant took actions to repair the failed pump. No maintenance or operations compensatory actions were put in place such as increased monitoring, temporary operating procedures, or reducing the number of starts and stops for the other pumps.
  - The team identified that some issues with examples below were not systematically captured in the Plant Corrective Action database:
    - Foreign Material Exclusion (FME) related issues, such as not using an FME cover on an emergency water connection.
    - Labelling issues on chemistry bottles or other products, such as expired validation dates.
    - Personnel protective equipment not properly used.

  - Radiation Protection issues, such as hot spots on low level waste.
- There were no procedures in place for the management of low-level radioactive waste (LLRW) with no path for disposal.
- The Radioactive Waste Building operation procedure states that 135 drums are allowed in the area for LLRW without a disposal path. More than 200 metal drums were observed in that area of Radioactive Waste Building.
- A manager conducting an ‘Industrial Safety Welcome’ briefing accepted two of seven attendees having masks positioned below their nose even though one of the topics covered was related to Covid-19 protocols.
- A table was found in the Safety Ultimate Diesel (DUS) building but was not secured. This had been previously identified by plant management; however, it was not corrected.
- During a walkdown for fire protection standards, a cardboard box and wood planked trolley were observed in a hot work area. However, the storage area permit sign allowed these items to be present in the hot work area in which grinding work was taking place. This was not challenged by managers or supervisors observing the area.
- There were several examples of storage of equipment without care including unlabelled liquid containers in the essential cooling water rooms. In the turbine building there were wood pallets, debris and metal parts stored in manner that could lead to damage.
- Workers in the electrical maintenance meeting area were seen eating food with masks off while about one meter apart from one another during morning work preparation. This was not challenged by supervisors or managers in the area.

Delivering on Commitments:

- Commitments to the regulator are not consistently completed on time. The plant indicated that one or two late commitments per month was quite a good result.
- The internal target for notification to the regulator for significant events within two business days was not consistently met from January to October 2021. The plant indicated that this had been a weakness noted in the past and actions to accelerate reporting had been unsuccessful at resolving this performance gap.
- A sampling of extensions to corrective actions recently approved in a corrective action review meeting showed that one action had been previously extended 7 times prior to the meeting. Decisions made in the weekly corrective action review meeting for granting extensions to corrective actions were being made without the information of previous extension approvals being available in the meeting package. The decisions were based on risk analysis of impact. A senior manager took action to correct this prior to the next review meeting.
- During a macro-process (MP8) meeting, two performance curves for completion of post modification actions showed performance not meeting the target completion line. Overall action delivery dates were delayed by two months for Unit 1 and one month for Unit 2. This delay had been previously discussed at the director level.

Opportunities to Engage:

- During an ‘Industrial Safety Welcome’ briefing conducted by a manager:
  - key messages were not highlighted and were diluted with a large volume of messages.

  - the duration exceeded stated time and covered a lot of material with risk of losing engagement of the attendees.
  - engagement with the attendees could have been improved by asking questions at the beginning of the session.
  - the briefing environment was noisy and multiple people passed into and through the briefing area, disrupting the session.
  - late arriving attendees caused disruptions.
- Most of the presentation of performance during a weekly macro-process meeting (RHMP) was delivered in a one-way manner by the presenter directed to the plant manager. Typically, there were few (zero to one) questions by peers per presentation.
- Actions in the annual business plan were created for the site, departments and teams in a cascade down manner. This cascade down started from the corporate level to the site level as well. The plant acknowledged that there was little worker up engagement in the development of the current annual plant business plan.
- The actual and potential consequences as presented in investigation reports for several safety significant events generally emphasize positive factors that included violation of technical specification limits through technical reviews that credit reliance on availability of alternate equipment, intervention or after the fact analysis showing minimal actual or potential impact. Internal event communication was normally limited to sharing the investigation report.

Performance Indicators:

- The number of significant safety events involving control of reactivity per unit has remained flat at 0.5 in 2019, 0.5 in 2020 and 0.5 in 2021 up till August.
- The trend of nuclear safety significant events (nuclear safety significant events ratio to workload) is relatively flat over the past 4 years at a value of approximately 0.25.

Plant Events:

- On 5 January 2021, the reactor coolant pressure exceeded the absolute limit of 45 bar in hot standby mode while operators were attempting to establish the required conditions to conduct an operations surveillance test (LLS003). The root causes included lack of adequate preparation and insufficient contingency management arrangements for the activity.
- In a chemistry laboratory, an unsafe condition was detected related to liquid on the floor from an air conditioning device. This was promptly addressed; however, the temporary measures were not effective at preventing a worker from slipping and falling in the same location. This resulted in a lost time accident.
- Three instances have occurred in 2021 in which radioactive waste has entered the conventional waste stream and was detected at the final check thus preventing the material from exiting the plant. Weaknesses were identified in monitoring equipment availability and behaviours related to radioactive waste handling. Following the first two events, actions taken to prevent further events were ineffective.

Without actively promoting excellent performance, plant and personnel safety could be challenged.

Recommendation: Managers and supervisors should actively promote excellent performance in all activities important to safety.

IAEA Bases:

SSR-2/2 (Rev.1)

Requirement 5: Safety Policy

The operating organization shall establish and implement operational policies that give safety the highest priority.

4.1 The operational policy established and implemented by the operating organization shall give safety the utmost priority, overriding the demands of production and project schedules. The safety policy shall promote a strong safety culture, including a questioning attitude and a commitment to excellent performance in all activities important to safety. Managers shall promote an attitude of safety consciousness among plant staff.

4.2 The safety policy shall stipulate clearly the leadership role of the highest level of management in safety matters. Senior management shall communicate the provisions of the safety policy throughout the organization. Safety performance standards shall be developed for all operational activities and shall be applied by all site personnel. All personnel in the organization shall be made aware of the safety policy and of their responsibilities for ensuring safety. The safety performance standards and the expectations of the management for safety performance shall be clearly communicated to all personnel, and it shall be ensured that they are understood by all those involved in their implementation.

GSR Part 2

Requirement 2: Demonstration of Leadership for Safety by Managers

Managers shall demonstrate leadership for safety and commitment to safety.

3.1. The senior management of the organization shall demonstrate leadership for safety by:

(a) Establishing, advocating and adhering to an organizational approach to safety that stipulates that, as an overriding priority, issues relating to protection and safety receive the attention warranted by their significance;

(b) Acknowledging that safety encompasses interactions between people, technology and the organization [2];

(c) Establishing behavioural expectations and fostering a strong safety culture;

(d) Establishing the acceptance of personal accountability in relation to safety on the part of all individuals in the organization and establishing that decisions taken at all levels take account of the priorities and accountabilities for safety.

3.2. Managers at all levels in the organization, taking into account their duties, shall ensure that their leadership includes:

(a) Setting goals for safety that are consistent with the organization’s policy for safety, actively seeking information on safety performance within their area of responsibility and demonstrating commitment to improving safety performance;

(b) Development of individual and institutional values and expectations for safety throughout the organization by means of their decisions, statements and actions;

(c) Ensuring that their actions serve to encourage the reporting of safety related problems, to develop questioning and learning attitudes, and to correct acts or conditions that are adverse to safety.

3.3. Managers at all levels in the organization:

(a) Shall encourage and support all individuals in achieving safety goals and performing their tasks safely;

(b) Shall engage all individuals in enhancing safety performance;

(c) Shall communicate clearly the basis for decisions relevant to safety.

Requirement 12: Fostering a Culture for Safety

Individuals in the organization, from senior managers downwards, shall foster a strong safety culture. The management system and leadership for safety shall be such as to foster and sustain a strong safety culture.

5.1. All individuals in the organization shall contribute to fostering and sustaining a strong safety culture.

5.2. Senior managers and all other managers shall advocate and support the following:

(a) A common understanding of safety and of safety culture, including: awareness of radiation risks and hazards relating to work and to the working environment; an understanding of the significance of radiation risks and hazards for safety; and a collective commitment to safety by teams and individuals;

(b) Acceptance by individuals of personal accountability for their attitudes and conduct with regard to safety;

(c) An organizational culture that supports and encourages trust, collaboration, consultation and communication;

(d) The reporting of problems relating to technical, human and organizational factors and reporting of any deficiencies in structures, systems and components to avoid degradation of safety, including the timely acknowledgement of, and reporting back of, actions taken;

(e) Measures to encourage a questioning and learning attitude at all levels in the organization and to discourage complacency with regard to safety;

(f) The means by which the organization seeks to enhance safety and to foster and sustain a strong safety culture, and using a systemic approach (i.e. an approach relating to the system as a whole in which the interactions between technical, human and organizational factors are duly considered);

(g) Safety oriented decision making in all activities;

(h) The exchange of ideas between, and the combination of, safety culture and security culture.

Plant Response/Action:

- Analysis conducted

- Diagnostics from the development of the plant project, the division project and the safety perception questionnaire:
  - Lack of focus on performance,
  - Organisation too top-down and too complex.
- Combined WANO / Nuclear Inspectorate Peer Review early 2022:
  - Weaknesses in Operating Experience (OE),
  - Lack of challenge for overdue actions.
- Specific analysis on the volume of actions:
  - Number of actions significantly higher than other stations, many sources,
  - Non-SMART actions (Specific, Measurable, Achievable, Relevant and Time-bound).

- The root cause(s) identified

- A station culture that has not focused on performance in the past. A capacity for mobilisation mainly in emergency situations or emergent technical conditions. An average performance considered as acceptable.
- High staff turnover between 2010 and 2015, high turnover at all times due to the location of the site and the surrounding industrial landscape. Managerial focus on the development of technical skills.
- Priority given to compliance rather than excellence during the 2018-2020 Nuclear Safety Recovery Plan. Search for a compliant completion of activities in the field, even if that means not being impeccable in all areas.
- Complex organisations, sometimes with conflicting rules, which lead to compromising on certain expectations or tolerating insufficient performance in certain key areas to preserve others.
- Evolution of action management tools in the past without any global review, lack of collective guidelines on the opening and prioritisation of actions, poorly defined checking loops.

- Corrective action plan

- Transformation of the plant management system. Developed in 2022 and deployed in early 2023:
  - Setting up daily meetings for the plant's teams, departments and management teams, with a time structure to ensure that information is escalated,
  - Weekly meetings eliminated and topics included in daily briefings,
  - Meetings refocused on the review of performance and operational effectiveness,
  - Annual contract between the different management levels with more feedback.
- Deployment of the Evolean method in the plant teams:
  - 2 teams as of 2021, 7 teams in 2022, 6 teams in the first quarter of 2023,
  - The diagnostic of each team established in relation to performance,
  - The setting up rituals that involve team members,
  - Introduction of tools for visual management and treatment of frustrations.

- Continued implementation of the leadership roadmap with a more excellence-orientated focus:
    - Continuation of leadership academy and seminars,
    - Evolution of "DU live" meetings (DU = Station Director), incorporation of OSART remarks,
    - Managerial approaches and get-togethers extended to Team Leaders,
    - Networks continued for Department Managers and First Line Managers,
    - Creation of networks for Deputy Department Managers, young executives and technical leaders,
    - Continuation of the Function-specific Coordination Groups, in particular for Team Leaders, Work Coordinators, Monitoring Supervisors,
    - Validation of the Operations Department project, incorporating the leadership of the Shift Manager,
    - Training of all managers concerned in reactivity management.
- A voluntary stream-lined approach.
    - Targeted cross-functional working groups to redefine the right rule, the adequate process, to ensure risk prevention while making it easier to complete activities,
    - Two worksites on storage and on internal/external access to the site, under the supervision of the Director,
    - Numerous 'operational excellence' worksites that will be tested during the Maintenance Outage on Unit 1 on behalf of the Division,
- Establishment of Independent Nuclear Safety Oversight (FIS) workshops and independent outage supervision,
    - Collection and pooling of very small deviations and low-level events through the Independent Nuclear Safety Oversight (FIS),
    - On a weekly basis during outage, informal structure,
    - On a quarterly basis with report to the Station Director,
    - Making it possible to challenge the plant senior management on any deviations.
- Rationalisation of action management tools:
    - Transfer of the Corrective Action Programme (CAP) into the Caméléon software,
    - Tracking of commitments to the Nuclear Safety Authority (ASN), recommendations from audits, action plans, significant events, committee decisions and continuous improvement actions in the same tool,
    - Preparation of a response sheet containing the criteria for prioritising actions,
    - Establishment of a monitoring and correction loop for inadequate priorities,
    - The weekly Corrective Action Programme (PAC) meeting now oversees all Caméléon actions (Caméléon is the name of the action tracking software),
    - The new monthly "oversight" review also examines ongoing actions.
- Work on reducing the number of actions:
    - Diagnostics on the volume of actions and recalibration of the elements captured by the Corrective Action Programme (CAP),
    - The 3 response sheets updated for actions and the Corrective Action Programme (CAP).

- Progress to date

- The previous points show the completed actions.
- Among the actions still to be carried out or finalised:

  - Use of international indicators through WANO's “Action for Excellence” programme,
  - Reinforcing the Independent Nuclear Safety Oversight (FIS) workshops so that they become a real driver for improvement,
  - Improving reporting times to the Nuclear Safety Authority (ASN),
  - Stabilisation of the new station management system,
  - Finalising the transition of the teams to Evolean (Evolean is the method name) to reach 100% of the teams.

- Corrective action effectiveness evaluation

- Driving actions to completion
  - The number of priority 1 actions (P1) that are overdue has fallen sharply (from 7% to less than 0.5%),
  - The number of priority-2 actions (P2) that are overdue has fallen sharply (from 30% to 10%).
- Management System:
  - Improved exchanges in the Senior Management Team (EDM) (“DU live”-type meeting, performance reviews),
  - Much more bottom-up, with the top-down practically non-existent.
- Nuclear Safety and Industrial Safety performance
  - 1st prize for EDF nuclear safety in 2022 (based on 2021 performance),
  - 2nd EDF prize for nuclear safety in 2023 (based on 2022 performance),
  - Nuclear Safety frequency rate improving since OSART (1.75 end 2021, 1.25 end 2022),
  - Clear improvement for Significant Safety Event (ESS) in reactivity (1+8 in 2021, 0+3 in 2022),
  - Disappearance of noteworthy outbreaks of fire since 2020, decrease in minor outbreaks of fire,
  - 1st place, winning the only prize in the Fleet for Risk Prevention in 2023, based on 2022 performance
  - Improvement in the Industrial Safety Accident Frequency Rate (tracking of Lost Time Accidents) and the Industrial Safety Accident Frequency Rate 2 (tracking of Lost Time Accidents and Non-Lost Time Accidents) => see the issue on industrial safety for indicators with numbers.
- Performance in production:
  - Milestone 22 maintained (the first fuel element removed) for the first time and on the two outages of 2022,
  - Duration of the 2022 Maintenance Outage respected (excluding strike actions), which is a first since 2015 (Refuelling Outage).
  - Improved reliability of the S+4 schedule (ERI 5.1) and S+1 schedule (ERI 5.2) for the 2022 Power Operations activities compared to 2021.

IAEA Comments:

The plant has carefully evaluated this recommendation and determined that the past performance and focus was tied to a culture of compliance rather than striving towards excellence, insufficient oversight, prioritization and challenge of important activities, complexity of expectations and high personnel turnover.

The plant has taken actions to restructure the management system to increase focus on performance in a bottom-up manner as opposed to a top-down manner.

The plant has consolidated multiple databases for tracking activities into a single database to allow clear oversight and prioritization of work activities including streamlining actions and increasing focus on areas important to safety.

The plant has continued the implementation of performance management model EVOLEAN to departments and teams across the site in a prioritized manner. This implementation is expected to continue to 2025.

The plant has continued implementation of a leadership roadmap with increased focus on excellence in performance through leadership seminars, engagement of leaders in the review of performance and consistency of implementation of standards.

Work has started on streamlining of expectations and rules to remove complexity. Additional work is planned in this area.

The number of significant safety events involving control of reactivity per unit has improved, with 0.5 in 2021, 0 in 2022 and 0 in 2023 up to April.

Performance indicators have shown improvement in completion of actions over the 12 months up to February 2023: the number of priority 1 actions that are overdue has decreased from 7% to 0.5% and the number of priority 2 actions that are overdue has decreased from 30% to 10%.

Some of the actions taken have been completed recently and additional time is required to show sustained improvement. Several actions are still planned to be performed including use of international performance indicators, reinforcing independent nuclear safety oversight workshops to drive further improvement, improving reporting times to the regulator, stabilisation of the new station management system and finalising the transition of the teams to the new performance management model EVOLEAN. The outage workload in the balance of 2023 will be high with two outages planned, including a three-month period of overlapping outages. The plant is aware of the high upcoming workload which may present a challenge to continuing progress on improvement activities in parallel with the outage workload.

Conclusion: Satisfactory progress to date

1.3. NON-RADIATION-RELATED SAFETY PROGRAMME

1.3(1) Issue: The plant activities are not always performed and controlled in a manner that ensures personnel safety.

The team noted the following:

Behaviours:

- A worker attached a lifting device to a crane hook while the hook was still in motion just above a filter assembly.
- There was an extension cord running on the ground through a doorway and the metal door was closed on the cord without any protection. There was an electrical outlet bar outside exposed to the rain without any protection. Both issues were located near the plant entrance.
- A spiked shoe cover was placed upside down (three cm spikes sticking up) at the entrance door to the Safety Ultimate Diesel (DUS) Building despite the presence of a designated storage location.
- A drainage catch device in the DUS air compressor room was not in the proper place and was full of oily water resting on a flange above the drain pipe, and was no longer catching dripping water from the pipe resulting in water on the floor.
- During assembly of the new filter elements into a filter cartridge, workers remained in a corner adjacent to drainage pipework that could at times have higher radioactive dose rates. This work was performed in a cramped area with limited mobility for the activity. An adjacent space was available but was not used. This precaution was raised by the Contract Manager during the post-job debriefing.
- Fire hoses that had been previously staged to support work activities on a roof were observed to be no longer stored in a manner that would allow easy deployment during a fire emergency. This was corrected promptly after it was identified by the OSART team.
- An individual was observed coming down a set of stairs inside a building without holding the handrail and not wearing a mask even though masks are required in the building. A manager challenged the individual.
- Two workers were observed moving upstairs with both hands carrying barricades and were not holding handrails in the pump station.
- Two instances where workers were observed in a plant area requiring eye protection and did not have eye protection. This was corrected by coaching from plant managers.

Unsafe conditions:

- On the ground floor in the radioactive waste area there were over 100 blue metal drums. These drums were stacked 5 drums high with no pallet between stacks.
- A work location on the roof of Unit 2 contained bricks, a wheelbarrow, two wooden pallets, and an electrical distribution panel next to a catch containment area. A temporary electrical cable in this area was positioned in a manner that created a trip hazard.
- In the Unit 1 Radiation Controlled Area (RCA) there were two metal gutter covers against the wall in vertical position leaving a 70cm*30cm, 30cm deep hole in the floor.
- At least four emergency exit lights were found out of service in the electrical building.
- All the lights were off in room 1KA0506 that contains steam driven emergency feedwater pump 1ASG031PO. This was determined to be due to a tripped circuit breaker.

- Two circuit breakers (2LUUB51JA and 2LUUC71JA) in an electrical panel were racked out and protruding from the panel with no cover applied to the top opening of the circuit breaker to prevent access to the internals.

Facilitating safe work practices:

- An electrical worker was aware of the need to have no rings or jewellery during electrical work. When questioned regarding wearing metal components such as access badge clips, the worker stated that it was not clearly forbidden by the applicable standards and was acceptable based on risk assessment, provided the metal badge was not dangling down into the panel during the work.
- An operator indicated that it was challenging to know the right system to use to report defects as there are multiple databases depending on the nature of the issue that needs to be addressed.
- The training mock-up area had multiple posters depicting 10 vital safety rules. The posters in the plant depict 11 vital safety rules. The posters in the training building come from the company wide list of the 10 vital safety rules and do not contain the additional safety rule added by the nuclear fleet on radiography.
- In the DUS building, two elevated doors with no exterior access platform were closed. An improvised rope arrangement was in place to control the door position if they needed to be opened.
- There was a long-standing scaffold built at the DUS generator building to allow liquid waste to be pumped out of the building. The connection point for pumping out the waste was too high up to be accessed without the scaffold. The scaffold partially obstructs the stairway. There is a modification outstanding to address this design issue so that the temporary scaffold can be removed.

Performance Trends:

- The plant continues to have lost time accidents with 11 in 2019, 12 in 2020 and 7 in 2021 up to the end of September.
- The plant has an increasing trend in minor accidents with 16 in 2019, 19 in 2020 and 21 in 2021 up to the end of September.
- The ratio of lost time accidents to minor accidents and near-misses is high at 11/37 in 2019, 12/32 in 2020 and 7/27 in 2021 to September.

Plant Events:

- On 13 June 2021, a worker was injured while moving an electrical cable with two other workers. After the activity, the worker felt a pain in his shoulder and went to the hospital. This was a lost time injury.
- On 19 March 2021, a worker injured their ankle while conducting rounds. While ducking underneath pipes they stumbled over some flexible fire hoses laying on the ground. This was a lost time injury.
- On 4 August 2020, a worker injured his hand while using an impact wrench and a hammer. The worker intended to hit the wrench with the hammer and instead hit his hand causing a fracture. This was a lost time injury.
- On 14 June 2020, a worker fell from standing on a plastic chair, injuring their knee while assembling an airlock in front of the In-core Instrumentation room. This was a lost time injury.

Without strict adherence to Industrial Safety standards, personnel safety could be challenged.

Recommendation: The plant activities should be performed and controlled in a manner that ensures personnel safety.

IAEA Bases:

SSR-2/2 (Rev.1)

Requirement 23 Non-Radiation-Related Safety

The operating organization shall establish and implement a programme to ensure that safety related risks associated with non-radiation-related hazards to personnel involved in activities at the plant are kept as low as reasonably achievable.

5.26 The non-radiation-related safety programme shall include arrangements for the planning, implementation, monitoring and review of the relevant preventive and protective measures, and it shall be integrated with the nuclear and radiation safety programme. All personnel, suppliers, contractors and visitors (where appropriate) shall be trained and shall possess the necessary knowledge of the non-radiation-related safety programme and its interface with the nuclear and radiation safety programme, and shall comply with its safety rules and practices. The operating organization shall provide support, guidance and assistance for plant personnel in the area of non-radiation-related hazards.

Requirement 24 Feedback of Operating Experience

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.

5.27 The operating organization shall establish and implement a programme to report, collect, screen, analyse, trend, document and communicate operating experience at the plant in a systematic way. It shall obtain and evaluate available draw and incorporate lessons for its own operations, including its emergency arrangements. It shall also encourage the exchange of experience within national and international systems for the feedback of operating experience. Relevant lessons from other industries shall also be taken into consideration, as necessary.

5.28 Events with safety implications shall be investigated in accordance with their actual or potential significance. Events with significant implications for safety shall be investigated to identify their direct and root causes, including causes relating to equipment design, operation and maintenance, or to human and organizational factors. The results of such analyses shall be included, as appropriate, in relevant training programmes and shall be used in reviewing procedures and instructions. Plant event reports and non-radiation-related accident reports shall identify tasks for which inadequate training may be contributing to equipment damage, excessive unavailability of equipment, the need for unscheduled maintenance work, the need for repetition of work, unsafe practices or lack of adherence to approved procedures.

5.29 Information on operating experience shall be examined by competent persons for any precursors to, or trends in, adverse conditions for safety, so that any necessary corrective actions can be taken before serious conditions arise.

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. Operating personnel shall be briefed on events of relevance and shall take the necessary corrective actions to make their recurrence less likely.

5.31 The operating organization shall be responsible for instilling an attitude among plant personnel that encourages the reporting of all events, including low level events and near misses, potential problems relating to equipment failures, shortcomings in human performance, procedural deficiencies or inconsistencies in documentation that are relevant to safety.

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.

GSR Part 2

Requirement 12: Fostering a Culture for Safety

Individuals in the organization, from senior managers downwards, shall foster a strong safety culture. The management system and leadership for safety shall be such as to foster and sustain a strong safety culture.

5.1. All individuals in the organization shall contribute to fostering and sustaining a strong safety culture.

Plant Response/Action:

- Analysis conducted

- On-site activities are not always carried out or managed in such a way as to guarantee personnel safety. The OSART team identified deviations in industrial safety-related behaviours, hazardous conditions and the application of safe working practices. The team issued a recommendation in this area.
- The analysis led to work, on the one hand, on the exemplary behaviours expected in relation to industrial safety (defining and displaying the key expectations for industrial safety, setting up a system for the treatment of deviations by managers and staff representatives, setting the level of expectations for monitoring supervisors, managers and risk prevention officers, working more with contractors on industrial safety, etc.), and, on the other hand, on detection and treatment of at-risk situations (the creation of an improved organisation and coordination for the treatment of hazardous situations, an analysis of the deviations observed on scaffolding and floor openings, and treatment of the causes to eradicate them).

- The root cause(s) identified

- On the topic of industrial safety-related behaviours, the root causes are:
  - Deviations in industrial safety tolerated at the plant,
  - Sanctions process not clearly defined other than those related to life-saving rules,
  - Lack of contractor monitoring in the area of industrial safety expectations,
  - Risk assessment not always sufficiently in-depth,
  - OE insufficiently shared with contractors,

  - Contractors insufficiently coached on industrial safety rules.

- For hazardous situations and hazardous work environments, particularly for risks associated with working at a height and lifting & rigging, the root causes are:
  - At-risk situations are not always detected and corrected,
  - Quality deficiencies concern the assembly of scaffolding,
  - Shortfalls were noted in the process for opening floor hatches,
  - Absence of areas or equipment dedicated to unloading activities on the site.

- Corrective action plan

- “Behaviours”:
  - Clarify our common expectations and implement the Management Response to Deviations process,
  - Work with the Contractor Monitoring Supervisors (CSIs) network to develop focus on common risks, in the managers network, within the Risk Prevention Department (SPR), and provide a support document of observable points for the Dedicated Field Teams (EDT) and Field Brigades to focus on,
  - Reinforce the coordination of Industrial Safety around contractors (particularly by embedding the QHSE networks (Environment, Health and Safety) and industrial safety rituals with the companies),
  - Set up training for Risk Assessment (ADR.) validators,
  - Set up a method to raise the delivery people’s awareness of industrial safety risks (“industrial safety induction”).
- “At-risk situations and hazardous work environments”:
  - Establish a specific organisation and enhanced coordination for the treatment of hazardous conditions,
  - Analyse the quality deficiencies observed on scaffolding, identify the root causes and determine the actions to eradicate them,
  - Analyse the deviations when opening floor hatches, identify root causes and determine actions to eradicate them,
  - Analyse the need for an area or equipment dedicated to unloading on-site.

