Operational
Safety Review
Team

IAEA | OSART

REPORT

OF THE

OPERATIONAL SAFETY REVIEW TEAM

(OSART)

TO THE

TRICASTIN

NUCLEAR POWER PLANT

FRANCE

28 NOVEMBER – 15 DECEMBER 2022

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 Tricastin 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.

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 ten operational areas: Leadership and Management for Safety; Training and Qualification; Operations; Maintenance; Technical Support; Operating Experience Feedback; Radiation Protection; Chemistry; Emergency Preparedness and Response; and Accident Management. Depending on individual needs, the OSART review can be directed to a few areas of special interest or cover the full range of review topics.

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

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

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

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

EXECUTIVE SUMMARY

This report describes the results of the OSART mission conducted for Tricastin Nuclear Power Plant (NPP) in France, from 28 November to 15 December 2022.

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 Long Term Operation.

The mission was coordinated by an IAEA Team Leader and Deputy Team Leader and the team was composed of experts from Armenia, Bulgaria, Belgium, Canada, Czech Republic, Finland, Slovenia, Ukraine, the IAEA staff members and one observer from the United Arab Emirates. The collective nuclear power experience of the team was 418 years.

The team identified 14 issues, three resulting in recommendations, and 11 in suggestions. Seven good practices were also identified.

Several areas of good practice were noted:

– The plant had established the position of a regional liaison and communication officer, to reinforce the plant's interaction with the region's general public, the elected officials and economic decision-makers, and to establish a strategy for creating a network of allies to support the future long-term operation of the plant.
– The plant uses personal hydrazine exposure measurement devices for the plant personnel who have the potential to be exposed to hydrazine.
– The plant uses 'Calculator' for identifying fire risk-sensitive jobs. The plant had available to all personnel a tool to identify jobs with specific fire-related hazards. The IT-based tool used straightforward questions to assign a score that reflects the likelihood and potential severity of fire-related hazards.

The most significant issues identified were:

– The plant should consider ensuring that the management expectations are systematically set and consistently reinforced to ensure that observed performance deficiencies are addressed in an effective and timely manner.
– The plant should enhance the rigor with which operators carry out field walkdowns in line with plant expectations.
– The plant should enhance its work management system to ensure that work is completed to schedule and maintenance backlogs are minimized.

Tricastin Nuclear Power Plant management expressed a determination to address the areas identified for improvement and indicated a willingness to accept a follow up visit in about 18 to 20 months.

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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 Tricastin Nuclear Power Plant from 28 November to 15 December 2022. 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 Long Term Operation. In addition, an exchange of technical experience and knowledge took place between the experts and their plant counterparts on how the common goal of excellence in operational safety could be further pursued.

The Tricastin OSART mission was the 215th in the programme, which began in 1982. The team was composed of experts from Armenia, Bulgaria, Belgium, Canada, Czech Republic, Finland, Slovenia, Ukraine, the IAEA staff members and one observer from the United Arab Emirates. The collective nuclear power experience of the team was 418 years.

Tricastin NPP is strongly mobilized to deploy a large-scale industrial programme spanning the decade 2018 to 2028, known as the Grand Carénage, the plant refit programme. This involves the completion of a 4th cycle of ten-year outage inspections known as VD4 including French regulatory periodic safety review (PSR), whereby the plant seeks permission to continue operating its reactors up until the 50-year mark. The plant is the first in France's 900 MW fleet to roll out the Grand Carénage while also being the first of the 900 MW plants to have completed a VD4. To date, the 4th cycle of ten-year outage inspections had been successfully completed on reactor Units 1, 2 and 3. The last one is planned at the beginning of year 2024 on Unit 4. Tricastin's workforce had produced a wealth of unique operating experience that it has shared with the other 900 MW plants in order to help them successfully complete the other VD4 outage inspections being carried out across the fleet.