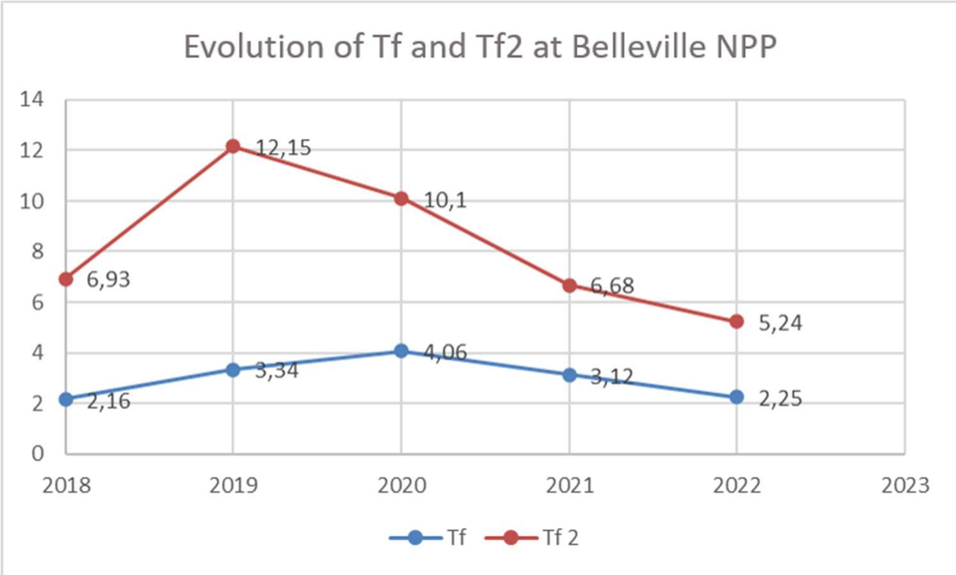
- Progress to date

- “Behaviours”:
  - Work has been done to define our common expectations, which have been shared with managers and staff representatives, and communicated to all teams. They are displayed at the site entrance, between the two units, at the smoking shelters, etc., and are presented to the contractors during the industrial safety induction training,
  - As part of the deployment of the Management Response to Deviations process, a Working Group (GT) that included representatives from different departments worked on defining what is unacceptable behaviour and the appropriate level of response. The work was then shared in a leadership seminar with all the managers at the plant, as part of the deployment of the Just Culture, and then in a meeting of station senior managers. A brochure has been issued for all managers, specifying what is unacceptable behaviour and the appropriate level of response,

  - The SPR (Risk Prevention) champions worked with the Contractor Monitoring Supervisors network to develop focus on everyday risks, in the network of managers, and within the SPR itself. A support sheet of observable points is being finalised to help focus the observations of the Dedicated Field Teams (EDT) and Field Brigades,
  - The coordination of Industrial Safety around contractors has been reinforced, with the creation of a monthly discussion session with company representatives in Power Operations (TEM) and a weekly session during Outages (AT), and the coordination of the QHSE network,
  - Training for Risk Assessment validators has been scheduled after the 2023 outage campaign,
  - Work is under way to raise delivery people's awareness of industrial safety risks (installation of a sign at the site entrance) under the supervision of the SPR department.
- "At-risk situations and hazardous work environments":
  - An organisation has been defined for reporting and managing the treatment of hazardous conditions at the plant (specific telephone number '4040' set up to report and record hazardous conditions, coordinated by the SPR, reported in performance review),
  - The quality deficiencies observed on scaffolding have been analysed. Actions have been initiated, such as extracting the list of scaffolding assembled for more than three months to initiate a check, defining an organisation for a typical scaffolding, ordering gates equipped with toe boards on work platforms to prevent objects from falling off, "scaffolding/thermal insulation monitoring" training for work coordinators and monitoring supervisors from the Fuel, Waste and Logistics Department (KDL), the high participation of the KDL Department staff at the presentation organised by our central services on the fundamentals of the scaffolder, and including observable scaffolding practices in the KDL Department monitoring programmes. In addition, an industrial safety briefing was held within the Modifications and Civil Engineering Department (MGC) on the checks to be carried out on scaffolding,
  - The quality deficiencies observed on floor openings were analysed. The process for opening floor hatches was the subject of a special working meeting, between the KDL Department and SPR in January 2023, which led to identifying and implementing actions to improve the process for opening/closing floors and/or guard rail removal with tracking by the KDL and SPR departments,
  - Work is ongoing for the definition and signage of areas dedicated to unloading on the site, under the supervision of SPR.

- Corrective action effectiveness evaluation

- The Industrial Safety performance of Belleville sur Loire NPP is improving. 1st place, winning the only prize in the Fleet for Risk Prevention in 2023, based on 2022 performance.
- We did not record any accidents related to critical risks in 2022.
- The Industrial Safety indicators are improving:
  - Improved Industrial Safety accident frequency rate (tracking of Lost-Time Accidents) => Tf = 4.06 in 2020, 3.12 in 2021, 2.25 in 2022,
  - Improvement of the Industrial Safety Accident Frequency Rate 2 (tracking of Lost Time Accidents and Non-Lost Time Accidents) => Tf2 = 10.1 in 2020, 6.68 in 2021, 5.24 in 2022.



IAEA Comments:

The plant has carefully evaluated this recommendation and determined that in the area of behaviours there was a tolerance of low standards and not detecting safety issues, and a lack of adherence to expectations and standards. In the area of unsafe conditions, there were weaknesses in detection and correction of standards, with specific gaps in lifting and rigging, working at heights, scaffolding and control of openings in floors.

The plant has taken actions to clarify expectations by defining and communicating expected standards for safety behaviours. These standards have been presented in a streamlined and simplified manner to plant teams and contractors. Additional work is planned to include these expected standards in a handbook for plant staff.

The plant has implemented the principles of a just culture model to recognize and celebrate positive behaviours and good practices, provide a blame-free environment to report errors and learn lessons, and to understand violations and address them at the appropriate level. This just culture model has been communicated to station leaders and contractors to establish a graded approach and consistency in response to issues, errors and violations.

The plant has redesigned the work quality training course to improve skills around risk assessment and has conducted several pilot sessions. This will be further reviewed and is planned to be delivered to plant staff in 2023 and 2024.

In-field-education, oversight and coaching of plant leaders on selected topics is conducted on a regular basis (weekly online or daily in outage), by dedicated teams, assembled for the occasion by a team leader from the senior leadership team, and including managers and subject matter experts. The main contractors for the plant also participate in this process. Observation templates to guide these field visits are used where available and will be included in a guide which is planned to be issued in July 2023.

The number of lost time accidents per million hours worked has decreased from 3.12 in 2021 to 2.25 in 2022.

The accident rate (lost time and non-lost time per million hours worked) has decreased from 6.68 in 2021 to 5.24 in 2022.

Some of the actions taken have been completed recently and additional time is required to show sustained improvement towards excellent performance. Several actions are still planned to be performed including completion of work quality training to improve skills around risk assessment and implementation of safety standards into the handbook for plant staff.

Conclusion: Satisfactory progress to date

2. TRAINING AND QUALIFICATION

2.2. QUALIFICATION AND TRAINING OF PERSONNEL

Human Performance Tool refresher training using the ‘escape game’ approach at the on-site training facility is providing an improved learning environment for the trainees to use most of the standard set of Human Performance tools, such as, reading and understanding work packages and adherence to procedures. The training facility also drives the teams to take into account operating experience in order to avoid the pitfalls in the game. To successfully complete the escape game, trainees must apply the human performance tools. This helps them understand and value the use of these tools during their activities on the plant. The team recognized this as a good practice.

The plant standards in the implementation of operations training are not always carried out in a systematic way to ensure the consistency of training delivered. For example, training materials are sometimes not formally approved; the simulator is not always a realistic replication of the plant; the staff who fill the field peer coach role do not undergo a formal selection process, training or authorisation. The team made a recommendation in this area.

DETAILED TRAINING AND QUALIFICATION FINDINGS

2.2. QUALIFICATION AND TRAINING OF PERSONNEL

2.2(a) Good practice: Human Performance Tool refresher training using the ‘escape game’ approach at an on-site training facility.

The aim is to reinforce good error reduction techniques using an engaging and dynamic approach, while maintaining good technical links to activities performed on a nuclear power plant.

Trainees must work as a team to solve puzzles, which are distributed across the on-site training facility. The scenario is modified annually to provide a new game for the trainees each year, thus maintaining a strong interest in refresher training.

The exercise forces trainees to use most of the standard set of tools required by Nuclear Power Generation Division from the Corporate, such as, reading and understanding work packages and adherence to procedures. The environment also drives the team to take into account the operating experience in order to avoid the pitfalls in the game in the industrial environment of the on-site training facility.

To successfully complete the escape game, trainees must apply the human performance tools. This helps them understand and value the use of these tools during their activities on the plant.

The feedback from trainees is excellent and they are enthusiastic about and entirely satisfied with this training approach.

This approach can be deployed at all plants with an on-site training facility by adapting the scenario.

(Note: This photograph was taken before the Covid pandemic).

2.2(1) Issue: The plant standards in the implementation of operations training are not always carried out in a systematic way to ensure the consistency of training delivered to conduct safe and reliable operations.

- The team noted the following: There is no process to assess the suitability of a staff member to be field peer coaches and on-the-job observers, this is a judgement call made by the shift team lead according to their experience and attitude.
- Formal training is available for staff who carry out the role of field peer coaches and on-the-job observers, but this is not always given to staff. The operations team indicated that it is only given if it is felt that they will carry out a lot of field peer coaching or on-the-job observations. Currently only one person in the operations department has undertaken this training.
- There is no formal selection process or training for staff who undertake field coaching and observation of staff to confirm their suitability for authorization.
- In interviews with deputy shift manager, lead operator, senior tagging officer, field operators, and online and outage operations teams:
  - All stated they had not received formal training regarding field peer coaches and trainers and on-the-job observers or assessment on granting authorization, instead they used their skills and experience.
  - All stated that the proposal for authorization of Tagging Officers trainees comes from Senior Tagging officer observing the trainee working in the field on multiple occasions. No formal training in on-the-job observations had been given to these team members at this time.
  - It was stated that the Field Operators proposal for the authorization process is completed by walk down with peer coach and trainee. This is in line with their guidance note for authorization of field operators. No formal training in on-the-job observations and training is given to the team members carrying out this role at this time.
  - It was confirmed that in line with Plant Processes, the Reactor Operator proposal for authorization process is completed by a walk down with peer coach. This is in line with their guidance note for authorization of field operators. No formal training in on-the-job observations is given to the team members carrying out this role at this time.
- There was no requirement in the management guidance to carryout formal post-training assessment when assessing skills or issuing and renewing reactor operator and field technicians' authorization. The only requirement in the standard training plan is field observations.
- During an interview with the operations documentation modification controller, it was stated that team training for smaller modifications may be given to shift team and if staff miss this, they have to get information from their team members. There was no formal make-up training available to ensure all team members get the same baseline knowledge in the field on plant modifications.

Simulator difference control:

- In cold shut down mode, from the point when the pressurizer manhole access starts to open, there are some parameters that are no longer representative in the simulator. For example, the simulator code does not cover:
  - emptying steam generators during cold shutdown.

  - steam generator tube failure causing dilution of the Reactor Cooling System (RCS) during cold shut down.
- Practical training is not possible in these situations with the simulator.
- There are several differences between the simulator and NPPs that generate complications during operator training.
  - On the simulator, there is no control panel for the containment sweeping ventilation system used during outage.
  - On the simulator, the threshold for tripping the circulating water pumps is different from that on the NPPs. The plant has a specific alarm response sheet in the simulator for trainees.
  - The Safety Ultimate Diesel (DUS) and the alarms are not included in the simulator.
  - Chart recorders are all digital for the simulator, but paper recorders are used in the NPPs.
- While observing one operator training on the simulator, the instructors did not discuss simulator deviations from the NPPs. Midway through the scenario, the deputy shift manager called the shift manager (a simulator instructor was acting as shift manager). The instructor informed the deputy shift manager that there was a difference from the NPPs, and that he had to look at indicators other than those that the procedure stated.

Operation training evaluation:

- Training materials can be modified by the trainer without any evaluation or analysis. The plant stated that the presenter is permitted to change the corporate material supplied within certain defined boundaries.
- For Severe Accident classroom training for Main Control Room (MCR) personnel, no formal evaluation of the trainees is conducted and so there is no confirmation that they understand the training topic.
- No mandatory refresher training on learning techniques is required for simulator instructors.
- In the summary report (annual report September 2020 to September 2021) on simulator training, it was stated that only 60% of trainees worked correctly with the procedures for a reactor control rod scenario.

Without a systematic and consistent training for operation employees, their knowledge of the training topic and associated skills may not be adequate to ensure safe and reliable operation.

Recommendation: The plant should improve operations training implementation to ensure the training is always delivered consistently to conduct safe and reliable operation.

IAEA Bases:

SSR 2-2 (Rev.1)

Requirement 7: Qualification and training of personnel

The operating organization shall ensure that all activities that may affect safety are performed by suitably qualified and competent persons.

4.16. The operating organization shall clearly define the requirements for qualification and competence to ensure that personnel performing safety related functions are capable of safely performing their duties. Certain operating positions may require formal authorization or a licence.

4.17. Suitably qualified personnel shall be selected and shall be given the necessary training and instruction to enable them to perform their duties correctly for different operational states of the plant and in accident conditions, in accordance with the appropriate procedures.

4.18. The management of the operating organization shall be responsible for the qualification and the competence of plant staff. Managers shall participate in determining the needs for training and in ensuring that operating experience is taken into account in the training. Managers and supervisors shall ensure that production needs do not unduly interfere with the conduct of the training programme.

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. The refresher training shall also include retraining provision for personnel who have had extended absences from their authorized duties. The training shall emphasize the importance of safety in all aspects of plant operation and shall promote safety culture.

4.20. Performance based programmes for initial and continuing training shall be developed and put in place for each major group of personnel (including, if necessary, external support organizations, including contractors). The content of each programme shall be based on a systematic approach. Training programmes shall promote attitudes that help to ensure that safety issues receive the attention that they warrant.

4.21. The training programmes shall be assessed and improved by means of periodic review. In addition, a system shall be put in place for the timely modification and updating of the training facilities, computer models, simulators and materials to ensure that they adequately reflect current plant conditions and operating policy, and that any differences are justified.

4.22. Operating experience at the plant, as well as relevant experience at other plants, shall be appropriately incorporated into the training programme. It shall be ensured that training is conducted on the root cause(s) of the events and on the determination and implementation of corrective actions to make their recurrence less likely.

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-2.4

6.19. A training programme should ensure that personnel at all levels of operation of nuclear power plants have the requisite competence. It should identify the activities in which safety is involved, should provide for acquisition of the knowledge and practical experience needed for these activities and should foster a responsible attitude towards all safety matters.

NS-G-2-8.

5.7. Personnel specified by the operating organization should be made familiar with the features of safety analysis as part of their training programme. Training and assessment of plant operators should ensure their familiarity with the symptoms of beyond design basis accidents and with the procedures for accident management. Simulators should represent the way in which an accident would evolve. If the available simulator facilities are inadequate, computer based training, classroom training and plant walkthroughs should be used to explain the consequences of an accident involving a seriously degraded reactor core.

5.19. Operators should be trained in routines for normal operation of the plant and in the response of the plant to changes that could cause accidents if not counteracted. The training programme should improve the diagnostic skills of the trainees. Operating procedures for normal operation and for anticipated operational occurrences and, as far as practicable, severe accident conditions should be included in the programme and should be practiced at the simulator, so that the trainees recognize the negative consequences of errors or of violations of procedures.

Plant Response/Action:

- Analysis conducted

- The causes of the weaknesses in reinforcement within Operations were analysed, which revealed that:
  - Training courses for coaches, tutors or managers exist but are not rolled out for all crews,
  - Corporate modification files do not systematically include a training component tailored to needs and to all the populations concerned.
- Discussions with the central services of UFPI (Corporate Training Organisation) have taken place on the training limits caused by both the differences of the simulator from the main control room and its operating limits. In addition, the safety impact of simulator differences from VD3 batch A and batch B modifications was analysed to request that priority would be given to the deployment of the future SATURNE simulator: a digital simulator which is smaller in size with touch panels, imitating the main control room as it is after VD3 Batch B.
- The practices and needs of instructors were assessed:
  - This confirms that instructors do not systematically present the differences between the simulator and unit at the beginning of the training scenario. There is no document stipulating that this presentation is required in simulator training, except in assessment conditions,
  - It confirms that the assessment practices used comply with the specifications. Some of the classroom training sessions are subject to a formative assessment based on the instructor’s questions. Depending on the answers provided by the trainees, the instructor adds elements to help the trainees brush up on their knowledge and skills,
  - It highlights that the need for refresher training for trainers had not been studied at station level until then and that there is a need to re-examine the instructors’ pedagogical skills.
- The causes of the main weaknesses identified during the 2020-21 operator skills upkeep training were analysed, which identified the need to include the use of the I-RGL (Incidental Procedure for Controlling the Control Rods) instructions in the next MCCO (Operators Skills Upkeep Training) scenarios.

- The root cause(s) identified

- The Operations Department (SCD) is included in the overall approach used at Belleville sur Loire NPP and the DPN (Nuclear Generation Division) relating to shadow coaching and so implements the organisational notes,
- In general, the instructors know the differences between the Control Room Simulator and the actual conditions on the facility but do not always take them into account in the training sessions,

- The Joint Training Department (SCF) has identified a lack of framework in the way that training documents are modified,
- Some areas had not been identified by the SCF prior to the OSART 2021 assessment, such as the refresher training in pedagogy for instructors.

- Corrective action plan

- Ensure that all Operations Department shadow coaches have a mission statement and have them complete one if this is not the case.
- Organize an annual focus meeting for the Operations Department shadow coaches to reinforce the core meaning of the functional group's requirements and the department's expectations.
- Ensure that all SCD tutors have completed tutor training and register them if this is not the case.
- Enrol the employees concerned in Management-in-the-Field (MIF).
- In addition to the initial training provided, train SCD employees on modifications with the aim of: one employee trained per crew who will then cascade it down along with the functional group referent.
- Deployment of the “START 2025” Skills project, which identifies shadow coaching as an essential driver for employee skills development.
    - Safety Message in the week starting 27 February 2023,
    - Update of note D5370MO12070 describing the methods for deploying shadow coaching in the departments, presentation in the Skills Management Committee on 23 February 2023 and the Skills Committee on 23 March 2023,
    - Tracking of the shadow coaches’ mission statements and their role in the Skills Committees for each department 3 times a year.
- The future SATURNE simulator, a digital simulator of reduced size with tactile panels, imitating the main control room in VD3 Batch B state, will be deployed on the plant of Belleville sur Loire in 2024.
- Update the SCF organisation note to define, in line with the corporate expectations, the framework for authorising the modification of training documents.
- The SCF will rework the Training Monitoring Sheets (FSP), which give the framework for the simulator instructor’s course, to include simulator differences covered by the training scenario. It will therefore be mandatory for the instructor to go through the reminder before starting the simulator training scenario. The SCF management team will check that this practice is correctly applied.
- The SCF questioned the need for refresher training for its instructors. Refresher training will be carried out in September 2023, before the future MCCO 2023-24 courses begin.
- During the back-of-the-class observations, the SCF manager checks the compliance of the assessment against the Training Specifications (CCF).
- The SCF rolls out scenarios on the use of the I RGL instruction on the 2 MCCOs in the years 2021-22 and 2022-23.

- Progress to date

- The actions relating to shadow coaching within the SCD show an overall completion rate of 57%. Upcoming actions are:
    - Tutors and coaches who are not yet trained to be registered for training,

  - Organize an annual focus meeting for our coaches to reinforce the core meaning of the requirements for the functional group and the expectations of the department,
  - Register employees concerned for MIF.
- The future SATURNE simulator will be deployed at Belleville sur Loire NPP in 2024. ➔ the action is 25% completed.
- The SCF organisational note has been updated ➔ and the action is 100% completed.
- The SCF is working on the Training Monitoring Sheets ➔ and the action is 20% completed.
- Refresher training will be carried out in September 2023, ➔ the action is 30% completed.
- During the back-of-class observations, the SCF manager checks the compliance of the assessment against the CCF. ➔ the action is 20% completed.
- The SCF rolls out scenarios on the use of the I-RGL instructions for the 2 MCCOs of the years 2021-22 and 2022-23. ➔ the action is 80% completed.

- Corrective action effectiveness evaluation

- The measure of effectiveness is to train all the staff who are SCD coaches, tutors and managers. The SCD is also committed to the MIF approach for its management line: DSE (Tagging Supervisor), CED (Deputy Shift Manager), CE (Shift Manager), CdSD (Deputy Department Manager), CdS (Department Manager) i.e. 32 employees.
- The effectiveness will be measured through scenarios created for use on the future SATURNE simulator.
- The MIF within the SCF will check that the document modifications are compliant, the instructors follow the Training Monitoring Sheets (FSP) correctly, and that their position as instructors is appropriate, and that there are no deviations from the Training Specifications (CCF).
- The results of the 2 MCCOs 2021-22 and 2022-23 will assess if the operators correctly adhere to the use of the I-RGL instructions.

IAEA Comments:

The plant has evaluated this recommendation and determined that the approach to mentoring and coaching and management evaluations of in-plant training were not fully formalized, the plant control room and simulator differences and capabilities were not always taken into account in training, and some training document controls and instructor refresher training were not formalized.

The plant has initiated training for mentors, with 36% completed and plans to train the remaining mentors. All the mentors to be trained have been identified and training has been scheduled for all but 2 of the remaining mentors.

The plant has identified, appointed, and issued formal job documents to all the in-plant coaches. In addition, the plant has established an operations training lead with operations field and control room experience that works closely with the operations and training departments to ensure consistency among the coaches.

The plant has qualified all the Shift Managers to perform management evaluations and has embedded this training in the initial Shift Manager training programme.

The plant training procedure regarding specific roles of mentors, coaches and management evaluators has been updated and the details rolled out to all station staff.

The plant has briefed simulator instructors on the need to discuss simulator/plant differences. Implementation of this change in expectations has been monitored by training management. The plant has created a formal refresher training session for simulator instructors which is planned for delivery in September 2023.

The plant has progressed development of an additional digital simulator that will be deployed in 2024 to provide additional training capability. This additional digital simulator will have software that will enable the plant to keep the simulator up to date with the plant.

Training management checks on the simulator/plant differences has confirmed that simulator instructors are appropriately considering and highlighting the simulator differences for training activities.

Outstanding actions remain regarding completion of the training for mentors, conduct of refresher training for simulator instructors, implementation of changes in simulator capability and establishment of monitoring for performance improvement.

Conclusion: Satisfactory progress to date

3. OPERATIONS

3.1. OPERATIONS ORGANIZATION AND FUNCTIONS

The plant has implemented monthly self-assessments using high-level and low-level events to assess the management of Operator Fundamentals. The team recognized this as good performance.

3.4. CONDUCT OF OPERATIONS

Reactivity manipulations are not always controlled and implemented at the plant in a manner that ensures precise plant control. For example, during the visit the team observed gaps from a number of reactivity manipulations in the control room. The team made a recommendation in this area.

Operator behaviours for some Main Control Room (MCR) activities do not always ensure high level of professionalism. For example, the team observed that in some cases, behaviours demonstrated by the operating crew did not meet management expectations. Behaviours observed included gaps in maintaining overall plant monitoring, inconsistent use of some human performance tools, and operators sitting on control panels. The team made a suggestion in this area.

3.5. WORK CONTROL

The plant's expectations for on-line work management is not robust enough to maximize equipment availability, effectively manage resources, and provide a stable work schedule. For example, work is regularly impacted for a variety of reasons but there is no process being used to identify and track the main reasons for work being delayed or cancelled. Learning reports are not regularly submitted to investigate the reasons. The team made a suggestion in this area.

3.7 CONTROL OF PLANT CONFIGURATION

Operations management developed a tool to alert operators when control rods are in manual position to prevent the rods from being controlled in manual mode due to operator error or omission. The team identified this as a good practice.

DETAILED OPERATIONS FINDINGS

3.4. CONDUCT OF OPERATIONS

3.4(a) Good Practice: Use of a Main Control Board layover plaque to provide an alert to the operator, when control rods are in manual position.

To prevent the rods from being controlled in manual mode owing to an operator error or omission, a double-sided plaque has been created, which fits onto to rod control switches.

This plaque can only be positioned on the panel if the rods are in automatic mode. Its presence therefore confirms that rod position is controlled in automatic mode.

When an activity requires the rods to be switched over to manual mode, this plaque is positioned on the vertical panel in the control room using magnets. Its red color and its position on the vertical panel alerts all operations staff in the control room that the control rods are in manual mode, thereby facilitating plant status control. This plaque was developed with inputs from past events from the plant.

On the left, control rod switches in automatic position with plaque (green side) in place.

On the right, flip side of plate (red side), positioned on the vertical panel using magnets and visible for all the crew when the rods are controlled in manual mode.

3.4 CONDUCT OF OPERATIONS

3.4(1) Issue: Reactivity manipulations are not always controlled and implemented at the plant in a manner that ensures precise plant control.

The team noted the following:

- During the performance of the Unit 1 Hydrotest Pump Turbine Generator Set (LLS) Surveillance Test:
  - The operator took precautionary action to raise volume control tank (RCV) pressure in anticipation of the test. However, switch manipulations were made without observable correct component verification or Stop-Think-Act-Review.
  - No control bands were established prior to the start of the test to take into account the potential to take suction on the refuelling water storage tank (RWST/PTR tank). Countermeasures outlined in the procedure were appropriately briefed and, in this case, the RWST level did not change.
- During a dilution of the reactor coolant system (RCS) to control RCS Temperature by the Main Control Room (MCR) operators, no procedure was used, or peer checks performed for the reactivity manipulation. However, it was informed that this meets plant expectations, if self-check is performed, when changes to RCS temperature are less than 1 degree C.
- On 10 March 2019, the RCS high-temperature limit was exceeded when operators did not recognize rod control had been taken to manual during a period of load following, and subsequent Xenon decay resulted in rising RCS temperature.
- On 23 March 2021, during cycle stretch-out mode on Unit 2, operators performed surveillance test RPN003 instead of surveillance test RPN008. This could have resulted in not identifying the need to reset the power channels. If the power range channels were not reset, the 'Automatic Reactor Trip upon high flux' protection function, set at 109%, could have been delayed. This was not classified as a reactivity management impact by the site but as a surveillance test issue.

Performing reactivity manipulations without rigour in human performance and supervisory oversight has the potential to result in unintended power transients and challenges to operating parameters.

Recommendation: The plant should improve the control and implementation of reactivity manipulations to ensure precise plant control.

IAEA Bases:

SSR-2/2 (Rev. 1)

7.20. The operating organization shall be responsible for establishing a safe reactivity management program under a strong management system for quality. Decisions on, and the planning, evaluation, conduct and control of, all operations or modifications involving the fuel that are liable to affect reactivity control shall be undertaken by using approved procedures and respecting predefined operational limits for the core.

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.

NS-G-2.14

5.21. The operations management should be involved in the planning, evaluation and conduct of all operations affecting the fuel while the fuel is under its supervision (i.e. not only during operation of the reactor). The level of involvement of the operations management should correspond to the degree of responsibility that the operations department has for the safe operation of the plant and to the degree of responsibility assigned to shift personnel under the supervision of the shift supervisor. Further recommendations on operations relating to reactivity are provided in Ref. [10].

5.22. Decisions on operations that may result in manipulations of reactivity should be such that the reactor is maintained within established core operational limits. Operation within operational limits for the core provides the basis for safety in anticipated transient operational states. The importance of maintaining margins to core operational limits should be highlighted as part of the management's expectations for operating within established limits.

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. Planned reactivity changes should only be performed in accordance with written operating instructions and the explicit permission of the shift supervisor. The supervisor should monitor the reactivity and the plant evolution and the reactor operator should be free from other duties and free from distractions while planned reactivity changes are carried out.

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:

- Analysis conducted

- Reactivity Management (MR.) actions are not always coordinated and implemented in such a way as to guarantee the precise operation of the units.
- Carrying out actions on reactivity without the rigorous use of Human Performance Tools and management checks can lead to unintentional transients and adverse trends on operating parameters.
- Similarly, the Nuclear Inspectorate (IN) revealed anomalies in the use or completion of criticality files that had not been detected by the level 1 and level 2 checks.

- The root cause(s) identified

- The workers lack rigour in the application of the operating documents.

- The lack of precision in the expectations for the technical check and the first level analysis (A1N) of activities means that not all anomalies can be captured.
- Lead Operators (PDT) must be responsible for controlling the reactivity on their unit.

- Corrective action plan

- Action plan to control the quality of criticality files:
  - Simplification of criticality files to improve quality: ongoing work with corporate entities to simplify criticality files with the Core & Fuel Operations Engineer (IECC),
  - Reinforce the Lead Operator's and the Deputy Shift Manager's supervision when elements are recorded in the operating documents during a criticality transient with the creation of supervision support sheet: Create a note for reactivity management activities, a schedule specifying all reactivity management activities, for any sensitive Transient (TS) there must be a Pre-Job Briefing (PJB) between Operators with the supervision of the Lead Operator,
  - Specify the expectations for the Technical Check (CT) and the first level analysis (A1N) of criticality files in the Function-Specific Coordination Groups (GAM) for "Lead Operators (PDT), Deputy Shift Managers (CED) and Shift Managers (CE)": currently being rolled out in the various Function-Specific Coordination Groups (GAM).
- Deployment of the Reactivity Management roadmap
  - The Lead Operators' Guide for supervision, in the area of Reactivity Management:
    - for any activity with a Reactivity Management risk in the main control room, a PJB must be carried out under the supervision of the Lead Operator,
    - work ongoing with the corporate Skills Support Group (PCC) in the form of an executive board,
  - Implementation of the Reactivity Management leaders charter: validation of this charter for Shift Managers/Deputy Shift Managers in 2023,
  - Identification of activities with Reactivity Management risks in the schedule,
  - Visual identification of Reactivity Management risks made available through a booklet for operator activities in the main control room: the change management for this additional "Reactivity Management booklet" measure remains to be deployed and coached within the crews
  - CPIL (Reactivity Management skills upkeep) training is provided every year to focus all operations crews on Reactivity Management risks.

- Progress to date

- The average completion rate of the above actions is 60%.

- Corrective action effectiveness evaluation

- The measure of effectiveness is to obtain Lead Operator supervision for any activity linked to Reactivity Management as a way of guaranteeing that our activities are correctly controlled: we propose observing and reporting a decrease in Significant Safety Events (ESS) where control room monitoring is impacted in relation to Reactivity Management.
- For information, we have progressed from 1 ESS MR (Significant Safety Event - Reactivity Management). and 8 ESS Reactivity in 2021 to 0 ESS MR. and 3 ESS Reactivity in 2022. The

theme of Reactivity Management is an integral part of the Operations Department MIF programme. As such, it is reviewed during each of low-level events analysis in the department and shared with the department management team.

IAEA Comments:

The plant has carefully assessed this recommendation and concluded that plant workers lack the rigour in the application of the operating documents and lack the precision in applying the expectation for the technical checks.

The plant has taken actions to develop, revise and optimize relevant documents on reactivity management, these include the establishment of supervision guideline for the lead operator (control room supervisor) with detailed expectations on key activities in the main control room, including reactivity manipulation and management; the optimization of plant procedure on approaching to criticality; and the establishment of clear expectations in the procedure for the Technical Checks and the first level analysis on approaching to criticality.

Training has been enhanced for the operators with each operator receiving an annual one-day classroom training on reactivity management. Plant and operation managers are putting more focus on the reactivity manipulation and management in their routine observations. The deputy station director participates in the briefing and debriefing on approaching to criticality training for operators. The observation inputs on reactivity manipulation and management are trended, and areas indicating weaknesses will become the focus areas for the next training session.

The plant has witnessed improvement in reactivity management, the number of significant safety events related to reactivity management decreased from 1 to 0 from 2021 to 2022, and the number of safety events related to reactivity management decreased from 8 to 3 from 2021 to 2022.

The plant indicated that about 60% of the planned actions have been completed and some of the actions were completed recently. It will require more time to demonstrate the sustainability of these actions.

The visit to the Main Control Room by the team observed that the lead operator was fully aware of the reactivity manipulation and management improvement actions and was applying the tools and expectations resulting from the improvement action plan.

Conclusion: Satisfactory progress to date

3.4(2) Issue: Operator behaviours for some Main Control Room (MCR) activities do not always ensure high level of professionalism.

The team noted the following:

- In the Unit 2 MCR, when an issue was reported on the Spent Fuel Pool Cooling system, all four operators in the MCR grouped around the Spent Fuel Pool Cooling system display. There was no one standing back maintaining an overview of plant conditions.
- During the performance of the Unit 1 Hydrotest Pump Turbine Generator Set (LLS) Surveillance Test:
  - At the Pre-Job Briefing, the crew aligned to performing peer checks due to the critical nature of the test. However, peer checks were not consistently performed. The lead operator did not provide coaching.
  - The operator started the turbine generator then signed off a few steps in a row; however, procedure use and adherence require step-by-step performance of surveillance testing. The operator took this action due to the belief that his actions were time critical.
  - At times, both board operators and the lead operator grouped in close proximity to the main control board leaving no operators in a position to maintain overall plant status. Following the test, coaching was provided by the operations manager.
- On several occasions, operators sat down on the horizontal section of the main control board. In one case, an operator sat on the main control board for the duration of the handover brief. No coaching was provided by the lead operator or peers.
- In the MCR there is demarcation representing the ‘at the controls’ area of the control panels. In many cases, field operators walked casually through the area without regard for the demarcation, in many areas the demarcation is wearing or missing. In discussion with management, field operators are authorized to enter this area, as long as no contact is made with any switches, without authorization.
- During the Shift Handover meeting report out by the Tagging Supervisor, a number of conversations started resulting in a lack of engagement in the information being shared by the Tagging Supervisor. The lead operator did not provide coaching, peers also did not provide coaching.
- During an observation of the Unit 2 MCR, the Risk Assessment engineer entered the control room, when staff were dealing with a Spent Fuel Pool cooling issue to deliver training. The at the controls operator role was transferred during this training for the opposite Reactor Operator to undertake.
- While observing operator training on the simulator, during the scenario the crew responded to a large reactor coolant system leak. No announcements were made from the control room to alert personnel to changing plant conditions. However, the plant informed that this meets the plant expectation. While observing operator training on the simulator, 50 minutes into the scenario the leak increased from 30 tons/hour to 120 tons/hour, the primary operator did not perform a crew update when RCS leakage had increased, despite the noted change in mitigating strategy.

Without the implementation of high operational standards and management expectations for MCR activities, shift personnel may be conditioned to perform at a lower standard of monitoring, precise control, and conservative bias behaviours.

Suggestion: The plant should consider improving expectations and practices for the conduct of operations in the MCR to ensure high level of professionalism.

IAEA Bases:

SSR-2/2 (Rev.1)

4.35. Monitoring of safety performance shall include the monitoring of: personnel performance; attitudes to safety; response to infringements of safety; and violations of operational limits and conditions, operating procedures, regulations and license conditions. The monitoring of plant conditions, activities and attitudes of personnel shall be supported by systematic walkdowns of the plant by the plant managers.

NS-G-2.14

3.5. The main responsibilities of the control room operators are to operate the plant and the plant systems in accordance with the design intent and operating procedures and to maintain the reactor and other plant systems within the established operational limits and conditions.

4.8. The panels in the control room should be closely monitored. Operators should be required to check important parameters periodically (e.g. hourly), irrespective of whether these parameters are also recorded electronically. An analysis of trends should be carried out if the parameters demonstrate drifting. Supervisors should ensure that other duties (e.g. log keeping) that might distract the operators from the monitoring of panels are limited to short periods of time.

4.17. Shift briefings should be conducted in such a way as to ensure that the expectations and objectives of the shift supervisor are effectively communicated to, and understood by, all the staff under supervision. The level and number of shift briefings may vary depending on the composition of the shift crews. Briefings for control room staff should be conducted in the control room and should include the communication of information between relevant individual members of the two shift crews, and also between the two shift crews as a whole.

4.29. The management's expectations with regard to performance in the control room should be established and operators should be trained to meet these expectations. These expectations should be made clear, and managers should ensure that all operators understand them. Managers should continuously monitor the performance of operators in fulfilling the management's expectations.

Plant Response/Action:

- Analysis conducted

- The behaviour of the crews in the main control room does not always guarantee a high level of professionalism.
- If high operating standards are not put into effect and management do not reinforce expectations related to activities in the main control room, the shift crew can become conditioned to operating at a lower level in terms of monitoring, accurate operating and conservative behaviour.

- The root cause(s) identified

- The Lead Operator (PDT) does not hold the position of a leader, particularly in abnormal conditions or periods of high work load.

- In abnormal conditions, the ERP (Problem Investigation & Solving) process is not sufficiently mastered: it is not properly defined and used by the workers.
- The expectations for carrying out Operations Department activities in the main control room are not sufficiently reinforced in the main control room.
- The methods for procedure adherence are not sufficiently covered in training and in the field.

- Corrective action plan

- Include a CPO-type training course in the 2022-2023 station-level skills upkeep training request to work on the position of the Lead Operator and other crew members in abnormal conditions or during periods of high work loads: started this year during situational training but considered as not necessarily appropriate, this action is to be continued on another CRE-type (Operations crew refresher) training.
- Participate in the PCCEO-WANO leadership training for Lead Operators: Lead Operators + Tagging Officers (CC) + Field Operator (AGT) registered for the workshop in May 2023.
- Create support material to help organise the implementation of the ERP and presentation in the GAMs (Business Automation Group): The I-ERP (Procedure for Troubleshotting) instructions are written and now need to be deployed in training sessions for eventual corrections before final application.
- Reinforce the expectations and practices related to the performance of operations activities in the main control room through the Manager-in-the-Field (VMT) programme: observations and feedback given to the Lead Operators through the completed MIF.
- Include the training of Operators (OPs) in adherence to procedures in the Operations skills upkeep training request 2022-2023: Included in the current training programme.
- The “shift handover” Working Group (GT) was relaunched in early 2023 and the Operator/Lead Operator GAMs must return to a fully operational level after various changes in coordinator despite the heavy industrial work load.

- Progress to date

- The above actions are 80% completed. The Operations Department's Annual Performance Contract (CAP) includes work on rules (practices and customs) between crews to guarantee professionalism and consistency between crews.
- To remind the crews of the need to monitor the unit parameters, a Timer rings every 2 hours to indicate that the operator in charge of the main control room monitoring must complete a full panel walkdown. The operator in charge of monitoring must check the flash parameters every 30 minutes. The department's MIF programme will monitor compliance with these expectations.
- The “shift handover” working group, which has been relaunched in 2023, must give us the tools to reduce shift handover times and have an effective briefing of quality. A working group is ongoing to find the tools to secure the presence of line management at the crew briefing.

- Corrective action effectiveness evaluation

- The measure of effectiveness is to obtain controlled activities in the main control room in any situation: the Shift Handover working group, the Operators and Lead Operators GAM will be our vehicles for developing a culture of professionalism.
- MIF observations performed by the Operations Department on the simulator or in-situ will check the application of the appropriate documents.
- The Operations Department will focus on checking that Operations crews correctly apply I-ERP when the entry criteria are met.
- Once the conclusions have been drawn from the “Shift Handover” working group and the “management presence at briefings” working group, the Operations Department’s MIF programme will focus on checking that the resulting expectations are applied.

IAEA comments:

The plant has analysed this suggestion and determined that the Lead Operator does not hold the position of a leader; the problem investigation and solving process is not well defined and used; and the expectations for conduct of operation in the Main Control Room are not reinforced sufficiently.

The plant has developed supporting material for the problem investigation and solving process with more detailed descriptions for delivering in future training sessions.

Observations are enhanced to focus on operator fundamentals and Human Performance (HU) tool use in the Main Control Room. There were about 665 observations conducted by the operation managers in 2022, and the inputs from the observations were trended and analysed in detail to identify the focus areas. Interviews of two operation managers indicated that both positive and negative inputs were captured during their observations.

The plant also started to pilot the Crew Performance Observation methodology to provide operators with more exposures to different scenarios and give operation managers opportunities to observe the operator fundamentals during these scenarios.

The plant indicated that about 80% of the planned actions are completed, and some actions, such as the complete roll out of Crew Performance Observation Programme and the standardization of handover documents are ongoing.

The visit to the Main Control Room by the team observed that the housekeeping conditions were improved. However, there were two operator aids lacking quality assurance check not identified by the plant; and in one case, an operator was observed leaning against the horizontal section of the main control room board.

Conclusion: Issue resolved

3.5. WORK CONTROL

3.5(1) Issue: The plant's expectations for on-line work management is not robust enough to maximize equipment availability, effectively manage resources, and provide a stable work schedule.

The team noted the following:

- Work Management set a target of 85% completion and is currently achieving 77%. The current process for work week review is not consistently and clearly identifying the issues impacting schedule completions. During interviews with operators, they indicated that changes to the work week plan on the day of execution was one of their top concerns. Late changes have resulted in plant equipment being taken out of service and made unavailable to the operators, with no work performed prior to restoration.
- Unavailability of spare parts causes maintenance delays on equipment, some of which has nuclear safety relevance. The Operations Department clearly sets priorities and expresses a sense of urgency to complete the maintenance. However, these priorities are not fully communicated to the Corporate Spare Parts Management Department.
- As an example, the maintenance work on Process Air Compressor 1SAP101CO had to be postponed for a longer period.
- The 2 DEL train 'A' control room HVAC unit was recently changed out under a corporate-led modification project. As there are no spare parts available for temperature module 2DEL101MT, the plant was forced to apply for a STE Group 2 event derogation on the unavailability limit period.
- Due to late availability of the spare parts required, Maintenance applied for a derogation on the Preventive Maintenance Plan of gaseous waste compressor 2TEG061CO and delayed completion with one week.
- The sampling pump 2SIT111PO failed on 28 March 2021, but was rerouted through the 2SIT116PO pump for sampling of the different condenser sections. The 2SIT111PO pump was unable to perform its function and a demand for replacement of the pump was sent to Maintenance. The redundant 2SIT116PO pump also blocked completely at a later date. The demand for replacement of both pumps was sent out to Maintenance on 20 July 2021. Maintenance requested the replacement pumps on the 23 July 2021, and by mid-August 2021 the delivery date for the spares was confirmed as 30th October 2021. This date has been further delayed by the Corporate until 31 January 2022.
- During interviews with the Online and Outage Operations teams it was stated that Work Authorization is performed by the Shift Manager at the time of execution. Authorization is provided based on experience, there is no formal procedure in place. However, it is referenced from Technical Specifications. This can impact work with delays or cancellations. No formal process is in place to control or track these events. The operations team follow two rules set at corporate level, Two Group 1 Technical Specifications entries or five group 2 Technical Specifications entries requires the impacted unit to be shut down. Operations limits the entries below these levels. No PSA or PRS assessment is done on site as it is done at a corporate level.
- The stock level and type of critical spares stored locally or at corporate fleet level are decided by the corporate organization.
- There is no requirement to have the critical spares for a modification procured before the modification is transferred to the plant for operation and the Original Equipment Manufacturer (OEM) warranty period has expired. The Station Black-Out Emergency

Power System was commissioned in a fleet-wide modification process and transferred to the site for operation in mid-2020. Limited parts are available to date in the fleet. Operating experience has shown that the diesel OEM who is contractually bound to deliver the parts during the warranty period works with particularly long response delay.

When Work Management accepts delays in work completion this can reduce equipment availability.

Suggestion: The plant should consider improving its on-line Work Management processes to maximize equipment availability, effectively manage resources and provide a stable work schedule.

IAEA Bases:

SSR-2/2 (Rev.1)

Requirement 31;

8.10. The work control system shall ensure that plant equipment is released from service for maintenance, testing, surveillance or inspection only with the authorization of designated operations department staff and in compliance with the operational limits and conditions. The work control system shall also ensure that permission to return equipment to service following maintenance, testing, surveillance and inspection is given by the operating personnel. Such permission shall be given only after the completion of a documented check that the new plant configuration is within the established operational limits and conditions and, where appropriate, after functional tests have been performed.

NS-G-2.6

5.14. A comprehensive work planning and control system applying the defense in depth principle should be implemented so that work activities can be properly authorized, scheduled and carried out by either plant personnel or contractors, in accordance with appropriate procedures, and can be completed in a timely manner. The work planning system should maintain high availability and reliability of important plant SSCs.

5.17. The work control system should be used to ensure that plant equipment is released from service for maintenance, testing, surveillance and in-service inspection only upon authorization of designated operating personnel and in compliance with the operational limits and conditions. It should also ensure that, following maintenance, testing, surveillance and in-service inspection, the plant is returned to service only upon completion of a documented check of its configuration and, where appropriate, of a functional test.

5.18. Management of the work should be recognized as a cross-functional process, not exclusive to any one work group but integrating the important activities of all work groups. Consequently, for the work control process to be fully effective, all needs and concerns in relation to operations, maintenance, technical support, radiation protection, procurement and stores, contractors and other matters should be considered and should be accommodated wherever appropriate, consistent with the long term operating strategy for the plant.

5.19. The effectiveness of the work control process should be monitored by appropriate

Indicators (such as repeated work orders, individual and collective radiation doses, the backlog of pending work orders, interference with operations) and by assessing whether corrective action is taken whenever required.

8.24. The operating organization should arrange to purchase appropriate quantities of spare items and components for systems important to safety at the same time as purchasing those to be installed at the plant. These spares should, as a minimum, meet the same technical standards and quality assurance requirements as the equivalent installed plant items, but with additional provisions for ensuring adequate protection during long term storage.

8.25. The initial quantities of spare items and components to be purchased should be approved by the plant management after consulting with the vendor and taking account of relevant maintenance experience available to the operating organization.

NS-G-2.14

7.4. The work control process should ensure adequate interfaces between all work groups. Operations personnel should assist the maintenance department in the planning and execution of work on plant systems and components to ensure that the reliability and availability of equipment are optimized. By doing this, operations personnel will be better able to assess the risk when equipment is inoperable and the period of unavailability of important items of equipment due to maintenance will be reduced.

Plant Response/Action:

- Analysis conducted

- The points raised by the OSART 2021 are among the weaknesses identified by the plant concerning its capacity to fulfil expectations for the management of Power Operations (TEM) activities that have a direct impact on the stability of the schedule.

- The root cause(s) identified

- Inefficient management of the maintenance activity schedule.
- Equipment Requests (DMs) from the maintenance groups are not always issued in compliance with the TEM (Power Operation) milestone planning, nor are they issued with the level of quality expected by the corporate entity in charge of spare parts.
- Availability of some spare parts on the corporate side.

- Corrective action plan

- Reinforce the management of the power operations work management structure and particularly the reliability of the work schedule through regular practice.
- Share the ERI 5.2 (W+1 schedule reliability) with the maintenance groups as well as including the TEM indicators in the tracking dashboard to give them a vision that is appropriate to their functional group.
- Launch of experiments with the “activity preparation” module of EOX (name of software) as the central tool for modular preparation. Experiments to begin with the SAE-El (Electrical Work Section), MCR-MEC (Mechnical Work Section), MCR-CHA (Boiler and Piping Work Section), MCR-SOU (Welding Work Section) and SCD (Exploitation Operation Section) functional groups.
- Creation of a third TEM Sub-Project Manager position within the TEM structure to work on cycle activity planning.
- Support for the maintenance groups on the spare parts request process.

- Progress to date

- There is now a managerial focus on Power Operations with the transformation of the daily Operational Performance Reviews (ROPs). With the deployment of the EVOLEAN approach, the plant has created daily station performance reviews which address the Power Operations (TEM) reliability indicator, the list of activities not completed in the previous day, the list of important activities of the day and an update on any difficulties in issuing work permits that could block the scheduled activities. The aim is to improve understanding of the causes for disruptions to the schedule and render it more reliable so that the day's planned activities are completed.
- The Power Operations structure also has a performance review on a Monday, but this weekly review focuses on its global dashboard. This includes power generation (from the previous week and the accumulation), indicators for schedule reliability and stability, control of preventive maintenance and the "Equipment anomaly (AM)" Work Request backlog, the manoeuvring coefficient of units, modular preparation indicators, ongoing technical and emergent threats as well as the priorities of the Power Operations structure.
- ERI 5.2 has been distributed to the maintenance groups, so that they can now measure the performance of their specialities.
- The plant has reinforced the Power Operations structure by creating a third TEM Sub-Project Manager to work on scheduling cycle activities, thus separating the real-time vision from the deferred vision.
- With regard to Spare Parts (PDR) which directly influence the capacity of the plant to complete its maintenance activities, Equipment Requests (DM) are not always issued in accordance with the expectations of the Power Operations modular preparation. An indicator has been created to identify non-conformities, or inconsistencies, present in the content of the DMs issued by the maintenance groups. These non-conformities mean that the spare parts process is not complied with and therefore the correct conditions are not obtained for reserving them from the corporate unit in charge of spare parts. This indicator is based on the DMs issued the previous week (regardless of the modular preparation) and it is now possible to measure the trend of DM compliance within the specialities. This indicator is shared every week in the Power Operations Senior Management Meeting (RDTEM) and then sent to all the functional group representatives within the Power Operations structure (Indicators + data to be analysed and worked on).
- Regarding improvements in the work carried out by UTO DPRL (Operational Technical Unit / Spare Parts and Logistics Division), we can take the example of the Feedwater Chemical Sampling pumps 2SIT111PO and 2SIT116PO, which were identified as a problem during the OSART 2021. Work on a larger scale has been undertaken since 2022, and it consists of improving national databases to render them more realistic. For any activity that has a Standard Equipment Request (DMM), its corresponding spare parts have moved from the "Parts On Order (PSC)" category to "National Operating Stock (SEN)". Each spare part requested for preventive maintenance from a plant series file has automatically become an SEN spare part. UTO DPRL can subsequently adjust its stock over a multi-year period.
- Belleville sur Loire NPP is also working on the Local Operating Stock (SEL). This has changed to a new protocol as part of the "START 2025" project. The stock has been resized (+50k€/unit for the parts most frequently required in the plant's maintenance activities) and it helps us to escape the typology of spare parts.

- Corrective action effectiveness evaluation

- This has been the focus of the management line since the beginning of 2023 and the inter-department discussions in the performance reviews have helped to identify the issues relating to the Power Operations structure in each functional group and to secure future activities. The TPLR (End-Extend-Launch-Postpone) has improved in quality and the schedule has thus become more comprehensive and readable.

- Improved reliability of W+4 scheduling (ERI 5.1 => name of the international indicator) and W+1 (ERI 5.2=> name of the international indicator) for 2022 Power Operations activities compared to 2021.

IAEA comments:

The plant has evaluated this suggestion and determined that the plant is not efficient in the management of maintenance activity schedule and equipment requests from maintenance groups are not always issued in compliance with the power operation milestone planning.

The plant has established a daily review mechanism of maintenance schedule performance at all levels in the plant. Dashboards, with details on each working groups, such as activities completed as planned, delayed, cancelled, and with no clear information, were monitored and communicated to the plant staff. Departmental commitments in completing activities on time are obtained by their participation in the daily review meeting with the plant director and their direct reports.

The plant has also improved the spare part availability review process by conducting weekly meetings with relevant departments for their needs of spare parts. Training is delivered to the maintenance staff on how to properly request spare parts in the plant systems to ensure that the needs are properly channelled and spare parts are reserved on time for maintenance activities.

However, the plant recently is subject to major impacts from strikes and fleet wide technical issues, which resulted in reduced resources and significant increase of workload. The maintenance backlog remained essentially unchanged for the past year, and the current performance indicator does not show a clear improvement trend. It will require more time to show the effectiveness of the actions taken and its sustainability.

Conclusion: Satisfactory progress to date

4. MAINTENANCE

4.5. CONDUCT OF MAINTENANCE WORK

The team observed that plant maintenance activities were not always controlled and implemented in a manner that ensures equipment and personnel safety. For example, the team observed in some cases works were not properly implemented, lifting and rigging operations were not performed in a safe manner, and materials were not stored according to the plant requirements. The team made a suggestion in this area.

4.7. WORK CONTROL

The team observed the implementation of a plant procedure with the detailed checklist on all relevant information in relation to the job to be performed and a formal declaration during the pre-job briefing that they are ready to perform the job, which contributes to the in-depth preparation of the technician performing the job and therefore the quality of the maintenance work. The team recognizes this as a good performance.

The team observed an extensive backlog in the schedule for repairing reported and logged leaks on the plant's equipment. The team encourages the plant to address this backlog and effectively reduce the number of active reported leaks.

DETAILED MAINTENANCE FINDINGS

4.5 CONDUCT OF MAINTENANCE WORK

4.5(1) Issue: The plant maintenance activities are not always controlled and implemented in a manner that ensures equipment and personnel safety.

The team noted the following:

Maintenance Work Practices

- When lifting a container onto a trailer outside the pump station:
  - It was observed that the lift driver moved the container passing above the ventilation duct of the pump station without using the safe route, and one of the supporting staff was observed putting his hand in between the suspended container and the surface of the trailer to remove some objects.
  - It was observed that the container when suspended above the trailer was not attached with a guide rope to prevent accidental bumping into surrounding structures.
- During the observation of a filter replacement work in Unit 1:
  - The bolt tightening pattern was prompted by the technical checker to the performer. The performer was not referring to a procedure or drawing for the bolt pattern. This was discussed in the post job debriefing.
  - A previously removed filter that was still draining in the filter container prevented the use of the container for draining the newly removed filter. A plastic drum was used instead, and plastic wrap placed on top once completed.
  - Tools for a filter replacement were stored on top of an adjacent filter housing by contractors performing the work even though they had brought a small table to the work location for that purpose.
- A contract monitor doing surveillance of a contractor performed job was at times helping the workers with handling tooling and equipment.
- During contractor work on hot water circulation pump 9SES011PO in the Unit 2 Turbine Hall, the work area was fenced off together with the close-by redundant pump in hot condition fenced in along with the cold pump to work on, despite the fence being marked as a hot hazard area.
- The pink Work Site Local Identification is inconsistently used:
  - In some cases, they had expired but were still at the worksite
  - In some cases, there was work ongoing without the on-site documentation present:
    - There was maintenance work ongoing in Unit 2 on the electrical building Chilled Water Unit 2DEL101CO without the work order being displayed.
  - In one case, an empty pink envelope hung at the worksite.
- In the train A Raw Water Pump Cellar, a technician performing the greasing of the bearings on Raw Water Pump 2SEC002PO climbed up the vertical pump foundation to get to the greasing nipple.
- In the Unit 1 Turbine Hall next to the main generator, a slab was found open, the label on the fencing showing that the authorization for this had expired.