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

The team found good areas of practice including the following:

- The plant had established the position of a regional liaison and communication officer, to reinforce the plant's interaction with the region's general public, the elected officials and economic decision-makers, and to establish a strategy for creating a network of allies to support the future long-term operation of the plant.
- The plant uses personal hydrazine exposure measurement devices for the plant personnel who have the potential to be exposed to hydrazine.
- The plant uses 'Calculator' for identifying fire risk-sensitive jobs. The plant had available to all personnel a tools to identify jobs with specific fire-related hazards. The IT-based tool used straightforward questions to assign a score that reflects the likelihood and potential severity of fire-related hazards.

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

- The plant should consider ensuring that the management expectations are systematically set and consistently reinforced to ensure that observed performance deficiencies are addressed in an effective and timely manner.
- The plant should enhance the rigor with which operators carry out field walkdowns to ensure plant expectations are met.
- The plant should enhance its work management system to ensure that work is completed to schedule and maintenance backlogs are minimized.

Tricastin Nuclear Power Plant management expressed a determination to address the areas identified for improvement and indicated a willingness to accept a follow up visit in about 18 to 20 months.

1. LEADERSHIP AND MANAGEMENT FOR SAFETY

1.1 LEADERSHIP FOR SAFETY

The plant management team had established a vision and a strategic direction and there are many signs of an engaged workforce with teamworking attributes being realized. The plant management worked in a collaborative manner with the workforce to create and implement strategies and improvement initiatives. The management team had also developed plant-specific strategic improvement projects covering deploying new methods of management working, improving competence of NPP staff and contract partners, delivering a challenging industrial programme and working collaboratively with local organizations. The plant had also started to successfully address previously identified weaknesses in procedure quality. This strategic business plan was very visible in the plant and had been regularly and consistently communicated to the plant staff. While the plant had invested in both comprehensive leadership training and Manager in the Field (MIF) programmes and there existed actions to secure improvements in human performance, the attributes and skills delivered through these initiatives required further embedding within the leadership team to ensure the future foundations for sustainable continuous improvement. A review of events, field observations and interviews with leaders and managers identified some weaknesses in leadership awareness and challenge relating to degraded Main Control Room (MCR) conditions, the MIF programme, some non-radiation safety issues and configuration control management. The team made a suggestion in this area.

1.3. CULTURE FOR SAFETY

The team did not undertake a detailed safety culture assessment at the plant. However, 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 Leadership for Safety is clear with a strong desire from the leadership team to integrate safety into every-day activities. There has been a noticeable improvement in the overall safety performance of the site in a number of areas and there was evidence of a collaborative relationship between the leadership team and the workforce. This was seen through the number of good practices and good performance activities raised during the OSART mission. The team also noted that a healthy working relationship existed between the plant, contract partners and the regulatory body regarding the sharing of information.

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 that deviations from expected standards were observed during field operator walkdowns, further work was required to improve maintenance work schedule completion and minimization of maintenance backlogs, and further improvements were required on the controls for both permanent and temporary modifications. There were also examples where individual behaviors were not at the expected standard. The leadership initiatives have not yet been effective in communicating and reinforcing the individual's awareness of the impact of their actions on safety.

DETAILED LEADERSHIP AND MANAGEMENT FOR SAFETY FINDINGS

1.1. LEADERSHIP FOR SAFETY

1.1(1) Issue: The plant leadership do not always set and reinforce management expectations in some areas to ensure that observed performance deficiencies are addressed in an effective and timely manner.

The team noted the following:

Main Control Room Practices

- While observing an instrument technician, who received permission to work in the Main Control Room (MCR) of Unit 3, two annunciator alarms initiated on the main alarm panels (approximately 9:30 on 9 December 2022). One alarm remained flashing (unaccepted) for five minutes and the second remained unaccepted for two minutes. No challenge was given from any MCR operators regarding the alarm. It was also noted that there were 13 standing alarms in the MCR.

- On 2 December 2022 during a visit to the MCR of Unit 2 (on power) with the nuclear safety engineer, it was observed that there were 10 standing alarms on the alarm facias. Discussion with the MCR operations staff revealed that although they were aware of the reason for each standing alarm, they were unable to state when the alarm would be cleared with some alarms having stood for four or five weeks. The operations engineers commented that some alarms were awaiting the plant being returned from repair or awaiting delivery of material with supply chain owning the issue. Later discussion with the shift manager for Unit 1 and 2 revealed that there was an operations engineer who had oversight of the alarms. Discussion with the responsible operations engineer for alarm reduction showed that 'ownership' of the alarm issue was devolved among plant departments.