Foreign Material Exclusion

- Two long handle tools were not fully secured in their storage location on the side of Unit 2 Spent Fuel Pool.
- During contractor work on Hot Water Circulation Pump 9SES011PO in the Unit 2 Turbine Hall, a soft textile Foreign Material Exclusion flange cover was used as a collecting box containing bolts and nuts. Some loose nuts and rings and a clip were found on the pump foundation.
- On four locations, loose screws, nuts and bolts were found under equipment.
- In the Unit 2 fuel building, a sign used to identify access to a radiological area was found broken near the spent fuel pool Foreign Material Exclusion area.
- In the mechanical workshop, there were large amounts of pigeon droppings on the floor at different locations where maintenance activities are conducted.
- New filter cartridges were stored on top of other equipment without protecting them from debris.
- Special tooling and hoses for outages were stored in the hot workshop without Foreign Material Exclusion covers on the openings.
- No Foreign Material Exclusion cover was applied on an emergency water connection to the Unit 1 Emergency Water Injection System.

Management of stored materials

- The lay down area for insulation material dismantled from Auxiliary Feed Water Pump 1ASG042TC steam admission valve was not fenced or marked.
- On the Unit 2 turbine hall ground floor, two 200L drums holding Fyrquel Phosphate Ester Oil were stored without a temporary storage label.
- In room 1NA0405, two 200 l plastic barrels were stored, one of them had no cover and no label.
- The barricade around the storage area of a contractor worksite outside the BAS building was broken and contained an informal liquid collection container under a mobile diesel powered compressor.

Without adequate controls on maintenance activities, there may be an increase in the risk of equipment damage and personnel injuries.

Suggestion: The plant should consider improving its control of maintenance activities to ensure equipment and personnel safety.

IAEA basis:

SSR-2/2 (Rev.1)

4.35 Monitoring of safety performance shall include the monitoring of: personnel performance; attitudes to safety; response to infringements of safety; and violations of operational limits and conditions, operating procedures, regulations and licence conditions. The monitoring of plant conditions, activities and attitudes of personnel shall be supported by systematic walkdowns of the plant by the plant managers.

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.

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-2.6

3.8 Contractors should be subject to the same standards as plant staff, particularly in the areas of professional competence, adherence to procedures and evaluation of performance. Suitable steps should be taken to ensure that contractors conform to the technical standards and the safety culture of the operating organization.

Plant Response/Action:

- Analysis conducted

- The observations made during OSART 2021 highlighted working practices that enable workers to correctly prepare their activities, to familiarise themselves with the documents and to have complete understanding of the purpose of their activities before going to the facility or the worksite area. However, several findings also show that once in the field, some rules are not, or only partially, applied.

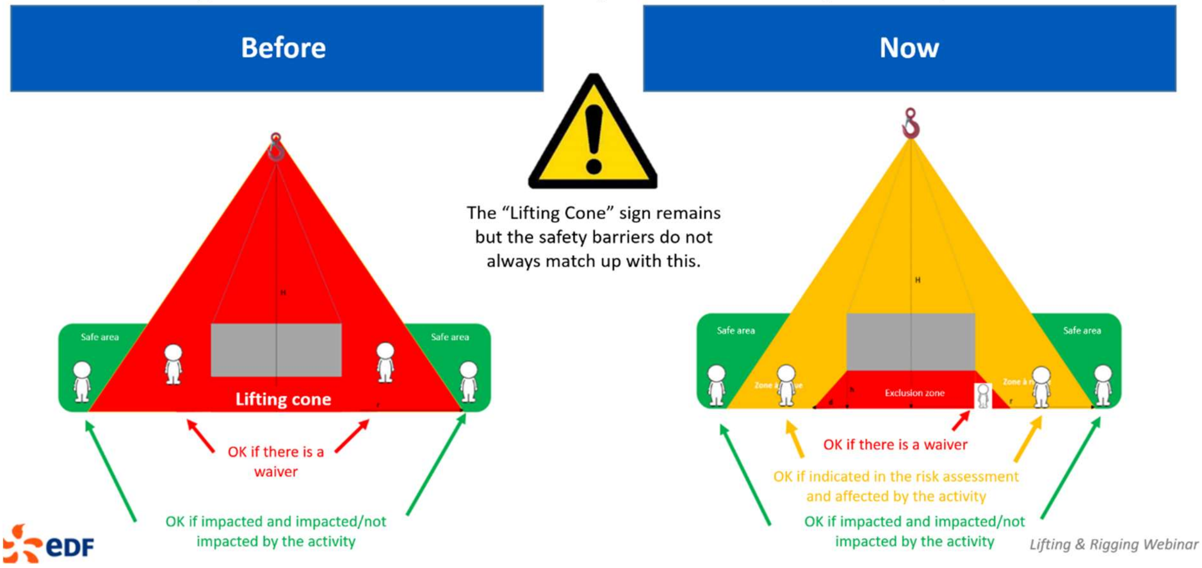
- The root cause(s) identified

- Several causes may explain these different findings:
  - Definition of expectations and complexity in fulfilling certain expectations,
  - Knowledge of the rules,
  - Lack of reinforcement by workers and the management line leading to a decrease in vigilance over the behaviour and rigour of workers,
  - Insufficient training or shadow coaching,
  - The lack of coordination for certain areas.

- Corrective action plan

- Behaviour, Rigour:
  - Management Response to Deviations and the Just Culture:
    - a management seminar has helped to focus the entire management line on the deployment of the just culture and a common core of intolerable behaviour at Belleville sur Loire station,
    - a tool for reactive response to hazardous conditions has been set up with a dedicated hotline.
  - Manager-in-the-Field (VMT):
    - The Maintenance Departments MIF (VMT) programmes have consistently taken industrial safety and maintenance quality control into account,
    - Field Brigades during Outage and Dedicated Field Teams in Power Operations have helped the management line and engineers from the functional groups to share and pool practices.
  - Monitoring:

    - Increased focus of monitoring programmes on observing technical actions during activities carried out by our industrial partners (tracked through monitoring indicators and networks).
- Skills / Knowledge of rules
  - Lifting & Rigging / Handling action plan:
    - In 2022, work on implementing the life-saving rule "Lifting & Rigging", definition of zones (exclusion, at risk or safe) and associated requirements, implementation of the rules during the second outage of the year



  - FME:
    - Transition of a cross-functional working group (GT) from twice-yearly to monthly with the various contributing functional groups.
    - Creation of a system to identify worksites with high FME (Foreign Material Exclusion) risks during outage 2P2422. This makes it possible, during an FME review, to identify high-impact activities and appropriate mitigation measures when preparing outages. This organisation has been used again during our Maintenance Outage in 2023 (1P2523) and was adapted for our unplanned outage 2F0123.
    - Several awareness-raising actions (including virtual reality training) and two half-days of field brigade (cross-functional station management team) dedicated to FME were set up during the last outage. These awareness-raising sessions were for the plant staff and also for our industrial partners.

  - QME:
    - Launch of Maintenance and Operations Quality Control (MQME) refresher training that includes the cornerstones of Maintenance and Operations Quality (QME) adapted to the population type; 3 types have been defined: maintenance tasks, work coordinator / planners and plant operators. This refresher training includes a reminder of the core QME elements but also practical exercises with simulations on the mock-up facilities,
    - Simplification of activity monitoring from the Activities with Quality Deficiency Risks(ARNQ) viewpoint and adaptation to the maintenance and operating professions,
    - Reinforcement of MQME coaching for contractors via the Industrial Policy Manager (RPI) at the plant, PEREN (name of the association of industrial partners for the nuclear sector for the 4 power plants in the Loire Valley) but

also opening our QME refresher training to the industrial partners is also planned.
        - Performance assistance review to be scheduled with the corporate. A review with peers from other stations, on the theme of FME, planned for outage 2F0123.
- Complexity in implementing certain expectations:
    - Creation of a working group to harmonise and simplify storage practices:
        - The working group re-examined first of all the established rules taken from the applicable reference baselines and to redefine operational temporary storage rules,
        - Some of these rules have been deployed on the facility and in our organisation, including:
            - Temporary storage management consistent with the time the worksite is open,
            - Clarification of the permissible fire load density in each work area,
            - Creation of the position of outage storage officer.
        - The working group is continuing with the objective of setting up a maximum of improvements for the Maintenance Outage on Unit 1 in 2023,
        - The indicator for coordinating storage compliance has evolved with a realistic view of the situation on the facility.
    - Creation of a working group to simplify site access and also access to the units for handling equipment while still respecting the rules,
    - Implementation of an “operational excellence” approach. Belleville NPP volunteered to be the first station in the fleet to launch the “operational excellence” approach with the experimental phase beginning as soon as outage 1P2523 starts.

- Lack of oversight:
    - Implementation of performance reviews in each work team:
        - The plant has set up performance reviews in all work teams, including the maintenance departments. The main objectives are to push for the successful completion of activities by analysing the performance of the previous day and by securing the performance of the coming day, but also to resolve certain recurring difficulties in the field, which will then improve compliance with the rules,
        - Regaining the momentum of the working group for leak management on the facility.

- Progress to date

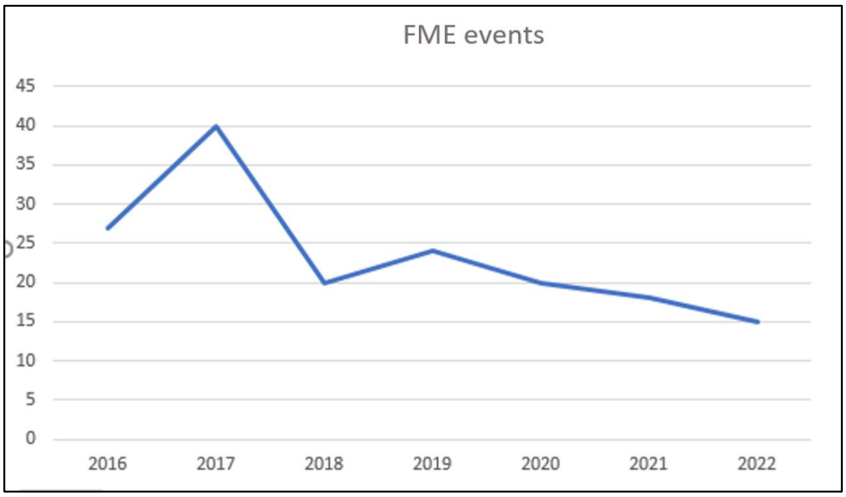
- Lifting and rigging
    - The clarification of areas has helped to harmonise practices and to render them more coherent with the risk incurred by workers during load handling operations.
- FME
    - After a noteworthy event detected during the first outage in 2022, caused by a maintenance activity completed in 2020, the Maintenance Outage on Unit 2 did not reveal any FME event with an impact on nuclear safety or power generation,
    - On outage 2P2422, 13 worksites with high FME risks were identified,
    - During the outage 1P2523 preparation review, 8 worksites with a high FME risks were identified and two areas where all activities will also have a high FME risk (condenser

interior and steam generator interior). These last two areas are also identified as having a high FME risk on our unplanned outage to treat stress corrosion on Unit 2.

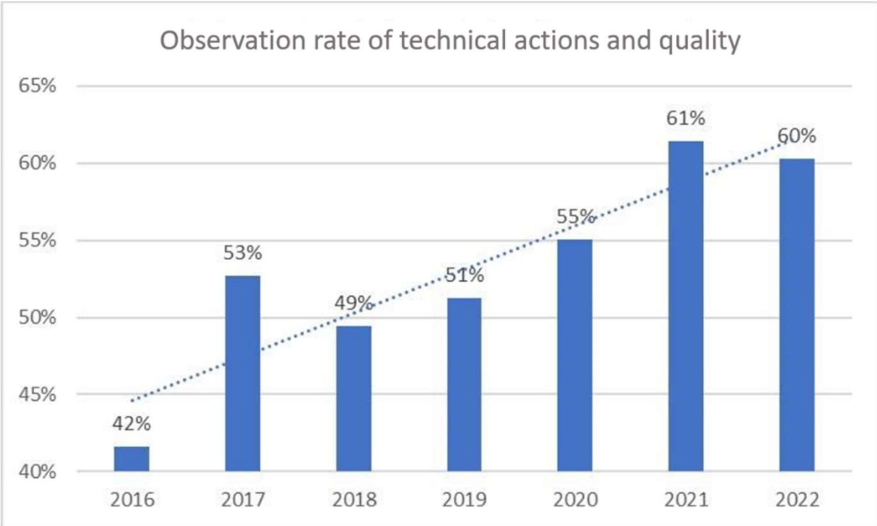
- QME
  - A better understanding by the functional groups of the meaning of the QME process has initiated the treatment of anomalies before a significant failure can be generated.
- Behaviour, Rigour:
  - The focus of the management line on the just culture method and unacceptable behaviours in Belleville has helped to provide consistency in the way managers respond to deviations in behaviour. The list of unacceptable behaviours has also been communicated to the whole site.
  - A single telephone number (40.40) has been available since July 2022 with a contact person from the Risk Prevention Department who is in charge of dealing with the reported hazardous conditions.
  - 527 findings on the theme of industrial safety were tracked by the two maintenance departments (336 positive, 191 points to be improved).
  - In 2022, 50% of the observations (1096 and 1077 findings for SAE (Automation and Electrical Service Unit) and MCR respectively) were on themes related to maintenance quality control (Risk Assessment (ADR), Isolation Requests (DR), Technical Check (CT), Human Performance Tools (PFI), Activity Preparation, Adherence to Procedures, Exercises). The target will remain the same in 2023.
- Monitoring:
  - The observation rate for technical actions, in observations of monitoring, has moved closer to 60%.
- Temporary storage / Storage
  - The actions taken provide a more realistic view of the state of the facility in terms of stored objects,
  - Simplification of the storage rules has also helped us to focus on the worksites that require our attention and not on worksites with purely document deviations, some of which are related to an unfounded site-level expectation (e.g., arbitrary temporary storage time limit which is not the same as the actual duration of the work).
- Leak management
  - Work to concatenate all active leaks has been started. They are currently being identified on the facility, and the treatment of leaks is tracked by a working group that uses a leak rating system to prioritise their treatment.
- Performance reviews
  - The implementation of the performance reviews has helped to give a more reliable vision of the completed activities, with everyone from the teams up to the plant senior management more focused on the activities with higher risks. This also means that the teams or senior management are more reactive in their actions that help the performance of future activities to be more reliable.

- Corrective action effectiveness evaluation

- FME:
  - No FME events on any of the high-risk worksites identified on the last Maintenance Outage on Unit 2 (2P2422)
  - Decrease in the number of FME events over several years:



- Monitoring:
  - Evolution of the observation rate on technical actions since 2016:



- Industrial Safety:
  - An improvement in the frequency rate of Industrial Safety events in 2022 from a TF2 of 7.8 at the beginning of 2022 to 5.2 at the end of the year (4th position in the EDF nuclear fleet)
  - 7 hazardous situations have been dealt with since the dedicated organisation was set up
- Stored objects and storage:
  - Improvements after the re-examination of EDF storage rules, in compliance with the regulations, has helped to reduce the number of specific risk assessments that are needed to justify an increase in fire load. This has made it possible to focus on worksites with real risks and on standardising the way that worksites are closed down
- Performance Review:
  - The first result to be highlighted is the reliability of the indicator for completing the schedule of Power Operations activities with a significant decrease in activities with no information

IAEA comments:

The plant has carefully assessed this suggestion and concluded that the root causes are the definition of relevant expectations, plant staff's knowledge of rules, and reinforcement of the right behaviours by plant workers and managers.

In 2022, the plant published clear expectations on intolerable behaviours, covering key aspects in the safe operation of the plant, aligned with the current plant priorities. The intolerable behaviours are classified, and clear reward/recognition and sanctions are defined. A management seminar was conducted to align the entire management team on the roll out of these expectations. These expectations were also widely disseminated and communicated to plant and contractor staff via postings in different plant areas, which are accessed frequently by large number of staff.

The manager-in-field programme was improved with dedicated observation teams during outage and on-line operation period. Cross-function teams were deployed to improve the effectiveness of these observations. There were 3500 observations conducted in 2022 with a total of 16500 findings captured. The findings from the observations were systematically trended and reviewed in meeting with plant senior managers. The top finding categories were identified, and these categories become the focuses of observations thereafter. For example, the current top finding category is the operation and maintenance work quality, and there is sign of improvement in this trend.

Plant contractors now have access to important plant training, such as Foreign Material Exclusion (FME), which ensures that contractors are following the same standards and expectations.

The plant is seeing sign of improvements on aspects related to this issue, such as the number of FME events, the number decreased from 18 in 2021 to 15 in 2022. The industrial safety accident rate (TF2) value decreased from 7.8 in 2021 to 5.2 in 2022. However, it will require more time to demonstrate the sustainability of these actions.

During the field visit by the team, it was observed that four water leaks around the condensers were not properly fenced off and leak management measures were not in place; and in another two cases, it was identified that scaffolding to be used for the upcoming outage was in contact with process pipes.

Conclusion: Satisfactory progress to date

5. TECHNICAL SUPPORT

5.1. ORGANIZATION AND FUNCTIONS

The plant operational practices in terms of checks carried out on items used during operation and maintenance activities do not always guarantee the prevention of a potential risk of interaction with seismically qualified equipment. The team noted that the plant did not always manage activities near seismically qualified equipment in accordance with plant expectations. For example, unsecured monitoring equipment and scaffolds were observed near seismically qualified equipment. The team made a suggestion in this area.

DETAILED TECHNICAL SUPPORT FINDINGS

5.1. ORGANIZATION AND FUNCTIONS

5.1(1) Issue: The plant operational practices in terms of checks carried out on items used during operation and maintenance activities do not always guarantee the prevention of a potential impact on seismically qualified equipment.

During the review the team noted:

- In electrical room 1LC0914, near the Main Control Room (MCR), a recorder was placed on the floor near seismic qualified electrical panel 1KRG301AR, without being secured. It had been there for nearly one month. The plant took prompt action to address the situation.
- In the unit 1 Safety Ultimate Diesel (DUS) building, in 1HDU1302LO room, four scaffolds were close to the diesel generator and could damage it in the event of a seismic event. In addition, these scaffolds had been there for over one month without being used.
- In electrical room 1LC0914, near the MCR, a damaged cable tray was found near seismic qualified electrical panels.
- In electrical room 1LC0914, a metal cover was not totally attached and could damage the 1LBF001RD panel if a seismic event occurred. Currently, it is not considered to constitute a seismic hazard because there are still several fixings in place, but if left to degrade further, it could become a hazard. The plant took prompt action to address the situation.
- In the Unit 1 and 2 DUS buildings, an oil pump cart close to safety-related equipment was not secured. Follow up with operators revealed that the painters had removed this oil pump cart from the secure location to paint the frame.

Without effective practices to check items used for operation and maintenance activities in the vicinity of seismically qualified equipment, the operability and reliability of these equipment could be potentially compromised in case of seismic events.

Suggestion: The plant should consider improving the effectiveness of checks carried out on equipment used for operation and maintenance activities in order to prevent their potential impact on seismically qualified equipment.

IAEA Bases:

GSR Part 2

4.32. Each process or activity that could have implications for safety shall be carried out under controlled conditions, by means of following readily understood, approved and current procedures, instructions and drawings.

SSR-2/2 (Rev.1)

Requirement 13. The operating organization shall ensure that a systematic assessment is carried out to provide reliable confirmation that safety related items are capable of the required performance for all operational states and for accident conditions.

NS-G-2.13

5.33. Plant walk-downs are one of the most significant components of the seismic safety evaluation of existing installations, for both the SMA and the SPSA methodologies. Plant walk-downs should be performed within the scope of the seismic safety evaluation programme. The term ‘plant walk-down’ is used here to denote the ‘seismic capability walk-down’ for the SMA approach and the ‘fragility walk-down’ for the SPSA approach. These walk-downs may serve many purposes, such as: gathering and verifying as-is data; verifying the screening-out of SSCs due to high capacities on the basis of engineering judgement; verifying the selection of safe shutdown paths for the SMA; evaluating in-plant vulnerabilities of SSCs, specifically issues of seismic system interaction (impact, falling, spray, flooding); identifying other in-plant hazards, such as those related to temporary equipment (scaffolding, ladders, equipment carts, etc.); and identifying the ‘easy fixes’ that are necessary to reduce some obvious vulnerabilities, including interaction effects. Walk-downs should also be used to consider outage configurations that are associated with shutdown modes. Detailed guidance on how to organize, conduct and document walk-downs should be developed or adapted from existing walk-down procedures.

Plant Response/Action:

- Analysis conducted

- The point identified by the OSART audit is one of the weaknesses already identified in the “Earthquake Event” basic process review. Several actions have been chosen and are being rolled out to improve the consideration of the event-level earthquake risk during all phases of an activity.
- We agree with the observations made during the inspection of the facility and these have already been identified in the Basic Process (PE) “Earthquake Event” (the “event-level earthquake” addresses the capacity of one piece of equipment to become a hazard for another piece of equipment after or during an earthquake).
- Only one could potentially have had an impact on the facility. This is a recorder that could potentially damage the 1KRG301AR cabinet. This was treated in a reactive manner during the OSART 2021.

- The root cause(s) identified

- The causes identified for this subject are:
  - Lack of knowledge among workers and management,
  - No identification of rooms/equipment at risk of an event-level earthquake.

- Corrective action plan

- Training of new functional group representatives for event-level earthquake conditions. Action renewed every year since 2021 to take into account the changes in the positions of the various correspondents. The role of the representatives is to reinforce expectations within the functional group and the teams.
- Multi-speciality team walkdowns. Ownership of the theme by the functional groups and workers is an important line of defence to avoid creating or detecting situations at risk from an event-level earthquake. It is therefore important to reinforce the methods to help the functional groups understand the subject. As such, the purpose of the walkdowns with the functional group representatives is to develop their focus as much as possible and to remind them of the fundamentals. The aim of field walkdowns within the functional groups is to transmit this expertise to as many people as possible using concrete situations. The earthquake champion organizes two walkdowns with these representatives and each representative must in turn do two walkdowns with members of their department.

- Introduction of the new scaffolding guide D5370NT21045578. The organisation of the plant based on the scaffolding reference baseline has experienced many difficulties in recent years and contributed directly to the weaknesses identified. After distributing the new earthquake guide, the plant rolled out this guide by creating a technical note that defines the rules to be followed which guarantee that the risk of an event-level earthquake has been correctly taken into account when installing scaffolding. The plant's decision to install tie-down plates will also help to reduce the anomalies observed. This decision is currently being deployed and will be finalised in 2024.
- Install tie-down plates for scaffolding. As part of the "Earthquake Event" basic process review, it was decided to initiate an experiment to install tie down plates to secure the anchoring of scaffolding. Indeed, according to the analysis completed for this review, it appears that scaffolding is the cause of 43% of the anomalies observed on the theme of the event-level earthquake. These plates have been developed and installed at Bugey and Blayais stations, we have taken over and modified the calculation notes and the design plans to strengthen these plates. For a two-unit site, we have estimated the need for 250 plates. These 250 plates will be purchased and installed as a long-term project. A list of Safety-related Equipment (EIPS) rooms where it would be useful to install these plates has been drawn up. Installation will start in March 2023.
- Install the "room at risk of event-level earthquake" sign in the identified rooms. To facilitate the identification of rooms with high safety risks in relation to the event-level earthquake risk, a sign will be installed in the following rooms: SIP (LC0913, LC0914, LC0915, LC0918, LC0920, LC0921, LD0907, LD0908, LD0916) and controbloc (LC 0704, LC0709, LD0706, LD0707). Once these activities have been completed, the effectiveness will be assessed to consider if it is appropriate to widen the signs to the rest of the EIPS rooms with an earthquake requirement.
- Other actions have been carried out to improve the management of this subject:
  - Update of the yearly Safety Message (the Safety Message is a weekly publication used to improve the culture of the employees and partners of Belleville sur Loire NPP on subjects that we consider as important within our remit as a responsible plant operator),
  - Taking into account and transmitting the most recent known OE on this subject (distributed in week 05 of 2023, for example),
  - Preparation of a reflex sheet (D5370FRX19015716) listing observable points that provide the key elements to be checked during a field walkdown or when carrying out an activity,
  - Post-outage inspections of engineered safeguard equipment,
  - Awareness-raising sessions in functional group meetings, on request from the functional groups,
  - Awareness-raising sessions for contractor managers in SCN3 training + field walkdowns, on request from the Industrial Policy Manager (RPI),
  - Coordination of the event-level earthquake theme as part of the Deviation Detection working group.

- Progress to date

- During field walkdowns, improvements have been observed in the anchoring of scaffolding.
- We have also observed an increase in the number of Exocet findings in the area of "event-level earthquake" while fewer deviations are observed during walkdowns by event-level earthquake representatives. Workers are therefore more aware of this risk and report deviations even if they are less present in the field.

- Corrective action effectiveness evaluation
- The functional groups more proactively identifying and resolving deviations in this area.

IAEA Comments:

The plant has carefully analysed this suggestion and developed a plan to address the issues, these include training and education, changes to equipment stability and the organisation for coaching and reinforcement of the standards.

The plant has formally trained some seismic departmental representatives, the training course takes approximately 2 hours, it raises the level of understanding on seismic control for each department. The department representatives are then tasked with educating and influencing the teams on the new standards regarding seismic event protection.

The plants safety message in February 2023 was focused on seismic standards, including staff responsibilities and expectations for all team members.

The plant also carries out multi-speciality team walkdowns. Ownership of the theme by the functional groups and workers is an important line of defence to avoid creating or detecting situations at risk from an event-level earthquake. The purpose of the walkdowns with the functional group representatives is to develop their focus as much as possible and to remind them of the fundamentals. The earthquake champion for the whole site organizes two walkdowns with these representatives and each representative must in turn do two walkdowns with members of their department.

A new scaffolding guide has been created, this includes the seismic standards required of scaffolders around sensitive equipment. After distributing the new earthquake guide, the plant rolled out this guide by creating a technical note that defines the rules to be followed.

The plant is planning to install the “room at risk of event-level earthquake” sign in the identified rooms. To facilitate the identification of rooms with high safety risks in relation to the event-level earthquake risk, a sign will be installed in 8 protection system rooms and 4 control system rooms. This action is being tracked on CAMELEON and is planned to be completed in 2024.

The plant has developed tie-down plates for scaffolding. As part of the “Earthquake Event” basic process review, it was decided to initiate an experiment to install tie down plates to secure the anchoring of scaffolding. Indeed, according to the analysis completed for this review, it appears that scaffolding is the cause of 43% of the anomalies observed on the theme of the event-level earthquake. A list of Safety-related Equipment (EIPS) rooms where it would be useful to install these plates has been drawn up. Installation will start in June 2023.

A plant inspection was carried out and all anomolies identified during the OSART mission have been corrected. The plant has achieved a high standard in the vicinity of the emergency diesels and the switchrooms that contain cabinets controlling sensitive equipment.

Conclusion: Issue resolved

6. OPERATING EXPERIENCE FEEDBACK

6.6. TRENDING AND REVIEW

Low level events in the plant are not always trended in a comprehensive manner to ensure adverse trends are identified early. For example, the various departments maintain different Excel sheets with issues identified at department level and trending is performed without systematically compiling them at plant level. The team made a suggestion in this area.

6.7. CORRECTIVE ACTIONS

The plant has a clearly defined process for performing root cause analyses and for establishing and tracking corrective actions related to safety-significant events. However, the team observed that there is a high backlog of corrective actions, with overdue target dates and a high number of actions being rescheduled. Furthermore, the time between the occurrence of an event and the decision to perform an analysis sometimes exceeded the plant’s own expectations. Examples of recurrent events and some quality-related issues in cause analyses show that, in some cases, corrective actions to prevent recurrence are incomplete or ineffective. The team made a recommendation in this area.

DETAILED OPERATING EXPERIENCE FEEDBACK FINDINGS

6.6. TRENDING AND REVIEW

6.6(1) Issue: Low level events in the plant are not always trended in a comprehensive manner to ensure adverse trends are identified early.

- The various departments maintain different Excel sheets with issues identified at the department level and trending is performed (example showed by the electrical maintenance department) without systematically compiling these at the plant level.
- During discussions with Industrial Safety specialists, it was identified that low level industrial safety trends from behavioural observations are difficult to establish since they are captured in multiple databases. The trends are only determined through verbal discussions of manager observations and from annual reviews.
- During an interview with a Corrective Action Program (PAC) coordinator, it was stated that it is generally accepted that near misses are not reported in PAC, only consequential events.
- During an interview with outage management, it was confirmed that only delays for critical path activities greater than 12 hours are included in the PAC. Lower-level issues are not analysed for causes or trending.
- The existing application allows the contractors to issue a corrective action report, however, a new application (CAMELEON), will be implemented that will not allow the contractors to issue this type of report, they will have gone through their plant supervisor.

Without performing an integrated data analysis on low-level events, there could be missed opportunities for the early identification and correction of adverse trends before they develop into events with more significant safety implications.

Suggestion: The plant should consider improving its trending in a more comprehensive manner to ensure adverse trends are identified early**.**

IAEA Bases

SSR-2/2 (Rev.1)

5.29. Information on operating experience shall be examined by competent persons for any precursors to, or trends in, adverse conditions for safety, so that any necessary corrective actions can be taken before serious conditions arise.

NS-G-2-4

6.64. The operating experience at the plant should be evaluated in a systematic way, primarily to make certain that no safety relevant event goes undetected. Low level events and near misses should be reported and reviewed thoroughly as potential precursors to degraded safety performance.

6.66. Operating experience should be carefully examined by designated competent persons to detect any precursor signs of possible tendencies adverse to safety, so that corrective action can be taken before serious conditions arise. Trending should identify recurring similar events and continued problems based on the causes and initiators of previous events. Event trend reviews and conclusive interpretations should be provided periodically to the plant manager and to the management of the operating organization.

NS-G-2-11

6.3. The purpose of an event trending process should be to determine the frequency of occurrence of certain conditions that have been gathered from reports on minor and major problems and event investigations.

6.5. Trending should be used to analyze the performance of various work groups, to identify those factors that result in either less than desired or better than expected performance.

7.2. Managers of nuclear installations should clearly define their expectations regarding the systematic reporting, screening and use of internal and external operating experience.

I–8. The aim of a programme for the feedback of operational experience is to ensure that the following objectives are achieved: (1) the collection of information is sufficiently comprehensive that no relevant data are lost (this necessitates broad reporting criteria and low detection thresholds).

Plant Response/Action:

- Analysis conducted

- Diagnostics resulting from the development of the plant project and the division project.
- Combined WANO / Nuclear Inspectorate Peer Review at the beginning of 2022:
- SOER Davis Besse self-assessment and assessment (SAT).
- Corporate Review of Operating Experience 2022 and 2023.

- The root cause(s) identified

- An organisation that is too top-down and too complex.
- No standardised tools that are difficult to access.
- Insufficient cross-functional exploitation of low-level events.

- Progress to date

- Transformation of the plant management system.
  - The introduction of daily meetings at team, department and management levels, scheduled in a way that ensures information is escalated,
  - Meetings refocused on the review of performance and operational effectiveness,
  - A weekly oversight review is held that also covers the main findings of the week, as well as a weekly review of the teams' frustrations.

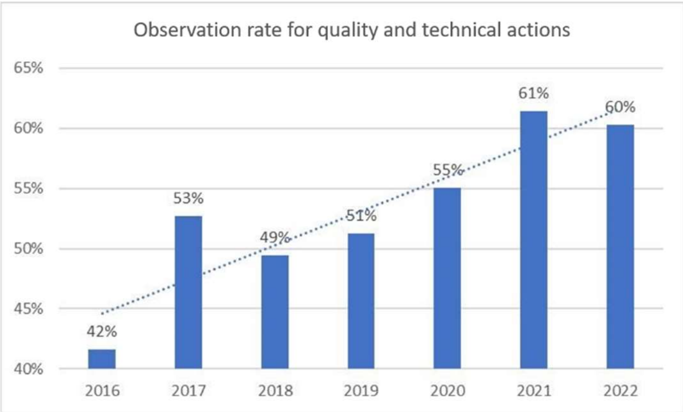
  These meetings are more conducive to feedback from the teams. For example, the number of near-misses recorded in the first quarter after the deployment of this method is as high as for the whole of 2022.
- Transformation of the tools:
  - Deployment of Caméléon to cover spontaneous reports and activity debriefings,
  - The corporate decision to open Caméléon directly to contractors is still to be deployed.

Caméléon is now used to track actions resulting from our Integrated Management System (IMS), but also to track findings from the Independent Nuclear Safety Oversight (FIS) audits, findings from the Nuclear Safety Authority audits, accidents, our laboratory findings, our maintenance and operations quality deficiencies, our debriefings and resulting actions, etc. (incomplete list).

The organisation of the tool in petals makes it easier to input an ever-increasing number of our findings and action plans. At the beginning of 2023, it was decided to give contractors access to the tool to enter findings. The tool facilitates user input because information can be entered via a mobile phone.

- Strengthen the exploitation of low-level events. Since OSART 2021, we have continued to work on an approach that reinforces the complemental aspect of low-level event analyses, whether they come from managerial, technical or organisational findings:
  - Development of themed analyses of cross-functional low-level events in the Management-in-the-Field (MIF) board. Half-yearly analyses of MIF findings by the departments have been shared in the MIF board since 2019. Since OSART 2021, additional themes have been added to reinforce the board's cross-functional analyses: fire protection, radiation protection, MQME (Operations and Maintenance Quality Control), HU tools, Automatic Reactor Scrams (AAR) and skills management:
    - In November 2021: Analysis of low-level events (ASF) in the areas of AAR, RP, Fire Protection, HU tools
    - In July 2022: Analysis of low-level events in the areas of HU tools, Radiation Protection, Fire Protection, MQME
    - In January 2023: analysis of low-level events in the areas of HU Tools, Fire Protection, Radiation Protection, field brigades, MQME, environment, skills management
  - Cross-functional analyses resulting from sub-process reviews have been reinforced. The sub-process review templates have been modified and work has been done to extract and make all the findings from the different tools available to Sub-Process Owners (ASPs) to help them build their analyses. The sub-process review template includes an analysis of low-level events resulting from MIF, equipment, organisational, stakeholder, audit and inspection findings. This provides reviews that have an all-inclusive and comprehensive vision (360° vision).
  - The use of information from debriefings has been consolidated. The Mechanical, Pipes & Vessels and Valves & Fittings Department (MCR) has set up a weekly "cold eye review" meeting for all the debriefings which has helped them to improve their assessment of low-level events that are then tracked. This meeting brings the methods and operational teams together every week so that they can decide on the best way to exploit their findings.
  - Analysis of low-level technical events is continuing with the use of Surveillance Tests results tracking (EP), function health reports on equipment and the use of e-monitoring for early detection of any deterioration. Function health reports are completed every year for the different technical elements of the facilities, that include a trend analysis of the main operating and maintenance parameters and an analysis of the Work Requests (DT) for the previous year. These health reports have existed since 2017. Since 2021, we have developed the method for their exploitation at corporate level with the establishment of "area reviews" by our central services, which has consolidated the way that the findings from the health reports are taken into account and facilitates the distribution of OE between stations. The analysis of spare parts use and requirements within the health reports has also been improved. In addition to the function health reports, the plant has continued to develop e-monitoring models that help to identify early signs of technical failure. The organisation for trending surveillance test results has also been embedded, with the consolidation of alert thresholds for each surveillance test that lead to analyses without waiting for the surveillance test criteria to be exceeded.
  - Establishment of Independent Nuclear Safety Oversight (FIS) workshops and independent safety supervision during outage:

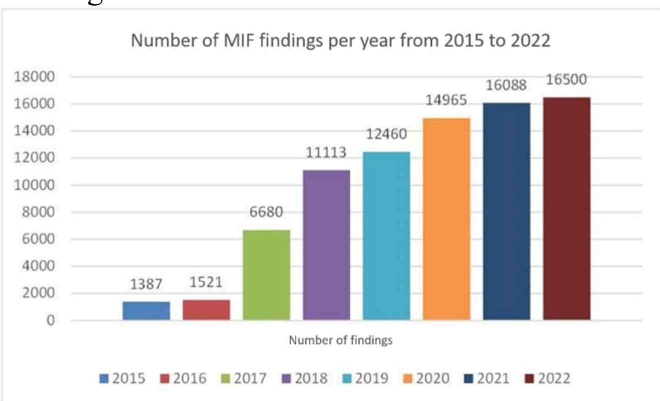
   - Collection and pooling of very small deviations and low-level events through the Independent Nuclear Safety Oversight (FIS),
   - On a weekly basis during outage, informal structure,
   - On a quarterly basis with report to the Station Director,
   - This makes it possible to challenge the plant senior management on any deviations.
- Analysis of data from monitoring. There has been an increase in the observation rate of technical actions since 2016:



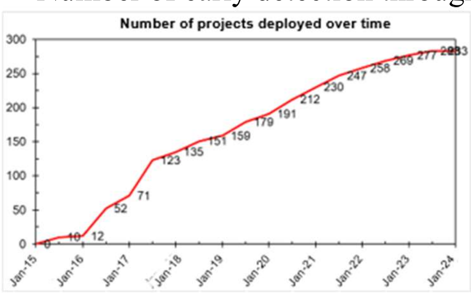
– Evaluation of the effectiveness of corrective actions

The number of low-level events collected is increasing, both in technical and organisational areas:

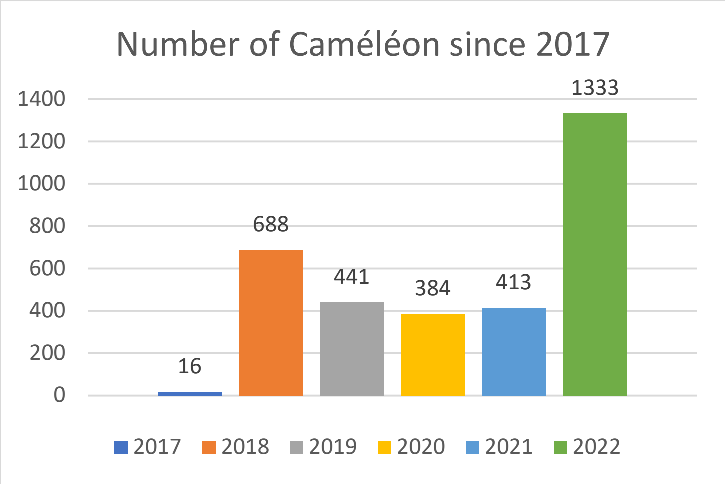
- Number of findings from MIF:



- Number of early detection through e-monitoring



- Number of Caméléon findings issued



– Improved station performance since 2021 (See the response to issue on industrial safety)

IAEA Comments:

The plant has carefully analysed this recommendation and determined three focus areas, changes to the plant management system, using CAMELEON as the central system to manage data capture, analysis, trending and action tracking and the use of OE from low level events to encourage improvement across EDF and Contractor teams.

The site management have mandated that Caméléon will be now used to track all significant actions, incldluing those resulting from Independent Nuclear Safety Oversight (FIS) audits, findings from the Nuclear Safety Authority audits, accidents, laboratory findings, maintenance and operations quality deficiencies, post-job debriefings, this also now includes near misses.

The site has supported staff to navigate and use CAMELEON through technical training sessions. Specialist have focused their efforts in supporting some of the key functions such as Operations and Maintenance to help smooth the transition. It is clear that these efforts are working.

The plant has improved their management system, this includes the introduction of daily meetings at team, department and management levels, scheduled in a way that ensures information is escalated, this is creating more ownership and focus on low level trends.

The plant has installed a weekly oversight review, this covers the main issues of the week and allows the managers to deploy extra effort and resources to resolve issues faster, if required. These meetings also allow staff to feedback to the plant’s leadership on progress and frustrations with action resolution. It is also a good tool to communicate key information to the teams.

The plant has been using themed analyses of cross-functional low-level events in the Management-in-the-Field (MIF) board. Since the OSART mission in 2021, additional themes have been added to this process to reinforce the board’s cross-functional analyses, this includes fire protection, radiation protection, Operations and Maintenance Quality Control, HU tools, Automatic Reactor Scrams (AAR) and skills management. This is a significant improvement.

The plant’s analysis of low-level technical events is continuing with the use of Surveillance Tests results tracking (EP), function health reports on equipment and the use of e-monitoring for early detection of any deterioration.

There are still a number of databases on site being used for tracking and trending of information. It is clear that some of these hold a level of value to the site teams and in some cases there are no plans to remove or disrupt their use. With the exception of EXOCET there is no plan or intention to migrate the use of other local databases to CAMELEON. However all identified databases/tools that hold information that have value adding information, are tracked and trended as part of the station evaluation process.

Conclusion: Issue resolved

6.7 CORRECTIVE ACTIONS

6.7(1) Issue: Corrective actions are not always developed or implemented in a timely manner and sometimes are of an inadequate quality to prevent the recurrence of events.

- Backlogs for corrective actions are presented and discussed during the weekly Corrective Actions Review Board (CARB), together with any extension requests. Over 30 actions were reported overdue in the CARB, with about 10 overdues by more than one month, some were overdue by more than one year (reported as such in several consecutive CARBs). In addition to the overdue actions, five to 10 actions are presented for rescheduling in every weekly CARB, with some being rescheduled several times.
- Examples of recurrent events showing incomplete or ineffective corrective actions to prevent recurrence:
  - Event on 15 March 2021, Scaffolding affecting the fire sprinklers for a pump – root cause analysis was requested by management and actions that could have prevented recurrence were confirmed as implemented in the CARB meeting on 5 August 2021. During the OSART team observations on 16 November 2021, a similar problem was detected.
  - Recurrent radiological safety event on 14 September 2020 (Operational dosimeter alarm of a contractor worker during radiological testing). The same individual had generated the same type of event on 8 August 2020; the rapid analysis from similar event on 8 August 2020 was not effective in preventing the occurrence of a safety significant event. Also, there were previous similar events at the plant, with the same company (10 July 2019 and 27 July 2019). There was no analysis to ascertain why the previous actions were not effective. Actions from the report only required an action plan for the contractor. There was no analysis on the root causes related to barriers and organizational aspects related to the supervision of this radiological work.
  - Over the successive years 2019, 2020, and 2021, there had been a recurrent environmental impact event of cumulative refrigerant fluid release in excess of 100kg (31 December 2019, 31 December 2020, and 28 August 2021). The analysis was limited to the technical contributors for the release (leaks from components) and actions only focussed on leak repair. There was no analysis in the reports on the recurrence of reaching the reportable value every year and there was no action to set up an overall approach to prevent this recurrence. The individual contributors to these events, even if the internal ‘alert’ limit of 20kg is reached, are treated as level 2 or 3 events, and even if a simplified analysis is requested, actions are limited to repairs.
- Quality issues on cause analyses, leading to ineffective corrective actions:
  - Safety significant event from 12 May 2021 (Shutdown of Unit 2 in accordance with the Action Statement for group 1 LCO SPA 6) – the root cause analysis concludes that the way the technical specification is written will lead to a significant reportable event in any similar situation. The action taken was only to inform the corporate entities of the issue, no actions were established to prevent recurrence by avoiding a similar situation.
  - Root cause analysis reports include section 4.2 that is used for Operating Experience (OE) analysis; on several of these reports (Safety significant events from 30 May 2020, 11 August 2020, and 30 September 2020) it is written ‘Not Applicable’ in this section.

  - Safety significant event from 23 March 2021 (Surveillance test RPN003 performed instead of surveillance test RPN008 in cycle stretch-out mode, Unit 2) – section 4.2, OE analysis describes events that had occurred in other plants. There was no analysis on how OE from similar events could have prevented the event at the plant, in order to establish if opportunities exist to improve use of OE. One new action was implemented for a root cause, to revise documentation. Later, this action was closed because it was identified that another action from another plant was created on 18 August 2020 (a similar event from the other plant existed from July 2020).
  - Examples of delays in screening approval for corrective actions:
  - Screening approval has a limit of one week for deviations and one month for improvements. Some cases exceed this limit, several cases by two to 10 months. The cases are from the meeting on 17 November 2021 (screening committee at PAC coordinators level), if they are not validated in this committee, they are not referred to the management committee that decides the screening approval. The backlog for PAC that are not screened includes 36 that are overdue by more than one month, and nine that are overdue by more than three months.
  - The screening meeting on 18 November 2021 (management decision level) had a case from June 2021 for which a decision was taken for the first time, five months after initiation. There was no challenge from management on this delay.
- Safety significant event from 11 August 2020 - Automatic start-up without connection of diesel generator 1LHQ upon criteria 1GEV001JA open and C8 (turbine trip) was initially assessed as category 2 and an action had been raised to perform an apparent cause analysis with a target date for completion on 15 October 2020. This action was reported overdue in every CARB up to December 2020. During the safety committee meeting in December, the event was upgraded to category 1 - safety significant by Nuclear Safety Director and a root cause analysis was initiated more than five months after the event.

Without timely implementation of appropriate corrective actions, there is a high potential for the recurrence of safety significant events.

Recommendation: The plant should improve the timeliness of corrective actions development and implementation and improve their quality and effectiveness to prevent recurrence of events.

IAEA Bases

SSR-2/2 (Rev.1)

5.28. Events with safety implications shall be investigated in accordance with their actual or potential significance. Events with significant implications for safety shall be investigated to identify their direct and root causes, including causes relating to equipment design, operation and maintenance, or to human and organizational factors.

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.

GS-G-3.1

6.75. Senior management should monitor the status of corrective actions frequently and should consider:

- Whether the time delay is reasonable for corrective actions that are still open (not completed);
- Whether the necessary resources are available to complete open corrective actions;
- Whether managers are being held accountable for completing corrective actions.

NS-G-2-11

3.6. The screening of internal events should be carried out promptly to assign priorities in the process for the feedback of experience from events and in the follow-up actions.

5.3. Recommendations on corrective actions should be proposed on the basis of the feedback of either internal or external information and should be identified prior to or as a result of a thorough analysis of an event.

5.7. A tracking process should be implemented to ensure that all approved corrective actions are completed in a timely manner and that those actions with long lead times to completion remain valid at the time of their implementation in the light of later experience or more recent developments. A periodic evaluation should be carried out to constantly review the need for items in the pending corrective actions list and separately to check the effectiveness of actions implemented.

Plant Response/Action:

- Analysis conducted
- Combined WANO / Nuclear Inspectorate Peer Review at the beginning of 2022 (weaknesses in Operating Experience, lack of challenge on overdue actions.
- Specific assessment on action volumes (number of actions significantly higher than other stations, numerous sources, non-SMART actions).
- Corporate OE Review (OE).
- Diagnostics resulting from the development of the site project, the division project and from the safety perception questionnaire (lack of focus on performance, organisation too top-down).

- The root cause(s) identified

- Lack of effectiveness of actions
  - Root-Cause Analyses (AAE) are insufficiently worked on (participants do not have sufficient experience, tendency to choose the easy option, insufficient involvement of the reviewers, etc.),
  - Multiple databases lead to inconsistent action plans,
  - Actions are not always SMART (Specific, Measurable, Achievable, Relevant and Time-bound).
- Insufficient consideration of OE
  - OE from maintenance work is not sufficiently collected and supervisors do not always participate in the debriefing,
  - Multiple databases lead to inconsistent action plans,
  - Corporate OE is not sufficiently utilised,
  - Managers do not give enough feedback.
- Delays in the treatment of actions
  - The rules for prioritising actions are not correctly understood and not complied with,

  - The number of tools available leads to multiple actions that are very similar in content when more integrated global action plans could be deployed.

- Corrective action plan

- Lack of effectiveness of actions
  - Generalise the specific 3-day training course for analysts in root cause analysis: 71% of our event analysis coordinators had received this advanced training at the end of 2022, compared to 63% in 2021 and 44% in 2020. For coordinators who have not followed this training course, completing event analysis reports is part of their training programme and they are systematically accompanied by a coordinator who has been trained since the end of 2021,
  - Extend training to reviewers and validators in a one-day session: a session is planned on 09 June 2023, specifically for reviewers and validators who have not completed the initial 3-day training for report writers,
  - Set up a regular OE review of the root cause analyses of our events to raise department managers' awareness of good practices: a review was organized mid-2022 and will be renewed in 2023. This OE covers UNIE-GPSN (EDF corporate function supprting the EDF fleet for all safety issues) feedback and the Human Performance Expert's perspective, as well as the immediate feedback from the strategic coordinators and the Deputy Plant Director, who validates all station reports. This helps to raises awareness among all the people involved of the importance of producing quality analyses,
  - Create a mission statement for the Root Cause Analysis Coordinators, which provides precisions on timing and expectations for the analysis: the mission statement clearly indicates the key stages of a good analysis (discussion with the strategic coordinator, with support, management, etc.). It formalises this additional assignment and the time it takes to produce quality work,
  - Set up an annual event analysis session for the coordinators: this session took place in early 2023.
- Insufficient consideration of OE
  - Transform the tools and organise the collection of contractors OE in the new Caméléon tool: Caméléon has been deployed to treat voluntary findings and activity debriefings. The departments have been trained in the use of the new tool and a coordination dashboard has been deployed. A corporate decision has been taken to open Caméléon to contractors, which is yet to be deployed,
  - Consolidate the use of information from debriefings: the OE from the maintenance debriefs (Mechanical/Valves & Fittings/Pipes & Vessels) is discussed in a tripartite meeting (Work execution/methods/CAP representative), so that follow-up actions can be decided (capitalisation in the form of a finding, corrective actions, analysis, etc.),
  - Analyse external OE from other stations in the fleet: an organisation has been set up to make sure that major OE that is relevant to the plant is identified and that it is taken into account by the functional groups (dedicated action plan for all significant OE),
  - Train managers in Feedback: a manager training module on Feedback has been created and will be deployed in early May 2023 for team leaders.
- Delays in the treatment of actions,
  - Set up a reflex sheet that is a reminder of the rules for creating actions and what a SMART action is: the document clarifies the prioritisation rules and can be used to check action quality,

- Set up data governance to correct errors in action codes and prioritisation: corrections are to be made at least once a month,
- Set up a daily station-level performance review to track action backlogs: the review can be used to re-prioritise if necessary,
- Widen the use of Caméléon to tracking action plans: Caméléon is now used for tracking actions resulting from our IMS, but also for tracking findings from FIS audits and Nuclear Safety Authority audits, accidents, our laboratory findings and our debriefings. The organisation of the tool in petals makes it easier to input an ever-increasing number of our findings and action plans.

- Progress to date
- The large majority of the actions have been deployed (see above).

- Corrective action effectiveness evaluation
- Effectiveness of actions: effectiveness is measured after 18 months for all our actions resulting from significant events. Of the 83 effectiveness measurements carried out over the period 2021-2022, 74 showed the effectiveness of contractor company actions, which corresponds to an effectiveness rate of just over 91%. The 9 effectiveness measurements with negative results led to additional actions.
- Quality of analyses: the quality of our Root Cause Analyses is assessed at corporate level every year: the 2022 assessment showed progress in the quality of event analyses carried out by the plant.
- A 2-0 indicator on OE: the specific indicator for tracking repeat events across the fleet is still being developed.
- Driving actions to completion
    - A significant decrease in the number of overdue P1 actions (from 7% to less than 0.5%),
    - A significant decrease in the number of overdue P2 actions (from 30% to less than 8%).

IAEA Comments:

The plant carefully assessed the issues and established actions to resolve the issue, these areas were a lack of effectiveness of actions, insufficient consideration of Operating Experience, delays in the treatment of actions and the evaluation of corrective action effectiveness.

The plant reviewed and reduced the competency gaps of some people given the job to identify root causes, in some cases people were conducting root cause analysis without being trained. Starting in 2022 people must either be trained or working with someone who is trained to carry out root cause analysis. This is now a site and corporate level expectation.

The plant created a mission statement for the Root Cause Analysis Coordinators, which provides precisions on timing and expectations for the analysis. The mission statement clearly indicates the key stages of a good analysis (i.e., discussion with the strategic coordinator, with support, management, etc.). It formalises this additional assignment and the time it takes to produce quality work.

The plant has focused on the competent root cause analysis trained personnel and built on this experience. These staff are all event anlysis coordinators and the percentage of people trained increased from 44% to 66% trained.

The plant created a seminar built up from the site and corporate level experience on root cause analysis, this was presented back to the the site event analysis coordinators. The plant also set up the annual event analysis sessions and all aspects of event analysis was discussed; standards and expectations were also discussed to improve the root analysis quality and timeliness and effectiveness of actions. This resulted in Operations agreeing to some specific actions to improve quality and effectivness of their CAP approach.

A remote teams sessions was set up to review OE, including root cause analyses of plant events to raise department managers' awareness of good practices: a review was organized in mid-2022 and will be renewed in 2023. This OE covers UNIE-GPSN feedback and the Human Performance Expert's perspective, as well as the immediate feedback from the strategic coordinators and the Deputy Plant Director, who validates all station reports. This helps to raises awareness among all the people involved of the importance of producing quality analyses.