- The regulator stated during his presentation to the OSART team that he was concerned about the management and number of alarms within the MCR.

  Manager in the Field

- During the walkdown of the Spent Fuel Storage Pond on Tuesday 29 November 2022, five deviations were noted by the OSART reviewer (non-radiation related safety, temporary modifications, leaks etc). Five plant personnel accompanied the reviewer, but no challenges were made for conditions adverse to safety by plant staff. However, when issues were pointed out to plant staff, immediate action was taken to address the deficiencies.

- During an interview with the first line managers, a manager stated that he did not hold his team accountable for the number of overall events that they reported as it was difficult in the culture. The manager did state that he was more interested in the quality of the events reported.

- On 2 December 2022 when accompanying a nuclear safety engineer on his daily checks, it was observed in the MCR of Unit 1 that there was an unsecured wheeled trolley that could impact control equipment in a seismic event. It was also observed that a book of drawings/plant information was placed on the control desk potentially covering indicators /controls. In Unit 2 (on power) it was observed that an unsecured chair (wheeled) was within the red line barrier posing a potential risk to striking the control desk during a seismic event or any incident that caused movement. Upon questioning the MCR operators all these deficiencies were rectified.

- On Friday, 9 December 2022 a tripping hazard and temporary modification in MCR Unit 2, was discovered which the operations team were aware of, but no action had been taken to remove the tripping hazard.

- An engineer in the rotating machine and electricity department (MTE) section, who was a Human Performance (HU) champion, stated that he would like to see more emphasis on effective manager in the field in his department, specifically on Human Performance.

- During an interview with the housekeeping team, it was stated that no individual person is accountable for each area of the plant, rather responsibility lies with an identified department and the housekeeping team being champions. The OSART team identified 104 plant-based deviations during the plant tour on 29 November 2022 indicating gaps in the housekeeping in the field.

Non-radiation Related Practices

- During an interview with the first line manager team, it was stated that during the last 12 months 159 non-radiation-related safety issues had been reported by the plant telephone reporting system (1515), however, they had been investigated and treated. There was also 64 other IS events captured in other databases.

- During the first week of the OSART review, 19 non-radiation-related safety concerns were raised by the team which included nine tripping hazards such as electrical cable lay down on the floor, and a new installed vent valve on pipe for containment spray system which presented a tripping hazard and could potentially be damaged as it was not visible for people crossing over the pipe.

- The plants non-radiation-related safety accident rate is above the plant target of < 8 accidents, currently at 8.7.

The following non-radiation related deviations were observed by the OSART team during the review and were not reported in the database:

- During an observation by the maintenance reviewer the following non-radiation-related safety issue was observed. In an unprotected cabinet, there were no signs to indicate that there was 220V AC inside the cabinet which was reachable by the hand.

- During maintenance reviewer plant-based observations the following non-radiation-related safety issue was observed at the location15,50m/L649: a cable was cut and unprotected without any marking.

- Between the turbine hall and the BAC Building, nearby on the road, a fuel pipe lay on the floor presenting tripping hazard (0-SEH-996-VI).

- During maintenance reviewer plant-based observations the following non-radiation-related safety issue was observed in the turbine hall at 0-meter level: an electrical cable lay down on the floor presenting a tripping hazard.

- During an observation by the maintenance reviewer the following non-radiation-related safety issue was observed in the Diesel building: tripping hazard on the floor next to diesel due to difference between levels of metallic and concrete parts.

- During an observation by the maintenance reviewer the following non-radiation-related safety issue was observed: in the component cooling system (RRI) area temporary electric cables were lying on the floor not protected, covered or identified (next to 2RRI 001 RF).

- During an observation by the maintenance reviewer the following non-radiation-related safety issue was observed in the turbine hall at the location 0,0m near B36 column: power cable found spread on the floor, not fixed, presenting a tripping hazard.