The site is also extending the root cause analysis training to the managers who validate the actions they set as a result of the analysis and written report.

The human factor consultant is encouraging the coordinators to explore the organisational and cultural aspects of some of the plant's events. This helps the organisation focus on preventing repeat events.

In February 2023 the site implemented daily station-level performance reviews to track action backlogs: the review can be used to re-prioritise actions if necessary. At 09:00 the Site level review takes place, this discusses status of actions and can make decisions on increases in level of effort, this can be done at station level.

These reviews and an increased site focus on KPIs is producing improvements in action delays, this resulted the following results over a 12 month period prior to the follow-up mission:

- Priority one actions have improved from 5.5% delayed to 0.5% now delayed.
- Priority two actions have now improved from a level of 30% delayed to approximately 5% delays.

The plant established effectiveness reviews for all actions resulting from significant events. Of the 83 effectiveness measurements carried out over the period 2021-2022, 74 showed the effectiveness of actions, which corresponds to an effectiveness rate of just over 91%. The 9 effectiveness measurements with negative results led to additional actions.

Conclusion: Issue resolved

7. RADIATION PROTECTION

7.3. RADIATION WORK CONTROL

The plant has utilized a double barrel key control programme for access to High Radiation Areas. The unique part of this process is that it ensures leadership engagement by requiring plant senior management to be present at the team briefing and to also be holder to one of the two required keys for access. There have been no reported High Radiation Access Events in the last five years. The team recognized this as a good practice.

The plant has installed a computer terminal at the plant entrance for all workers to check their qualification status. This gives workers the capacity to ensure that their data is valid and up to date upon their first entry to the site and before arriving at the Radiologically Controlled Area (RCA) to perform work. This is particularly useful during outage periods where the number of workers at the plant is greatly increased. The team recognized this as a good performance.

7.4. CONTROL OF OCCUPATIONAL EXPOSURE

The team observed that contamination control practices are not always implemented in a manner to ensure the spread of contamination is prevented. For example, worksites are not always properly prepared and controlled and workers do not always properly adhere to radiation work practices. The team made a suggestion in this area.

7.6. RADIOACTIVE WASTE MANAGEMENT AND DISCHARGES

The team observed that some plant Low Level Radioactive Waste (LLRW) activities are not appropriately managed and implemented. For example, some LLRW bags were stored in the chemistry hot laboratory hallway for over two weeks and the trefoil labeling of LLRW containers in the enclosed outside LLRW storage area was missing or degraded from weather exposure. The team encourages the plant to improve in this area.

DETAILED RADIATION PROTECTION FINDINGS

7.3 RADIATION WORK CONTROL

7.3(a) Good Practice: Radiation Protection had a double barrel key control programme for High Radiation Zone access in which Senior Management person and a Radiation Protection (RP) officer are the only key holders. Both people must attend to open the lock.

Access to the High Radiation Zones is granted by meeting the following criteria:

- A justified and planned activity
- An approved High Radiation Zone access form
- An approved specific Radiological Work Permit (RWP)
- A specific Risk Analysis
- A briefing of the workers in the presence of plant senior management (one key holder) and a Radiation Protection officer (second key holder).

These well-defined access criteria include senior management engagement for both access and briefing. The senior management engagement in granting access to red area contribute to the heightened awareness on this topic. There have been no reported High Radiation Access Events in the last five years. This practice can be applied to any plant.

7.4 CONTROL OF OCCUPATIONAL EXPOSURE

7.4(1) Issue: The practice of Contamination Control is not always implemented to prevent the spread of contamination.

The team noted the following:

- When the Large Equipment Room at the containment hatch is used for large items to be removed from the RCA this provides conditions for spread of contamination as some items are too large to be fully checked and wrapped. There were two road contamination events at the plant in 2021.
- The Large Equipment Room at the containment hatch had many half-filled open pink radiological waste bags and bird excrement on the floor. The inside of the Fuel Handling Building was dirty with trash in various spots and piles of dirt on the floor.
- The Equipment and Material Transfer Area in the Decontamination Facility did not have a barrier installed, frisker available, or a personal protective equipment (PPE) posting. The step off pad signage was installed backwards.
- A worker in the chemistry lab in the RCA was seen without the required white gloves, rubber gloves and eye protection. The worker self-corrected without coaching.
- A decontamination worker was observed working in cotton gloves, not the rubber gloves required to be used when working in the area. When questioned, the worker said he was writing so didn't need to wear rubber gloves and then continued to handle bags full of contaminated items.
- Required rubber gloves and paper coveralls were not provided and stocked at the entrance to the LAM room at the Arrival and Departure Vehicle Check building.
- Lab coats were used instead of the required paper coveralls at the LAM room at the Arrival and Departure Vehicle Check building. The lab coats were stored on a coat rack in the LAM room.
- Observed four Not Contaminated and Contaminated (NP/NC) interface areas without the correct PPE posting.
- In the changing room of the Fuel Handling Building, the required PPE was not available.
- The ladies change rooms did not provide a clear direction for entering and exiting the RCA.

Without consistent application of radioactive contamination control practices, spread of radioactive contamination outside the RCA could occur.

Suggestion: The plant should consider enhancing its practices of contamination control to ensure the risk of the spread of contamination is minimized.

IAEA Bases:

GSR Part 3

Requirement 21

3.77(a) Employers, registrants and licensees: Shall involve workers, through their representatives where appropriate, in optimization of protection and safety;

Requirement 22

3.83. Workers: (a) Shall follow any applicable rules and procedures for protection and safety as specified by the employer, registrant or licensee; (b) Shall use properly the monitoring equipment and personal protective equipment provided;

GSG-7

2.18 In planned exposure situations, employers, registrants and licensees (hereinafter referred to simply as the 'management') are responsible for ensuring that protection and safety is optimized, that applicable dose limits are complied with, and that appropriate radiation protection programmers are established and implemented.

3.11 From a practical viewpoint, the requirements for optimization call for an approach that:

(a) Considers all possible actions involving the source(s) and the way workers operate with or near the source(s).

(b) Implies a 'management by objective' process with the following sequence: planning, setting objectives, monitoring, measuring performance, evaluating and analyzing performance to define corrective actions, and setting new objectives.

(c) Can be adapted to take into account any significant change in the state of techniques, the resources available for the purposes of protection or the prevailing societal context.

(d) Encourages accountability, such that all parties adopt a responsible attitude to the process of eliminating unnecessary exposures.

3.16. The optimization of protection and safety should be considered at the design stage of equipment and installations, when some degree of flexibility is still available.

Plant Response/Action:

- Analysis conducted

- The various observations and remarks recorded by the OSART 2021 inspection concerning the spread of contamination were analysed and presented to the plant senior management:
  - In the "radiation protection management action plan" on 16 Feb 2022.
  - In the "basic process review: contamination control" on 01 June2022

- In these two presentations, led by the Risk Prevention Department (SPR), several low-level events at the plant in this area were identified: they include those identified during the OSART 2021 inspection. As a result, actions were validated by the Senior Advisor for Risk Prevention & Environment and then managed in the Caméléon action tracking application in 2022.

- The analyses carried out before these two action plans confirmed weaknesses in:
  - Controlling the spread of contamination when removing large components during outage via the access points to the Reactor Buildings (TAM) and the plant's hot workshop (ATC),
  - Storage conditions and equipment at the RCA entrance/exit points,
  - Inappropriate individual practices and working conditions of some workers in RCA (e.g. missing glove or not wearing the correct gloves),
  - The absence of Personal Protective Equipment (PPE) at certain access points with contamination risks (e.g. fuel building (DMK),
  - Risk prevention signs are sometimes unclear or insufficient.

- These two action plans were tracked in 2022 with periodic reporting to senior management. These two action plans were updated and renewed in 2023 with validation from the contributing functional groups and the plant senior management on 22 February 2023 during a specific committee meeting.

- The root cause(s) identified

- The 3 root causes identified are:
  - Progressive erosion of the fundamentals of workers' RP culture in the field,
  - Insufficient reinforcement of RP fundamentals by the management line in the field,
  - Some RCA equipment access points are not protected, with an increased risk of contamination spread, particularly when removing large components during outages.

- Corrective action plan

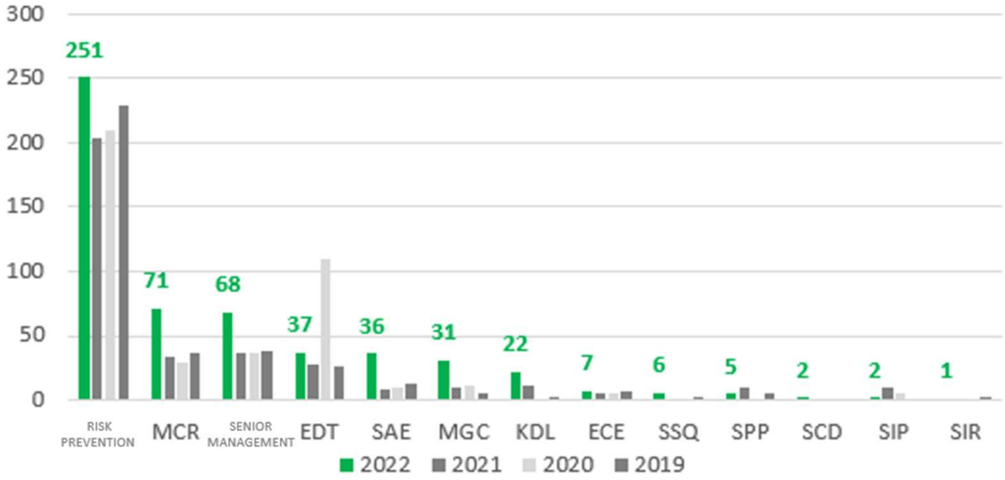
- Radiation protection management plan 2022: contains 24 actions, 91% completed as of 31 December 2022. Examples:
  - Awareness-raising sessions on radiation protection fundamentals (EDF and partners) by the Risk Prevention Department,
  - Number of MIF observations within the scope of radiation protection fixed for operational departments,
  - Improved radiation protection checks with the installation of a C3 gantry at the entrance to the conventional waste storage area

- "Contamination Control" Process Review in 2022: contains 14 actions, 60% completed as of 31 December 2022. Examples:
  - Improvement of RCA exit points in the Reactor Building (BR), Hot Workshop (ATC) and Waste Treatment Building (BTE),
  - Risk Prevention Department hold point when large components are removed from the Reactor Building during outages,
  - Installation of decontamination stands at the personnel air-lock exits in the reactor buildings.

- Progress to date

- The progress identified in 2022 for contamination control is as follows:
  - No triggering of C3 vehicle inspection gantries at the site boundaries (compared to 3 in 2021),
  - No contamination detected on the site's roadways (compared to 2 detections recorded in 2021),
  - A contamination rate of personnel at C2 inspection gantries at the RCA limits of 0.18% which is in line with the plant objective,
  - One single contaminated worker at the C3 control gantry at the site exit in 2022 for a site target of ≤ 2,

- The implementation of systematic non-contamination checks of roadways and adjacent areas during the transfer of large components (for internal transport other than sealed containers),
- The contamination control of the hatches is organized through the EPSILON software (software for worksite logistics requests) as close as possible to the moment that the hatch will be used,
- Implementation of non-contamination checks every 10 weeks of areas adjacent to the RCA access points,
- Awareness-raising sessions for industrial partners and EDF employees on RP fundamentals (16 sessions in 2022) with the distribution of booklets published specifically,
- An increased number of MIF observations (MIF) on the scope of radiation protection for the operational functional groups (+55%) as shown below:



- Corrective action effectiveness evaluation

- The improvements made are considered effective and durable on:
  - the control over the spread of contamination outside RCA through equipment access,
  - the additional measurements that are periodically carried out,
  - reinforced checks by the management line and independent department audits contribute to this.
- The 2022 results on the absence of road contamination and triggering of vehicle inspection gantries confirm this point. In 2023, the installation of additional monitoring devices will reinforce the work already undertaken.
- Regarding the conditions of certain equipment access points and their supply of consumables (e.g. Personal Protective Equipment), work will have to be continued in 2023 to reach compliance with the established national standards.
- Finally, in the area of compliance with radiation protection fundamentals, we will continue the awareness-raising actions for workers, particularly in the field, the continued presence of managers in the field, and the monitoring programmes of our industrial partners at the correct level so that the reinforcement of radiation protection is permanently entrenched. In addition, “radiation protection essentials for managers” training will be rolled out in 2023.

IAEA Comments:

The plant has evaluated this recommendation and determined that there had been an erosion of the worker execution and management reinforcement of radiation protection fundamentals. In addition, the plant noted that some RCA equipment access points are not protected, with an increased risk of contamination spread, particularly when removing large components during outages.

The plant has taken action to improve awareness of radiation protection fundamentals and increase field observations by managers related to radiation protection. Plant department managers have taken responsibility to perform observations, identify gaps and provide coaching on radiation protection behaviours of plant workers.

The plant has worked with the fleet to develop consistent expectations for radiation protection behaviours and implement a fleet wide booklet of radiation fundamentals. Radiation protection training in the field has been implemented to ensure workers are provided just-in-time training on expected radiation protection fundamental behaviours including use of a simulated work area in the field. Over 100 workers have completed this field training activity in the past two months in preparation for the upcoming outage.

The plant has improved contamination control protocols at the exit points in the reactor building, hot workshop and waste treatment building. The plant has implemented a risk prevention hold point when large components are removed from the Reactor Building during outages and has installed decontamination stands at the personnel airlock exits in the reactor buildings. The plant has also engaged workers in radioactive waste ownership through scannable bar codes on radioactive waste bags to permit follow up with the waste owners for improperly sorted waste.

The plant has reduced road contamination events from 2 in 2021 to 0 in 2022.

The plant has increased management observations on radiation protection from an average of 89 per 3 months in 2021 to 130 per 3 months in 2023.

Conclusion: Issue resolved

8. CHEMISTRY

8.1. ORGANIZATION AND FUNCTIONS

The plant chemistry section is a part of the Environment-Chemistry and Testing department. The chemistry department has its own goals and objectives to improve the quality of the activities for chemistry parameters. The team observed an effective interface with other sections and departments through the Operational Chemistry Monitoring Unit. The performance of operational chemistry is monitored by the weekly Unit meeting and the results are distributed to the managers. As a result, they initiated early interventions in the chemistry process. The team recognized this is a good performance.

8.5. LABORATORIES AND MEASUREMENTS

All necessary procedures and equipment are available in the laboratories to perform the analyses. The equipment which has an impact on chemical measurements is not always maintained and returned to service in a timely manner. For example, a pump of the feed water conductivity meter has been out of order since March 2021. The team encourages the plant to ensure that the maintenance of equipment which has an impact on chemical measurements is performed in a timely manner.

8.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

The plant work practices for handling, labelling and use of chemical substances are not always applied properly to prevent adverse effects on laboratory safety, equipment reliability and the environment, and to maintain the quality of chemistry measurement. For example, in several cases, chemical products used in the plant were observed not properly labelled and stored. The team made a suggestion in this area.

DETAILED CHEMISTRY FINDINGS

8.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

8.6(1) Issue: The plant work practices for handling, labelling and use of chemical substances are not always applied properly to prevent adverse effects on laboratory safety, equipment reliability and the environment, and to maintain the quality of chemistry measurement.

During the review the team noted:

– In the Unit 2 laboratory of the auxiliary building, a yellow metal cupboard which contained 4x5L canisters with 55% concentration hydrazine was found in the total gamma analysis room. This cabinet carried no inventory list, no dangerous product symbol, and no storage area information.

– In the Puisaye laboratory, a storage cabinet intended for acids and bases (alkaline) contained nitric acid (one litre, 65%) in the section for bases. This was stored with ethanol, glycerol and hydrogen peroxide. The inventory list was out of date: it showed only nitric acid but not the other stored products.

– In the Unit 2 turbine hall, an oil leak from an upper level (2SVA999IC, auxiliary steam distribution system) was being collected in a plastic canister which was not properly labelled. There was no information about the type of oil and no label on the canister which had a handwritten note.

– Near the fenced conventional island liquid waste collection system and the nuclear island liquid radwaste monitoring and discharge system, there were two near-empty plastic containers (one m^3) each with no retention tray. The temporary storage was not marked as such. One container was for Coolelf gel and the other was 15W-40 for diesel engine oil.

– In the Unit 2 laboratory of the auxiliary building, near the Mettler Toledo for boron analysis, Manitol powder (chemical product) was stored in an open canister. The label on the canister showed that this container was opened in 2015 and the contents had expired in 2019.

– In the Puisaye cold laboratory, empty plastic canisters, labelled with radioactive stickers, were stored, awaiting transfer to the RCA. These canisters contained no product information and were not stored in a separate area.

– In the Environment and Control laboratory (LEC) outside the plant premises, the signs on the chemical cabinet doors were not coherent with the contents inside: where the sign indicated bases, there were products such a Nitromethane, Collodion and Ethanol which were not bases. This cabinet also had no inventory list.

– In the Puisaye cold laboratory, one storage cabinet for chemicals was not properly labelled; no safety instructions or inventory were listed on the front of this cabinet. Inside, different products were stored but they were not chemicals.

Without the proper application of work practices for handling, labelling and use of chemical substances, there is an increased risk that the use of chemical substances could adversely affect laboratory safety, equipment reliability, the environment and the quality of chemistry measurement.

Suggestion: The plant should consider enhancing its work practices for handling, labelling and use of chemical substances to minimize adverse effects on laboratory safety, equipment reliability and the environment and to maintain the quality of chemistry measurement.

IAEA Bases:

SSR-2/2 (Rev. 1)

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

Safety in the use of chemicals at work- ILO; 4.3.2: ‘The purpose of the label is to give essential information on:

a) The classification of the chemical;

b) Its hazards;

c) The precautions to be observed.

The information should refer to both acute and chronic exposure hazards.

SSG-13

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 to 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).

9.2. The operating organization should be responsible for the use of proper chemicals and for their correct quality.

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.

9.12. Staff involved in receiving, storing, transporting and using chemical substances should be trained to understand storage compatibility, labelling requirements, handling, safety and impacts on structures, systems and components at the plant (see Section 8).

9.13. Management should periodically carry out walkdowns of the plant to evaluate the effectiveness of the chemistry programme and to check for uncontrolled storage of chemicals.

9.15. Chemicals should 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 departments.

9.16. In the storage of chemicals, account should be taken of the reduced shelf life opened containers. Unsealed and partly emptied containers should be stored in such a manner that the remaining product is kept in satisfactory condition.

NS-G-2.6.

8.32. The operating organization should ensure that storage facilities offer adequate space and provide for the secure retention of stocks in suitable environmental conditions, in order to prevent deterioration. Access and the installed handling equipment should be adequate for the types and sizes of items to be stored.

Plant Response/Action:

- Analysis conducted

- The OSART 2021 team reported one point that was the subject of a suggestion. This is related to the reinforcement of on-site work practices concerning the management, labelling and use of chemicals in order to minimise negative effects on laboratory safety, equipment reliability and the environment, and to maintain the quality of chemical measurements.
- The analysis led to the continuation of the Laboratory action plan on the theme “chemicals” as well as strengthening presence in the field, checks and animations/awareness-raising actions for the Laboratory team on the subject.

- The root cause(s) identified

- On the subject of chemical management, the root causes identified are:
  - Lack of workers’ knowledge on the expectations for the management and storage of chemicals,
  - Lack of arrangements for presence in the field and checks on the subject of chemicals.

- Corrective action plan

- Continue the Laboratory section action plan with the addition of the “labelling”, “storage” and “PPE” themes.
- Include the theme of chemical management into the plant’s MIF programmes.
- Carry out annual PCIs (Internal Audit Plans) on storage and temporary storage management of flammable or combustible materials and on hazardous product exposure management.
- Organize activities on the subject of chemical management.
- Continued work on the single register of chemicals used on site.
- Scheduled quarterly tracking of the chemical register in each functional group (PMRQ).
- Implementation of the new corporate chemical management tool (SIRCE) and support for the functional groups. This new tool, replacing the OLIMP software, provides better management of chemicals by taking stock inventory into account and facilitates the printing of labels on products (a module allowing product flashing and facilitating cabinet management is being researched at corporate level).
- Awareness-raising sessions on chemicals available through e-learning (currently scheduled for 2023).

- Progress to date

- Continue the action plan coordinated by the Laboratory section with the addition of the themes “labelling”, “storage” and “PPE”: Overall progress of the action plan: 65% completed, Progress on the theme of “labelling”: 90% completed, Progress on the theme of “storage”: 46% completed and progress on the theme of “PPE”: 86% completed
- Include the theme of chemical management in the MIF programmes: 90% completed. The topic of chemical management was included in the 2022 programmes and is continued in 2023.

- Carry out annual PCIs on storage and temporary storage control of flammable or combustible materials and on the exposure control to hazardous products: 100% completed. PCIs were completed in 2022 and the same PCIs are planned for 2023.
- Carry out activities and events on this theme in the Laboratory team: 2 events in 2022: “chemical management in the Laboratory” and “risks related to CMR products”.
- 6 MIF observations in 2022 on chemical risks: no major deviations detected. Overall feedback from MIF on this theme: sound knowledge in terms of labelling of chemicals of the oil store manager, positive point concerning product labelling and product management on a paint worksite.
- A MIF with an SPR employee in 2023, highlighting that the industrial safety work planner mastered the subject well.

- Corrective action effectiveness evaluation

- The tracking of the Laboratory’s “Chemical products” action plan and the team’s awareness-raising sessions have led to an improved control and organisation around the expectations in this field.
- The PCIs have helped to clarify the process for tracking the chemists’ exposure to hazardous products.
- The management of chemical storage cabinets is improving but remains an area of weakness identified during the MIF observations in 2022 (40% of positive findings for the area observed).
- An independent ISO 14001 audit was carried out at the beginning of 2023 with a focus on the proper management of chemicals through the register and the arrangements for this.
- Corporate level has reported that chemical risks are correctly managed at Belleville sur Loire NPP based on the VLEP (Personnel Exposure Limit Value) measurements with 100% of the measurements completed (Results maintained over the long term as measured over 4 years).

IAEA Comments:

In response to the suggestion the plant performed an analysis of the on-site work practices concerning the management, labelling and use of chemicals and identified several underlying causes for this issue, such as a lack of worker knowledge of the existing plant expectations for the management and storage of chemicals, degraded equipment conditions for the storage of chemicals and insufficient arrangements for manager presence in the field and related observations and checks.

The plant action plan considered several corrective actions and activities focused on the correction of the identified deficiencies leading to the improvements in the areas of labelling, storage, utilization of chemicals and use of relevant personal protective equipment.

The subject of chemical management was introduced in the plant’s Managers in the Field (MIF) programmes for 2022 and 2023. The plant performs Internal Audits on storage and temporary storage of chemicals, management of flammable and combustible materials and on management of exposure to hazardous products. The implementation of the new corporate chemical management tool and support provided better management of chemicals including stock inventory and easy printing of labels on products.

The plant management periodically carry out walkdowns of the plant to evaluate the effectiveness of the management and storage of chemicals and to check for uncontrolled storage of chemicals. The plant staff, involved in handling of chemicals, received appropriate training (awareness raising sessions) to better understand storage compatibility, labelling requirements, safety aspects and impacts of chemicals on structures, systems and components at the plant.

Some activities within the action plan were completed, however, several activities are still to be completed such as: overall progress of the action plan coordinated by the Laboratory section in the areas of labelling, storage and PPE reached 78% of completion; progress in labelling: 98% completed; storage: 63% completed; and progress in the area of PPE: 93% completed. Although the management of chemical storage cabinets shows improvements, it remains an area of weakness identified during the MIF observations in 2022. Awareness raising sessions on handling of chemicals is now available at the plant through e-learning and is currently scheduled for the plant chemical staff for 2023.

During the plant tour, the team observed improvements achieved by the plant and activities in progress according to the plant's action plan.

Conclusion: Satisfactory progress to date

9. EMERGENCY PREPAREDNESS AND RESPONSE

9.2. EMERGENCY RESPONSE

In the plant emergency planning flowchart (LOIC), there are criteria for emergency plan activation, but there is no direct classification system with emergency action levels to evaluate the severity of initial events. In the internal emergency plan, there are no deadlines for event severity classification. The team encourages the plant to improve these procedures.

The plant arrangements for protective and response actions for emergencies are not always sufficiently developed and verified to ensure an effective and timely response. For example, there was no procedure or display for what the first emergency responders who enter the Emergency Control Centre (BDS) should do. Regarding the habitability of the Emergency Control Centre (BDS), there were no prescribed criteria and no checking processes relating to air quality, including radiation limits and these points were not checked during exercises. There is no alternative template for the form for calculating dose and estimating the authorized time the emergency teams may spend in the field. The team made a suggestion in this area.

9.3. EMERGENCY PREPAREDNESS

A one-week exercise, conducted in June 2021, tested coordination and cooperation between the plant, Nuclear Rapid Action Force (FARN) teams and the Corporate support organization (GIE-INTRA). Various operational activities were implemented by partner entities. This type of large-scale exercise, based on practical simulation, creates exchanges between the different departments and external entities that would work together in the event of a real emergency situation. The entities contribute constructively to effective cooperation between the plant and external emergency services, including medical teams. The plant exercise in 2021 could be used as a reference exercise for a variety of activities and cooperation between different organizations and the plant operator. The team considers this as a good performance.

In 2021 the plant developed a new alert system (GUEPARD) for on-call personnel at home and for planning purpose. It is a decentralized system that allows the emergency manager to remotely activate an alert sent to emergency personnel and emergency support personnel’s homes. The team considers this as a good performance.

DETAILED EMERGENCY PREPAREDNESS AND RESPONSE FINDINGS

9.2. EMERGENCY RESPONSE

9.2(1) Issue: The plant arrangements for protective and response actions for emergencies is not always sufficiently developed and verified to ensure an effective and timely response.

The team noted the following:

- There was no procedure or display for what to do for first emergency responders who enter the Emergency Control Centre (BDS) via the decontamination room in the event of an emergency with possible radiation consequences.
- Regarding the habitability of the Emergency Control Center (BDS):
  - there were no prescribed radiation limits which should be used as an indicator to leave the bunker in case of a worsening radiation situation.
  - there was no tracking sheet to ensure that this radiation data (regarding habitability) is checked during exercises.
  - there were no prescribed criteria and no checking processes relating to air quality and filter change during an emergency.
  - the ventilation system cooling system was heavily corroded.
- There was no defined rest area with beds in the Emergency Control Center (BDS), only two camp beds stored in the kitchen.
- In the Emergency Control Center (BDS) decontamination room:
  - there was no tray for contaminated waste.
  - there was one inventory for two storage cupboards, with no details about which items are in which cupboard.
  - items were not properly stored in one cupboard.
  - seven towels were missing (out of 50).
- In the Technical Support Center (LTC) room in Unit 1, there was only one neutron dosimeter (two in inventory list), and 15 gamma dosimeters (only 13 in inventory list).
- The emergency muster points should have FFP3 respirators to protect the people gathering there, but these respirators were moved away at the beginning of the Covid-19 crisis. They are temporarily stored in the plant management room and can be taken only by the Station Director and the Emergency Directors (PCD1) in an emergency. However:
  - this temporary change had no written record or instructions.
  - in the temporary-storage place for the FFP3 respirators from the muster points:
    - there was no inventory of the numbers of FFP3 respirators.
    - some of the shelves storing respirators also stored other non-emergency material.
    - the respirators were not stored in an efficient way.
- There is a process for calculating the length of time emergency teams can stay in the field based on the expected dose rate. The calculation is recorded in the PREVAIR, an application used in normal operation to issue radiological work permits. However, if the application is not available, there is no alternative template form which could be used as

evidence of the calculation and of the authorized time the emergency teams may spend in the field.

- In the Logistics Emergency Response Center (PCM) room:
  - there was a plant layout on the wall that does not show the new muster point No.7,
  - on the nearby wall table, muster point No.7 was also not on the list.
- The location of muster point No.7 was not signed either internally or externally.
- In the mobile truck used for environmental monitoring in case of emergency, there was:
  - no visible inventory of required protective equipment.
  - no iodine tablets.
  - various items stored in individual lockers in an untidy manner.
- Muster point No.7 was not fitted with an automatic badging system as other muster points.
- There is an exercise on evacuation from the muster points every three years, but it does not systematically involve real-time bus evacuation, only evacuation (on foot) to the defined gates was exercised.
- During the muster point assembly exercises, there was no evidence that iodine administration was simulated.
- The volunteers' forms with the estimated radiation risk are available for the intervention emergency group, but there was no evidence that these had been used during exercises.
- The emergency procedures do not prescribe how to manage contaminated waste collected from the Emergency Control Center (BDS).
- In the Health Physics Emergency Response Center (PCC) room, there is a corporate support document for the calculation and prognosis of radiation consequences including distance-based (0.5, 1, 2, 5, 10, 20 km) protective measures (evacuation, iodine administration and sheltering) which is used by members of this center. However, messages based on this methodology (the PCC2.1 form) do not refer to the 0.5 km distance (i.e. the plant). If relevant information is required, it is added by hand to the form as a separate note.
- Out of business hours, the shift manager (PCL1) can decide alone to order iodine intake for people present on site if the radiation situation deteriorates only in one instance when the situation affects the emergency teams' mobilization to the power plant. However, the shift manager (PCL1) has no support documentation in order to take this decision. In all other cases, emergency director (PCD1) approval is mandatory.

Without providing sufficient arrangement for protective and response actions, the effective implementation of the emergency response actions may be compromised.

Suggestion: The plant should consider improving the arrangement for protective and response actions to achieve the effective and timely implementation of the emergency response.

IAEA Bases:

GSR Part 7

Requirement 9: Taking urgent protective actions and other response actions.

The government shall ensure that arrangements are in place to assess emergency conditions and to take urgent protective actions and other response actions effectively in a nuclear or radiological emergency.

5.37. Arrangements shall be made for actions to save human life or to prevent serious injury to be taken without any delay on the grounds of the possible presence of radioactive material (see paras 5.39 and 5.64). These arrangements shall include providing first responders in an emergency at an unforeseen location with information on the precautions to take in giving first aid or in transporting an individual with possible contamination.

5.41. The operating organization of a facility in category I, II or III shall make arrangements to ensure protection and safety for all persons on the site in a nuclear or radiological emergency. These shall include arrangements to do the following:

(a) To notify all persons on the site of an emergency on the site;

(b) For all persons on the site to take appropriate actions immediately upon

notification of an emergency;

(c) To account for those persons on the site and to locate and recover those

persons unaccounted for;

(d) To provide immediate first aid;

(e) To take urgent protective actions.

5.42. Arrangements as stated in para. 5.41 shall also include ensuring the provision, for all persons present in the facility and on the site, of:

(a) Suitable assembly points, provided with continuous radiation monitoring;

(b) A sufficient number of suitable escape routes;

(c) Suitable and reliable alarm systems and other means for warning and

instructing all persons present under the full range of emergency conditions.

Requirement 11: Protecting emergency workers and helpers in an emergency.

The government shall ensure that arrangements are in place to protect emergency workers and to protect helpers in a nuclear or radiological emergency.

5.52. The operating organization and response organizations shall ensure that arrangements are in place for the protection of emergency workers and protection of helpers in an emergency for the range of anticipated hazardous conditions in which they might have to perform response functions. These arrangements, as a minimum, shall include:

(a) Training those emergency workers designated as such in advance;

(b) Providing emergency workers not designated in advance and helpers in an emergency immediately before the conduct of their specified duties with instructions on how to perform the duties under emergency conditions (‘just in time’ training);

(c) Managing, controlling and recording the doses received;

(d) Provision of appropriate specialized protective equipment and monitoring equipment;

(e) Provision of iodine thyroid blocking, as appropriate, if exposure due to radioactive iodine is possible;

(f) Obtaining informed consent to perform specified duties, when appropriate;

(g) Medical examination, longer term medical actions and psychological counselling, as appropriate.

5.53. The operating organization and response organizations shall ensure that all practicable means are used to minimize exposures of emergency workers and helpers in an emergency in the response to a nuclear or radiological emergency (see para. I.2 of Appendix I), and to optimize their protection.

5.58. Arrangements shall be made to assess as soon as practicable the individual doses received in a response to a nuclear or radiological emergency by emergency workers and helpers in an emergency and, as appropriate, to restrict further exposures in the response to the emergency.

5.61. Information on the doses received in the response to a nuclear or radiological emergency and information on any consequent health risks shall be communicated, as soon as practicable, to emergency workers and to helpers in an emergency.

Plant Response/Action:

- Analysis conducted

- The prominent issue raised by OSART 2021 has two parts:
    - A first, relating to the provisions taken to monitor the level of habitability of the Site Protection Building (BDS), serving as the station emergency control centre, specifically during emergency situations,
    - A second, relating to the optimisation of certain operational emergency response documents (displays, procedures, etc.).
- The lessons learned from the OSART 2021 were shared with the national network of EROs and led to the drafting of 2 comment sheets for the national ERO group, to request the modification of the non-adjustable parts of the ERO reference baselines. The 2 comment sheets are currently being analysed for the next update of the national Internal Emergency Response Plan (PUI) reference baseline planned for 2024/2025.
- In addition to sharing feedback at corporate level, discussions were also initiated at station level with the various functional groups concerned to identify how much room for manoeuvre was possible at station level. These discussions have resulted in the action plans detailed below.

- The root cause(s) identified

- The areas for improvement identified with regard to the habitability of the BDS were already the subject of corporate studies to find solutions for:
    - firstly: the lack of configuration and ergonomics of the emergency control centre. Most of the facts reported during the OSART 2021 are currently taken into account in the corporate project to build a new on-site emergency control centre (CCL) to replace the BDS on the 18 stations in the fleet,
    - secondly: different practices between the plants to manage the unavailability of the BDS due to a lack of habitability.
- A lack of visual supports in the BDS decontamination room or the procedures still to be updated on the basis of recent organisational changes.

- Corrective action plan

- Development of a three-year action plan for the optimisation of displays and protocols for the protection of personnel, within the emergency response rooms.
- Station-level application of corporate-level provisions to manage unavailability/inhabitability of the BDS and to meet recommendation 5H of SOER 2013-2.
- Sharing of international OE within the national emergency response network and the request to take 2 suggestions from the OSART 2021 into account relating to:
  - The ergonomics of the emergency response flowchart (LOIC): the document does not specify the different accident scenarios/events that could lead to the triggering of a PUI/PAM (Emergency Response - Deployment and Support Plan),
  - The lack of air quality control in the BDS: the procedures of the ERO team members do not specify the checks that need to be completed to ensure a sufficient level of habitability.
- It was pointed out that there is no benefit taken from certain methods of working resulting from the ERO exercises, so the ERO engineers included the evidence relating to the effectiveness of staff protection measures used for radiological risks in the 2022 exercise reports (21-28 January 2022).

- Progress to date

- The 2022 actions were thus 100% deployed:
  - Participation of the Belleville station's ERO engineer in the national working group dedicated to the definition of measures to manage the unavailability of the BDS,
  - Set up a display for radiological checks and for managing ERO team members detected as contaminated at the entrance to the BDS,
  - Update the emergency response room inventories using report D5370MO20024153,
  - Add signs for staff assembly points that include recent building updates at the plant,
  - Update the radiological monitoring procedure for team members in the event of computer failures,
  - Observations from recent emergency response exercises have concluded that personnel protection measures, including the distribution of iodine tablets to personnel, are managed in a compliant manner,
  - Sharing of OE to the national ERO network.
- Ongoing actions in 2023:
  - Reprinting of site maps,
  - Provision of equipment dedicated to the management of radioactive waste potentially generated within the BDS,
  - Installation of a new decontamination kit within the BDS,
  - Implementation of actions to manage the unavailability of the BDS in the form of a reflex sheet for the PCD 1 on-call (senior management decion-maker),
  - Implementation of the Social Organisational and Human Factors Analysis (SOH) associated with the implementation of the Site Emergency Control Centre (CCL) project.

- Corrective action effectiveness evaluation

- The ERO exercise scenarios are established to test the new procedures, which are readjusted as required, based on the feedback from the emergency response team members

- The review of the ERO sub-process scheduled for mid-year and the internal assessments (audit/verification) and external (EGE-Peer-Review / OSART / ASN / etc.) periodically carried out on the subject, help to assess the effectiveness of the emergency response and to consider whether the expectations and recommendations have been correctly embedded.

IAEA Comments:

The plant team analyzed the suggestion and identified several underlying causes of the problem, such as: insufficient equipment and ergonomics of the Emergency Control Center (BDS), uncertainty in managing the unavailability of the BDS due to lack of habitability and outdated visual supports and lack of visual support in the BDS decontamination room.

Based on the causes identified, the plant adopted an action plan to address the issue, which resulted in a number of activities involving the development of a three-year action plan for the optimisation of displays, procedures and protocols for the protection of personnel, within the emergency response premises, and the application of corporate-level updated provisions to manage unavailability/inhabitability of the BDS.
The plant personnel took part and contributed to the activity of two national working groups for compiling requirements and specifications related to:

- unavailability/inhabitability of the BDS in 2022. The solutions resulting from this group and described in a corporate reference document were distributed to all NPPs in March 2023 for implementation.
- the management and ergonomics of the new BDS (CCL) that is planned to be constructed and commissioned in 2025. This project incorporates the five new ventilation configuration methods necessary to maintain the habitability of the new crisis centre. These methods are detailed in the corporate note and distributed to all the French NPPs. They facilitate the anticipation of training actions for emergency crews.

Actions planned for 2022 were fully completed. The most indicative are as follows:

- Participation of the plant staff in the national working group dedicated to the definition of measures to manage the unavailability of the BDS,
- Set up a display for radiological surveys and for managing Emergency Response Organization (ERO) team members detected as contaminated at the entrance to the BDS,
- Update the emergency response room inventories using a local template,
- Add signs for staff assembly points that include recent building updates at the plant.

As of May 2023, the plant is implementing planned activities involving the following actions:

- Reprinting of site ERO related maps,
- Provision of equipment dedicated to the management of radioactive waste potentially generated within the BDS,
- Installation of a new decontamination kit within the BDS,
- Implementation of actions to manage the unavailability of the BDS in the form of a guideline for the PCD 1 on-call (senior management decision-maker).

During the plant tour, the team observed improvements achieved by the plant and activities in progress according to the plant’s action plan.

Conclusion: Satisfactory progress to date

10. ACCIDENT MANAGEMENT

10.1. ORGANIZATION AND FUNCTIONS

The scope and timeliness of the Severe Accident Management training, exercises and drills are not comprehensive to maintain an adequate level of knowledge, experience and proficiency of the Emergency Directors involved in the application of the severe accident management guidelines at the plant. For example, three of the six of the Emergency Directors (PCD-1) have not performed a formal Severe Accident Management tabletop exercise. The team made a suggestion in this area.

10.2 OVERVIEW OF THE SEVERE ACCIDENT MANAGEMENT (SAM) PROGRAMME

The plant accident management program is not comprehensive enough to ensure that all modes and states of operation and all fuel locations are considered in its scope. For example, there is no guidance for severe accidents occurring in the Spent Fuel Pool. The team made a suggestion in this area.

10.5. PLANT EMERGENCY ARRANGEMENTS WITH RESPECT TO SAM

On the loss of all AC and DC power, lighting is very limited, impeding local actions to maintain core cooling, such manually supplying Auxiliary Feedwater to Steam Generators and manually controlling the steam release to the atmosphere. On these critical components necessary to maintain core cooling, the plant has installed fluorescent tags to aid the field operators to quickly identify the correct equipment. The team recognized this as a good practice.

The plant has installed a backup system that, in the event of a loss of all AC and DC power, can depressurize the primary circuit to avoid the vessel failing at high pressures. This is critical to preserving the last fission product barrier, the Containment building. The backup system consists of a light battery pack stored near the Main Control Room (MCR) which connects into an installed electrical cabinet. Sufficient charge is available to open (and maintain open) all of the primary circuit pressurizer relief valves. The system is easy to use which is essential in the challenging conditions experienced during loss of all AC and DC power. The team recognized this as a good practice.

The plant has implemented many additional safety features to prevent a severe accident. Examples include:

- The upgrading of the Ultimate Safety Generators (GUS), from one single gas turbine (of 4 MW) to four independent diesels (each of 1.2 MW) that can be synchronized. This improved the reliability and maintainability of this AC power supply.
- The upgrading Nuclear Rapid Action Force (FARN) to include the mitigation of the Loss of the Ultimate Heat Sink with new materials and training.
- Installing a ground water extraction pump (SEG) for the re-supply of water to tanks used in accident mitigation (such as the Auxiliary Feedwater and Refueling Water Storage Tanks) and make-up to the Spent Fuel Pools. As the pump is underground, it is protected from many external hazards.

The team recognized this as a good performance.

DETAILED ACCIDENT MANAGEMENT FINDINGS

10.1 ORGANISATION AND FUNCTION

10.1 (1) Issue: The scope and timeliness of the plant Severe Accident Management training, exercises and drills are not comprehensive to maintain an adequate level of knowledge, experience and proficiency of the Emergency Director (PCD1) in the application of the Severe Accident Management guidelines at the plant.

The team noted the following:

- The Emergency Preparedness (EP) drills involving the use of severe accident management guidance by the Technical Support Centre (ELC) and the Emergency Response Centre (BDS) occur every 2 years. Given 5 teams, personnel may only get to perform a Severe Accident Management (GIAG) drill once every ten years. A similar situation exists for multi-unit accidents (PUI-SACA) drills.
- The plant Emergency Director (PCD1) can be appointed with no Severe Accident Management training for a period of up to 6 months.
- The plant Emergency Director (PCD1) is not required to do re-qualification training in Severe Accident Management.
- Three of the 6 of the Emergency Directors (PCD1) have not performed a formal Severe Accident Management tabletop exercise.
- Four of the 6 Emergency Directors (PCD1) have not performed an EP Drill that involved core melt.

Without adequate training, exercises and drills, the severe accident management guidelines may not be applied in an effective manner in case of emergencies.

Suggestion: The plant should consider extending the scope and improving the scheduling of the training, exercises and drills to ensure an adequate level of knowledge, experience and proficiency of the Emergency Director (PCD1) in the application of the Severe Accident Management guidelines at the plant.

IAEA Bases:

SSR-2/2 (Rev.1)

5.8E. The accident management programme shall include training necessary for implementation of the programme.

NS-G-2.8

4.32. A training programme for emergencies should be established to train and evaluate plant staff and staff from external emergency response organizations in confronting accident conditions, coping with them and maintaining and improving the effectiveness of the response. Emergency preparedness exercises should be designed to ensure that plant staff and staff from other participating organizations possess the essential knowledge, skills and attitudes required for the accomplishment of non-routine tasks under stressful emergency conditions.

SSG-54

2.98 Personnel responsible for performing accident management measures should be trained to acquire the required knowledge, skills and proficiency to execute their tasks. A comprehensive training programme for accident management should be prepared that includes the interfaces with emergency preparedness and response. Training should include a combination of techniques, such as classroom training, drills, tabletop exercises and the use of simulation tools.

2.103 Training, including periodic exercises and drills, should be sufficiently realistic and challenging to prepare personnel responsible for accident management duties to cope with and respond to situations that may occur during an event [21]. Drills should extend over a time period long enough to realistically represent the plant response and should allow for the transmission of information during shift changes to be tested. Special exercises and drills should be developed to practice shift changeovers between operations staff and technical support centre staff and information transfer between different teams. Training should cover accidents occurring simultaneously at more than one unit, accidents occurring in different reactor operating states and accidents in the spent fuel pool. Training should consider unconventional line-ups of the plant equipment, the use of non-permanent equipment (e.g. diesel power generators, pumps) and repair of the equipment.

2.105 Training for new staff, as well as refresher training for existing staff, should be developed for all groups of staff involved in accident management. The frequency of refresher training should be established on the basis of the difficulty and the importance of accident management tasks. A maximum interval for refresher training should be defined, but depending on the outcome of exercises and drills held at the plant, a shorter interval may be selected. Changes in the guidance or in the use of the guidance should be reflected in the training programme. Such changes should be communicated to interested parties.

2.106 Criteria for evaluating the effectiveness of an exercise or a drill should be established. Such criteria should characterize the ability of the team participating in the exercise or drill to understand and follow the evolution of the plant status, to reach well founded decisions for various events (including unanticipated events), to initiate appropriate actions and to meet the objectives of the exercise or drill.

2.017 Results from exercises and drills should be systematically evaluated to provide feedback for the improvement of the training programme and, if applicable, the procedures and guidelines, as well as the organizational aspects of accident management.

3.114 Training, including periodic exercises and drills, should be sufficiently realistic and challenging to prepare personnel responsible for severe accident management duties to cope with and respond to situations that may occur during an event. Drills should extend over a time period long enough to realistically represent the plan response and should allow for the transmission of information during shift changes to be tested. Special exercises and drills should be developed to practice shift changeovers between operations staff and technical support centre staff and information transfer between different teams. Training should cover severe accidents occurring simultaneously at more than one unit and severe accidents occurring in different reactor operating states. Training should consider unconventional line-ups of the plant equipment, the use of non-permanent equipment (e.g. diesel power generators, pumps) and repair of the equipment.

3.115 Exercises and drills should be based on scenarios that require the application of a substantial portion of the overall severe accident management programme in concert with emergency response and should simulate realistic conditions characteristic of those that would be encountered in an emergency. Large scale exercises providing an opportunity to observe and evaluate all aspects of severe accident management should be undertaken.

3.117 Some of the scenarios used for exercises and drills should assume an extensively damaged state of the core that eventually results in failure of the reactor pressure vessel and the containment. Consideration should be given to conducting exercises that enhance the awareness of main control room staff, technical support centre staff and engineering staff of the need for and possible consequences of defeating or resetting control and logic systems.

Plant Response/Action:

- Analysis conducted

- The scope and frequency of training, exercises and drills on severe accident management are not sufficient to maintain an adequate level of knowledge, experience and expertise of the emergency response director (PCD1) when applying the SAMG,
- On-site discussions were also held with the Joint Training Department (SCF) and all PCD1s to work on an appropriate training plan that will guarantee a sufficient level of knowledge of severe accident management.

- The root cause(s) identified

- All PCD1s are not able to participate in an ERO exercise with a SAMG scenario every year because of the way that they are scheduled in the long term. To maintain the skills of all the team members involved in ERO at a sufficient level, the exercises planned over the year covered several themes, which means that each team member does not encounter all the themes within the same year.
- The on-call duty form for PCD1 does not stipulate that SAMG training is compulsory before taking on-call duties, but that it is necessary within the following 6 months. This form has not been reconsidered to this effect.
- Not many people need the refresher training called CIAG (SAMG (GIAG) refresher training), the plant has experienced difficulties in scheduling and tracking these training sessions, which has led to PCD1s who have not completed them.

- Corrective action plan

- To deal with the problem of SAMG training for PCD1, this subject was addressed in a meeting between the people concerned to develop different solutions that would strengthen our knowledge and skills for an eventual severe accident.

- Progress to date

- At a meeting between PCD1s, the scenario adopted is to complete a 15-day CIAG training course every 3 years. The PCD1 Standard Training Plan has been updated accordingly. To date, registrations and invitations have been completed for 2023, 2 PCD1 completed refresher training on 15 February 2023, the other 4 have signed up for July 2023. PCD2 and PCD2.1 on-call personnel from the same ERO command post also take part in these training courses to increase the probability of having one person who has recently been trained or drilled in SAMG in the event of an accident.

IAEA Comments:

The plant team conducted an analysis of the suggestion and identified several underlying causes of the problem such as: insufficient attention to the long-term planning of the Emergency Response Organization (ERO) exercises, lack of formal requirements for the compulsory training of the plant Emergency Directors (PCD1s) on Severe Accident Management Guidelines (GIAGs

(SAMGs)), and scheduling and tracking of the training sessions associated with GIAGs for PCD1s.

Based on the causes identified, the plant adopted an action plan to address the issue, which resulted in the rescheduling of the ERO exercises, the PCD1s training plan, and streamlining the PCD1s GIAG training session schedule to ensure that all PCD1s complete the course training every three years.

As of May 2023, according to the updated arrangements, two PCD1s have completed their GIAGs training and the remaining four PCD1s are assigned to the next scheduled GIAG training session in July 2023.

Conclusion: Issue resolved

10.2 OVERVIEW OF THE SEVERE ACCIDENT MANAGEMENT PROGRAMME

10.2 (1) Issue: The plant Severe Accident Management programme is not comprehensive enough to ensure that all modes and states of operation and all fuel locations are considered in its scope.

The team noted the following:

- There is no guidance for severe accidents occurring in the Spent Fuel Pool.
- The severe accident management (GIAG) supporting analyses do not scope a severe accident on more than one unit or severe accidents in the Spent Fuel Pool.
- There is no training provided for multi-unit severe accidents to the Technical Support Centre (ELC) or the Emergency Response Centre (BDS) personnel.
- There is no training provided for severe accidents occurring in the Spent Fuel Pool for the Technical Support Centre (ELC) or the Emergency Response Centre (BDS) personnel.
- There has been no Emergency Preparedness (EP) drill where a severe accident was simulated to occur on both units.
- There has been no EP drill where a severe accident was simulated to occur in a Spent Fuel Pool.

Without a comprehensive severe accident management programme, the plant may not be able to effectively manage a severe accident involving both units or a severe accident involving fuel in a Spent Fuel Pool.

Suggestion: The plant should consider expanding the scope of the severe accident management program to address multi-unit severe accidents and severe accidents involving spent fuel locations.

IAEA Bases:

SSR-2/2 (Rev. 1)

5.8A. For a multi-unit nuclear power plant site, concurrent accidents affecting all units shall be considered in the accident management programme. Trained and experienced personnel, equipment, supplies and external support shall be made available for coping with concurrent accidents. Potential interactions between units shall be considered in the accident management programme.

SSG-54

2.11 The accident management programme should address all modes and states of operation and all fuel locations, including the spent fuel pool, and should take into account possible combinations of events that could lead to an accident. The accident management programme should also consider external hazards more severe than those considered for the design, derived from the site hazard evaluation, that could result in significant damage to the infrastructure on the site or off the site which would hinder actions needed to prevent imminent significant degradation of the fuel rods or to mitigate significant fuel rod degradation

2.37 Accident management guidance should be considered for any specific challenges posed by shutdown plant configurations and large scale maintenance. The potential for damage to fuel in the reactor core and in the spent fuel pool, and in on-site dry storage if applicable, should also be considered in the accident management guidance. As large scale maintenance is frequently carried out during planned shutdown states, the protection of workers should be a high priority of accident management.

2.65 For a multiple unit nuclear power plant site, the accident management programme is required to consider concurrent accidents affecting multiple units, in accordance with para. 5.8A of SSR-2/2

2.66 Accident management guidance should include the equipment and supporting procedures necessary to respond to accidents that might affect multiple units on the same site and last for extended periods of time. Personnel should have adequate skills to use such equipment and implement supporting procedures, and adequate staffing plans should be developed for emergency response at sites with multiple units.

2.94 For multiple unit sites, the on-site emergency plan should include the necessary interfaces between the various parts of the overall on-site emergency response organization responsible for different units. Emergency directors for each unit may be assigned to decide on the appropriate actions at specific units. In this case, an overall emergency director should also be assigned to coordinate activities and priorities among all affected units on the site. Decision making responsibilities should be clearly defined. If there are different operating organizations at a given site, appropriate arrangements should be established for the coordination of emergency response operations, including accident management measures, among those organizations.

3.105 All significant sources of radioactive material in the plant, including the reactor core and spent fuel pools, and the occurrence of accidents in all relevant normal operating and shutdown states (including open reactor or open containment barriers) should be addressed.

Plant Response/Action:

- Analysis conducted

- EDF is structured as a fleet with corporate headquarters. Some expectations are defined at station level, but most are fleet-wide corporate expectations. This fleet effect is even more evident when dealing with multi-unit severe accident management and spent fuel pool severe accident management for which Belleville NPP applies corporate standards.

- Corrective action plan

- The activation of the severe accident management organisation occurs when degrading emergency operating conditions are not covered by the state-oriented approach (SOA) emergency procedures and may lead to a partial or total core meltdown. Entry into the severe accident management procedure is activated upon meeting a ‘severe accident’ criteria, which are monitored as part of SOA, in compliance with roles and responsibilities as defined in the on-site emergency plan. While the priority in SOA mode is to preserve the core, activating the severe accident management procedure shifts the operation focus to preserving containment.
- The responsibility for implementing the required actions shifts from the operations team to the Belleville existing emergency response organisation. This Emergency Response Organization (ERO) conducts several on-site emergency plan exercises every year.
- Therefore, in order to respond to a two-unit severe accident, Belleville NPP uses the existing on-site emergency plan organisation in addition to the quick-response nuclear taskforce (FARN) which is calibrated to respond on two units simultaneously. Whatever the case, the response strategy would be agreed between the FARN, the corporate crisis management organisation in Paris (corporate technical emergency team (ETC-N)/Corporate crisis director

(PCDN), the station crisis management organisation via the station crisis director (PCD1), and the corporate support centres involved.

- In concrete terms, this translates into:
  - The plant operation personnel and the on-site emergency response teams implement the severe accident management guidelines (one set per unit);
  - The set-up of an organisation in agreement with corporate level to face the challenges and limit releases to the minimum required level while prioritising actions on both units based on the situation;
  - Concrete actions in the field: setting-up by station response personnel of emergency equipment available on site,
  - The support of the FARN with specific additional means.

- The plant also endeavours to implement two concrete actions in 2023 to strengthen its crisis management organisation:
  - To develop a procedure/guideline to better define responsibilities within the chain of command when a severe accident involves two units;
  - To build an inventory of equipment available on site (other than emergency equipment) that could be used at any time as additional equipment (pumps, hoses, …) to handle accident conditions affecting two units until the FARN arrives on site.

- Concerning severe accident management involving the spent fuel pool, the final safety report states that an accident of this type is not included in design-based or extended design studies and, as such, remains hypothetical. The evolution would be slow and allow emergency response personnel, with the support of corporate experts (including the FARN) to develop a strategy and use the necessary response means.

- Finally, concerning the risk of loss of inventory in the spent fuel pool, a modification programme is underway at Belleville NPP to afford the plant additional make-up capabilities and automatic isolation to limit the drainage of the spent fuel pool and reactor cavity during an outage.

- Progress to date

- To manage a situation that impacts multiple units, the plant has arrangements and procedures defined as part of the PUI-SACA (on-site climate and environmental safety emergency plan). In the event of a severe accident, the management arrangements would be virtually the same, i.e., the plant has specific procedures (SAMG) (one per unit) on which staff are trained. Resources are available as part of the on-site emergency plan.

- In 2021, the plant conducted two PUI-SACA drills, one in 2022 and one in 2023. The Belleville station hosted the Nuclear Rapid Response Force (FARN) and the INTRA group (group created as a response to the Chernobyl accident that is specialised in emergency response interventions using remotely operated robots) for a one-week practical training session from 28 June to 1 July 2021, including an on-site emergency plan exercise on 29 June 2021.
- To work with corporate entities, an on-site emergency plan exercise was jointly conducted on 14 October 2021 and the corporate emergency response team (ETCN) came on-site to deliver training at Belleville at the end of 2022.

- In addition, the plant also has procedures to manage off-normal situations impacting the spent fuel pool (SPF), contained in chapter 6 of our General Operating Rules (emergency operating procedures). Operations staff are trained and complete refresher training on these procedures, meaning it is possible to limit the probability that a severe accident occurs in the Fuel Building. An update of the emergency procedures is planned in 2025, to add the last-resort arrangements for restoration of the water supply for the Auxiliary Feedwater tank and the spent fuel pool in the event of loss of heat sink across the entire site (modification file 'site H1').
- Furthermore, and in relating to the Site H1 modification file, since the OSART in 2021, Belleville is the first of a kind (FOAK) site to deploy the essential service water coarse filtration and trash removal system (SEG) to test all the procedures (simulator procedures and procedures used in the field).

- Since the Fukushima accident, the plant has set up the ESE (Extreme Situation Team) to ensure the additional and sufficient resources are available on both units to cope with emergency and extreme conditions where the plant could be cut-off for 24 hours to be autonomous until the FARN arrives on site.

- In the same vein, the plant has added mobile telephones at the end of 2022, which is used as station emergency response equipment. In an extreme situation, this equipment will make it possible to have three-way simultaneous communication (1 operator, 2 field operators), both inside and outside buildings on the plant. They would have autonomy of 3 days or 20 hours.

- Effectiveness evaluation

- All modifications and exercises completed at Belleville (PUI SACA, support from FARN) demonstrate the plant is capable of responding to a multiple-unit scenario with satisfactory station-/corporate-level interfaces, which have been tested since 2021, and including staff from the ETCN in our scenarios. As such, the plant has arrangements, procedures and resources that are considered satisfactory, with a positive momentum that should be sustained over time for continued progress.

IAEA Comments:

The plant identified the cause as being due to its application of EDF Corporate organization frames of reference for the multi-unit severe accidents and Spent Fuel Pool severe accidents.

EDF Corporate organization did not envisage providing Severe Accident Management guidance for the Spent Fuel Pools with the justification being that the risk of fuel melt in the Spent Fuel Pools was not sufficient to warrant such formalized guidance. This was supported by the EDF spent fuel reprocessing strategy which prevents fuel pools becoming full. Consequently, the EDF policy assumes that sufficient cooling will always be available within the spent fuel area. Finally, concerning the risk of loss of inventory in the spent fuel pool, a modification programme is underway at Belleville NPP to afford the plant with additional make-up capabilities and automatic isolation to limit the drainage of the spent fuel pool and reactor cavity during an outage.

To respond to a two-unit severe accident, Belleville NPP uses the existing on-site emergency plan organisation in addition to the quick-response nuclear taskforce (FARN) which is calibrated to respond to severe accidents on two units simultaneously. Whatever the case, the response strategy would be agreed between the FARN, the corporate crisis management organisation in Paris (corporate technical emergency team (ETC-N)/Corporate crisis director (PCDN)), the station crisis management organisation via the station crisis director (PCD1), and the corporate support centres involved. The station also endeavours to implement two concrete actions in 2023 to strengthen its crisis management organisation:

- To develop a procedure/guideline to better define responsibilities within the chain of command when a severe accident involves two units;
- To build an inventory of equipment available on site (other than emergency equipment) that could be used at any time as additional equipment (pumps, hoses, …) to handle accident conditions affecting two units until the FARN arrives on site.

The plant had carried out exercises to demonstrate its ability to prevent and mitigate complex accidents. However, the EDF corporate organization will begin to study potential organizational and technical improvements in 2024 - 2025 that could improve the severe accident management programme by considering simultaneous multiple unit severe accidents and ensuring that trained and experienced personnel, equipment, supplies and external support shall be made available for coping with concurrent accidents.

Conclusion: Satisfactory progress to date

10.5 PLANT EMERGENCY ARRANGEMENTS WITH RESPECT TO SAM

10.5(a) Good Practice: Identification of essential equipment with fluorescent tags

On the loss of all AC and DC power, lighting is very limited which impedes local actions to re-establish core cooling, such as manually supplying Auxiliary Feedwater to the Steam Generators and manually controlling steam dump to atmosphere. On critical components necessary to re-establish core cooling in this difficult situation, the plant has installed fluorescent tags to aid the field operators quickly identify the correct equipment. This improves the reliability of these local actions and aids the prompt recovery of core cooling.

Benefits:

- Time saved by identifying equipment more readily,
- Reduced stress when applying emergency documents, and
- Reduced exposure to ionizing radiation.

Fluorescent tag

Fluorescent tag on steam dump valve

10.5(b) Good Practice: Protection against high pressure vessel failure

The plant has installed a backup system that, in the event of a loss of all AC and DC power, can be used to depressurize the primary circuit to avoid the vessel failing at high pressures. This is critical to preserving the last fission product barrier (Containment). If the primary circuit vessel fails at high pressure then High Pressure Melt Ejection (HPME) occurs leading to Direct Containment Heating (DCH) with the potential of a simultaneous hydrogen burn. The resultant pressure spike can challenge the final fission product barrier.

The backup system consists of a light battery pack stored by the Main Control Room (MCR) which connects into an installed electrical cabinet. Sufficient charge is available to open and maintain open all of the primary circuit pressurizer relief valves. The system is easy to use which is essential in the challenging conditions experienced by loss of all AC and DC power.

Benefits:

- An easy and effective means of depressurizing the primary circuit on loss of all AC and DC power,
- Ensuring the injection of water from accumulators attached to the primary circuit, delaying the progression of the accident, and
- The preservation of the final fission product barrier (Containment) on loss of all AC and DC power.

Portable Battery Pack

Installed Electrical Cabinet for opening of the pressurizer relief valves.

11. HUMAN-TECHNOLOGY-ORGANIZATION INTERACTION

11.1. INTERFACES AND RELATIONSHIPS

The team identified that the contractor workers performance is not always properly challenged and followed up to ensure they meet the plant expectations for safety. There were several contractor performance shortfalls observed, including behavioural, human performance tool use, and in the plant approach used to improve contractor performance. The team made a recommendation in this area.

11.5 SAFETY CULTURE

The overall experience of the team was utilized to capture safety culture attributes, behaviours and practices which help to shape and define the safety culture at the plant. With respect to observed strengths, the team noted that the strongest characteristic was that the importance of safety is reflected in the business plan and that the high priority given to safety is shown in documentation, communications and decision making. The team also noted that an open working relationship existed between the plant and regulatory body regarding the sharing of information and working together to improve performance. However, the team noted that some attributes could be strengthened to improve the overall safety culture and safety performance at the plant. The team observed deviations from established standards and expectations in the areas of operations, maintenance, industrial safety, and contractor performance monitoring. This indicated that shortfalls exist in the safety culture characteristic areas of leadership for safety and accountability for safety.

The plant carries out an assessment of nuclear safety management every two years, this approach is complemented by the nuclear safety culture climate survey on the alternate year. The nuclear safety management assessment survey looks primarily for improvement opportunities at all levels of leadership, focusing on senior management, departmental managers and first line managers. It delivers a clear picture of the leadership performance opportunities in this priority area. The team considers this as a good performance.

DETAILED HUMAN-TECHNOLOGY-ORGANIZATION INTERACTION FINDINGS

11. INTERFACES AND RELATIONSHIPS

11.1(1) Issue: Contractor workers performance is not always properly challenged and followed up to ensure they meet the plant expectations for safety.

The team noted the following:

Professionalism of contractors that affects safety performance

- Several contractors were challenged by their leader for not wearing surgical masks and also safety goggles, this was despite the fact the radiation work permit contained contamination hazards and the team had undergone a pre-job brief that stated these risks. The workers were coached further by their leader and some still did not respond positively. The team leader then justified their actions by stating four different excuses that were not accepted by the manager observing.
- During the plant observation it was noted that a significant plant leak of demineralized water had occurred on a task that contractors were working on. The area had been left flooded, with no control being managed by barriers, signs or a person to prevent entry to the unsafe area. After a number of telephone calls, it was established by a senior manager that the contractors had called the plant maintenance team to report the issue and then left the building in this unsafe condition.
- During outage work activities in 2019 and 2020, a contractor performed measurements on several primary coolant system piping support devices. In some cases, the measurements were not properly conducted, nor checked against the required limits. Weaknesses were identified in technical knowledge, document preparation, conduct of measurements, and checks of the measurements compared to the limits.
- On 19 August 2021, a motor was disconnected from a rolling shutter door during a contractor maintenance activity, resulting in the shutter door dropping, damaging scaffolding and injuring a worker. The worker suffered injuries to their forearm and shoulder and was taken to the hospital. The investigation revealed that several safety rules had been violated. This was a lost time injury.

Drive for timely and appropriate improvement actions

- After leader in the field tours, managers write reports, which include suggestions to improve work and frequently these include contractor work that does not achieve site standards. Apart from significant events, there is no formal or systematic approach to report these findings to contractor senior management.
- The results of the human performance tools weak signals analysis for the plant were presented to the senior management in June 2021. The gaps were the performance of the site and contractor personnel. The only action delivered to date was for each manager to brief their teams and take into account the weak signals analysis paper when managing their team's objectives.
- Three contractor companies carry out joint observations with plant managers and they write up reports, and some include items that require actions to resolve. The plant management does not have access and does not regularly request copies of contractor's leader in the field reports, making it difficult to understand how the contractor management have decided to close out any issues and therefore if this process is effective in meeting the plant's objectives.

Human performance tool use

- As part of work related to a filter replacement, a Pre-Job Briefing (PJB) was conducted after the assembly of replacement filter cartridge had been completed. The PJB discussion included operating experience relevant to filter cartridge assembly. This was not recognized by the Contract Manager or the Contract Monitor present at the job site and was not discussed in the post-job de-brief until prompted by an observing manager.
- Thirty two event reports related to human performance between September 2020 and August 2021 were analyzed by the consultant for human factors, and about 50% were linked to contractors. This analysis of events suggested that contractors may not always be consistently applying human performance tools and techniques to mitigate risks associated with their activities.
- A contractor whose job is to brief teams being set to work on high-risk task stated, “we get full attendance at the PJB on these high-risk tasks because I demand it, but rarely do we get full attendance at the post-job debriefing”.
- A post-job debriefing was interrupted by a contract manager with questions to the team leader near the beginning of the discussion and as a result the workers were less engaged in the discussion of performance.
- A contractor’s PJB, which was for a high-risk job (cleaning ‘Hepa’ filters using a high-pressure acid wash, then flushing the system) took place in an environment outside next to some cooling fans, making it difficult to hear.
- During the observation of a contractor’s PJB, which was for a high risk job (cleaning ‘Hepa’ filters using a high pressure acid wash, then flushing the system), the briefer engaged in a two way conversation with the team leader for approximately 80% of the PJB. They discussed the risks, the mitigation and briefly discussed the human performance tools they could use. The contractor staff involved in the task had very little input to the conversation, in fact, one staff said nothing throughout the entire 10 minute brief.

Without consistently challenging and following on contractor performance gaps, the potential of events related to personnel injuries and equipment safety could increase.

Recommendation: The plant should improve their challenge of contractors, respond more effectively to analysis, timeliness and quality of improvement actions associated with gaps identified.

IAEA Bases:

SSR-2/2 (Rev. 1)

3.1. The prime responsibility for safety shall be assigned to the operating organization of the nuclear power plant. This prime responsibility shall cover all the activities relating to the operation directly and indirectly. It includes the responsibility for supervising the activities of all other related groups, such as designers, suppliers, manufacturers and constructors, employers and contractors, as well as the responsibility for operation of nuclear power plant(s) by the operating organization itself.

NS-G-2.4;

4.5. Contractor personnel may be used to perform tasks that are of a specialized or temporary nature for which it is not feasible to hire or maintain a full-time plant employee. When contractor personnel are used, their duties and authorities should be clearly defined. Contractor personnel should be trained and qualified for the task to be performed and held to the same performance standards as plant personnel performing similar tasks.

NS-G-2.6;

3.8. Contractors should be subject to the same standards as plant staff, particularly in the areas of professional competence, adherence to procedures and evaluation of performance. Suitable steps should be taken to ensure that contractors conform to the technical standards and the safety culture of the operating organization.

Plant Response/Action:

- Analysis conducted

- The problem identified by the OSART 2021 was included in the annual assessment conducted as part of our IMS (Integrated Management System) on partner relations.
- Three weaknesses have been identified by the Industrial Policy Sub-Process:
  - Organisation for tracking quality deficiencies,
  - Reinforce the tracking of our partners' performance,
  - Having partners, who are behind, following the approaches driven by EDF (Maintenance Quality Control, Manager in the Field, Training & Exercises)

- The root cause(s) identified

- Lack of worker skills,
- Insufficient reinforcement of expectations by EDF and partner company management line,
- Failure to apply Human Performance Tools,
- Difficulties in working in a more partnership manner (regulatory constraints, unlawful loan of labour, the weight of habit, contract agreements).

- Corrective action plan

- Crucial elements
  - The Station’s crucial elements are displayed at the site entrance and were communicated when they were set up. These crucial elements will be included in the Worker’s Guide that is currently being developed.
  - During Outages (AT), two sessions and meetings with the managers from partner companies have been added:
    - On Monday, presentation of the week’s objectives and reminders of the expectations from a safety and radiation protection point of view,
    - On Friday, review of the week's inspections and the issue of requests for corrective actions to the companies.
- Professional skills and Human Performance Tools
  - To improve understanding and consideration of the strengths and weaknesses of the partner teams, Belleville sur Loire NPP gave the PEREN association the assignment in 2022 of conducting the first major project on Maintenance Quality Control. For this, 7 companies on 42 worksites were monitored in 2022 during outage 2P2422.
- Professional skills and Training

  - Training and practice sessions are tracked on a monthly basis during meetings between the Joint Training Department, the PEREN association and the Industrial Policy Manager.
- Coordination
  - The partner companies are coordinated and accompanied throughout the year in Power Operations,
  - There are specific monthly updates in Power Operations and Outage with the partner in charge of the Global Worksite Assistance responsible for all the worksite logistics at the plant,
  - Continuous work with the PEREN association to maintain constructive and fair discussions between EDF and its industrial partners.
- Monitoring expectations
  - Issues and major issues are tracked with a grading of treatment that renders the entire decision-making chain accountable. For example, the "lowest level" subjects are treated in the field either directly with the Contractor Monitoring Supervisors/Work Coordinators, or with the Technicians from the Risk Prevention Department (for industrial safety) or with the Technicians from the Fuel, Waste and Logistics Department (for the logistics part of the worksite),
  - Technical feedback is tracked specifically through the Non-compliance reports processed directly between industrial partners and the maintenance groups,
  - Preventive industrial safety feedback is tracked through Suggestions for Industrial Safety Improvements (PAS) or through High Event Potential reports (HPE),
  - Including feedback from industrial partners is part of the plant action plans after discussions and analysis with the client functional group, but these feedback elements are not flagged as specifically coming from a partner,
  - The action plans of the major companies in the field of Maintenance Quality Control are monitored and regularly updated by the industrial partners, level 2 contract managers, the Industrial Policy Manager and the Station Maintenance and Operations Quality Control Manager.

- Progress to date

- Crucial elements
  - Between the start of outage 2P2422 and the end, we observed that our partners complied with the wearing of PPE,
  - The "FIELD BRIGADES" database has been supplemented by feedback from the management line of industrial partners,
  - Activity preparation and readiness are now part of the outage schedule for the most important tasks.
- Professional skills and Human Performance Tools
  - The PEREN study on compliant use of Human Performance Tools on 2P2422 worksites was presented,
  - Presentation to the companies who have incorporated the feedback into their Maintenance Quality Control action plans.
- Professional skills and Training
  - 54 hours of training exercises for our partners over 2022 in addition to their internal training,
  - Implementation of monitoring of Activities with a Non-Quality Risk (ARNQ),
  - Monitoring of PEREN activities

- Monitoring expectations
  - Request made to 3 partner companies to review their action plan so that it is aligned with our expectations,
  - Drafting of contractual letters in the event of significant Quality Deficiencies that have an impact on our station performance,
  - Implementation of Partner Quality Deficiency tracking in Caméléon.

IAEA Comments:

The plant has carefully analysed this recommendation and determined that the past performance and focus was tied to weaknesses in the Industrial Policy Sub-Process, these include the organisation for tracking quality deficiencies and the tracking of the contractor partners' performance.

The plant has established some focus areas to drive and began the work to improve performance in this area. This work included the development of a standard of culture expected at the site under the banner of "Just Culture". This helps the staff understand what their role is in supporting the right behaviours for all people who work at the Belleville site.

As part of the launch, contractor's management attended a seminar style workshop where contractor partners were encouraged to declare issues they were challenged by that affected culture. This seminar was the start of enhanced collaboration with Belleville management.

During the outages the plant increased focus on contractor observation and coaching, they deployed field brigades, these are teams of approximately five managers and contractor leads who spend time on the plant each day focusing on all aspects of work delivery. These teams also focused on "Just Culture", the results were then written, declared, trended and corrective actions raised to improve gaps. These field brigades compliment the sites leader in the field programme and help address issues, such as the issue with PPE use by the contractors, this issue was resolved satisfactorily before the end of the last outage.

A number of additional monitoring and coaching activities are dedicated to engaging and focusing contractors on safety, these vigilance activities provide further inspection in the field to supplement EDF management in the field activities.

The plant has also taken actions to improve contractor knowledge and skills through collaborative efforts with PEREN (contractor training organisation); they worked closely in partnership to educate and train contractors across the plant. This includes developing training courses, using EDF specialists to observe PEREN delivery for feedback and to improve.

Training and practice sessions are tracked on a monthly basis during meetings between the Training Department, the PEREN association and the Industrial Policy Manager.

Over the past 12 to 18 months partnership between contractors and Belleville EDF shows a visible improvement and this is demonstrated in the KPI suite. The site contractors conduct manager-in-thefield visits, and the Belleville management are challenging some of their contractors to raise their standards and dig deeper to identify gaps in performance of their teams. It is clear that all of this work is resulting in improved performance, accident rates for contractors had fallen by 50% during 2021-2022, and this trend is continuing.

Conclusion: Issue resolved

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

	RESOLVED	SATISFACTORY PROGRESS	INSUFFICIENT PROGRESS	TOTAL
Leadership and Management for Safety				
R1.1(1)		X		
R1.3(1)		X		
Training and Qualification				
R2.2(1)		X		
Operations				
R3.4(1)		X		
S3.4(2)	X			
S3.5(1)		X		
Maintenance				
S4.5(1)		X		
Technical Support				
S5.1(1)	X			
Operating Experience Feedback				
S6.6(1)	X			
R6.7(1)	X			
Radiation Protection				
S7.4(1)	X			
Chemistry				
S8.6(1)		X		
Emergency Preparedness & Response				
S9.2(1)		X		
Accident Management				
S10.1(1)	X			
S10.2(1)		X		
Human, Technology and Organization Interaction				
R11.1(1)	X			
TOTAL R	2	4		6
TOTAL S	5	5		10
TOTAL	44%	56%		100%

DEFINITIONS

DEFINITIONS – OSART MISSION

Recommendation

A recommendation is advice on what improvements in operational safety should be made in the activity or programme that has been evaluated. It is based on inadequate conformance with the IAEA Safety Requirements and addresses the general concern rather than the symptoms of the identified concern. Recommendations are specific, realistic and designed to result in tangible improvements.

Suggestion

A suggestion is advice on an opportunity for safety improvement not directly related to inadequate conformance with the IAEA Safety Requirements. It is primarily intended to make performance more effective, to indicate useful expansions to existing programmes and to point out possible superior alternatives to ongoing work.

Good Practice

A good practice is an outstanding and proven 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 enough 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:

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

Normally, good practices are brought to the attention of the team on the initiative of the plant.

DEFINITIONS – OSART 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 it having minimal impact on safety.

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.

REFERENCES

Safety Fundamentals (SF)

SF-1 Fundamental Safety Principles (Safety Fundamentals)

General Safety Requirements (GSR)

GSR Part 1 Governmental, Legal and Regulatory Framework for Safety

GSR Part 2 Leadership and Management for Safety

GSR Part 3 Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards

GSR Part 4 Rev.1 Safety Assessment for Facilities and Activities

GSR Part 5 Predisposal Management of Radioactive Waste

GSR Part 6 Decommissioning of Facilities

GSR Part 7 Preparedness and Response for a Nuclear or Radiological Emergency

Specific Safety Requirements (SSR)

SSR-2/1 Rev.1 Safety of Nuclear Power Plants: Design

SSR-2/2 Rev.1 Safety of Nuclear Power Plants: Commissioning and Operation

General Safety Guides (GSG)

GSG-2 Criteria for Use in Preparedness and Response for a Nuclear and Radiological Emergency

GSG-7 Occupational Radiation Protection

GSG-11 Arrangements for the Termination of a Nuclear Radiological Emergency

Safety Guides (SG)

NS-G-2.1 Fire Safety in the Operation of Nuclear Power Plans

NS-G-2.13 Evaluation of Seismic Safety for Existing Nuclear Installations

GS-G-1.1 Organization and Staffing of the Regulatory Body for Nuclear Facilities

GS-G-2.1 Arrangement for Preparedness for a Nuclear or Radiological Emergency

GS-G-3.1; Application of the Management System for Facilities and

	Activities
GS-G-3.5	The Management System for Nuclear Installations
RS-G-1.8	Environmental and Source Monitoring for Purposes of Radiation Protection

Specific Safety Guides (SSG)

SSG-2 Rev.1	Deterministic Safety Analysis for Nuclear Power Plants
SSG-3	Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants
SSG-4	Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants
SSG-13	Chemistry Programme for Water Cooled Nuclear Power Plants
SSG-25	Periodic Safety Review for Nuclear Power Plants
SSG-28	Commissioning for Nuclear Power Plants
SSG-38	Construction for Nuclear Installations
SSG-39	Design of Instrumentation and Control Systems for Nuclear Power Plants
SSG-40	Predisposal Management of Radioactive Waste from Nuclear Power Plants and Research Reactors
SSG-47	Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities
SSG-48	Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants
SSG-50	Operating Experience Feedback for Nuclear Installations
SSG-54	Accident Management Programmes for Nuclear Power Plants
NS-G-2.2	Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants
NS-G-2.3	Modifications to Nuclear Power plants
NS-G-2.4	The Operating Organization for Nuclear Power Plants
NS-G-2.5	Core Management and Fuel Handling for Nuclear Power Plants
NS-G-2.6	Maintenance, Surveillance and In-service Inspection in Nuclear Power Plants
NS-G-2.8	Recruitment, Qualification and Training of Personnel for Nuclear Power Plants
NS-G-2.14	Conduct of Operations at Nuclear Power Plants

TEAM COMPOSITION OF THE OSART MISSION

IAEA

JIANG, Fuming	Years of nuclear experience: 24
Team Leader	
MARTYNENKO, Yury	Years of nuclear experience: 37
Deputy Team Leader	

REVIEWERS

MOECK, Andy	Years of nuclear experience: 31
Company:	Omega Energy Leadership Solutions Inc., Canada
Review area:	Leadership and Management for Safety
SOLJA, Taija	Years of nuclear experience: 14
Company:	Fortum Power and Heat Oy, Finland
Review Area:	Training and Qualification
PAGLIA, Thomas	Years of nuclear experience: 34
Company:	Duke Energy, United States of America
Review Area:	Operations 1
MONAGHAN, Mark	Years of nuclear experience: 20
Company:	EDF NNB, Hinkley Point C, United Kingdom
Review Area:	Operations 2
BRACKE, Paul	Years of nuclear experience: 34
Company:	Engie Electrabel, Doel NPP, Belgium
Review Area: Maintenance	
HEJDUS, Josef	Years of nuclear experience: 29
Company:	CEZ Group, Temelin NPP, Czech Republic
Review Area: Technical Support	
TEODOR, Vasile	Years of nuclear experience: 28
Company:	SNN S.A. CNE Cernavoda, Romania
Review Area: Operating Experience Feedback	
GREGORY, Cristy	Years of nuclear experience: 20
Company:	IAEA
Review Area: Radiation Protection	
ELTER, Eniko	Years of nuclear experience: 27
Company:	MVM Paks NPP Ltd., Hungary
Review Area:	Chemistry
MANČÍKOVÁ, Mariana	Years of nuclear experience: 36
Company:	Slovenske Elekrarne, Mochovce NPP, Slovakia
Review Area:	Emergency Preparedness and Response

PERRYMAN, Lindley	Years of nuclear experience: 32
Company:	Nawah, Barakah Nuclear Power Plant, United Kingdom
Review Area:	Accident Management
GEORGE, Andrew	Years of nuclear experience: 39
Company:	Sellafield Ltd. United Kingdom
Review Area:	Human-Technology-Organization Interaction

TEAM COMPOSITION OF THE OSART FOLLOW-UP MISSION

IAEA

JIANG, Fuming	Years of nuclear experience: 26
Team Leader	
Review Areas:	Operation, Maintenance
MARTYNENKO, Yury	Years of nuclear experience: 39
Deputy Team Leader	
Review Areas:	Chemistry, Emergency Preparedness and Response, Accident Management

REVIEWERS

MOECK, Andy	Years of nuclear experience: 33
Company:	Omega Energy Leadership Solutions Inc., Canada
Review area:	Leadership and Management for Safety, Training and Qualification, Radiation protection
GEORGE, Andrew	Years of nuclear experience: 41
Company:	Nawah Company, United Arab Emirates
Review Area:	Operating Experience, Technical Support, Human-Technology-Organization Interactions