- In 2022, there were four first-aid accidents for the I&C department (SAU).

- In 2022, there were two lost time accidents, six accidents without lost time and six first aid accident for Static Machine and valves department (MSR).

- In 2022, there were six lost time accidents and one first aid accident for rotating machine and electricity department (MTE). In addition, there were five near misses on vital rules (electrical, height and lifting).

- In 2022, there were four lost time accidents, five accidents without lost time and nine first aid accident for logistics department (GNU). In addition, there were four near misses on vital rules.

Configuration Control Practices

- On 9 December 2022 while observing two technicians carrying out instrument checks within the instrument room below the MCR, one unidentified work area was observed with what looked like test equipment in the adjacent room. In the area where work was being carried out two temporary modifications with instrument/test connections connected to plant terminations were observed, one with an incorrectly dated and another with no label/tag. A senior manager challenged the automation department to address the situation.

- There was an installed modification in the Spent Fuel Storage Pond area for water transfer between pond areas which presented a tripping hazard and was installed in an unprofessional manner. Flexible pipework was lying along the footway and was unsupported and not identified.

- There were a large number (156) of temporary modifications (MTI) on equipment important for safety.

Without leaders setting and reinforcing high performance standards, operational safety could be compromised.

Suggestion: The plant should consider ensuring that the management expectations are systematically set and consistently reinforced to ensure that observed performance deficiencies are addressed in an effective and timely manner.

IAEA Bases:

SSR-2/2 (Rev.1)

Requirement 5. 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.

Requirement 9. The operating organization shall establish a system for continuous monitoring and periodic review of the safety of the plant and of the performance of the operating organization

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.

Requirement 23: Non-radiation-related safety

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.

GS-G-3.1

2.35. Management at all levels should promote the types of behavior, values and basic beliefs that lead to the development of a strong safety culture. Managers should monitor and reinforce the attributes that have been identified as essential for achieving a strong safety culture and should pay attention to early signs of decline in these attributes and thus in the safety culture.

3.2. The senior management is responsible and accountable for the planning and implementation of a management system that is appropriate to the organization. It is the role of senior management to establish and cultivate principles that integrate all requirements into daily work. Senior managers should provide the individuals performing the work with the necessary information, tools, support and encouragement to perform their assigned work properly.

3.3. Visible and active support, strong leadership and the commitment of senior management are fundamental to the success of the management system. Senior managers should communicate the beliefs that underlie the organization's policies through their own behaviour and management practices. The whole organization should share the management's perception
and beliefs about the importance of the management system and the need to achieve the policies and objectives of the organization

3.6. Managers should examine samples of work practices and related information on a regular basis to identify areas needing improvement. They should also encourage each individual under their supervision to look for more efficient and effective ways of accomplishing assigned tasks.

GS-G-3.5

2.15. Senior managers should be the leading advocates of safety and should demonstrate in both words and actions their commitment to safety. The 'message' on safety should be communicated frequently and consistently. Leaders develop and influence cultures by their actions (and inactions) and by the values and assumptions that they communicate. A leader is a person who has an influence on the thoughts, attitudes and behaviour of others. Leaders cannot completely control safety culture, but they may influence it. Managers and leaders throughout an organization should set an example for safety, for example, through their direct involvement in training and in oversight in the field of important activities. Individuals in an organization generally seem to emulate the behaviours and values that their leaders personally demonstrate

2.33. The concept of safety culture embraces this integration of individuals and technical aspects. However, whereas the culture of an organization influences human behaviour through the values, beliefs and assumptions held by the personnel of the organization, there are also other factors that may have an influence on how humans act in a given situation.

2. TRAINING AND QUALIFICATION

2.2. QUALIFICATION AND TRAINING OF PERSONNEL

Dedicated resources in training review all significant events and their corresponding analyses for applicability to training. Applicable operating experience (OE) events are shared with peers from other plants during a monthly conference call for potential inclusion into corporate wide training courses. These events are also recorded in a local OE Share point folder that all plant instructors have access to. They are provided with a link to the new event in an email and just in time training is provided to all plant instructors, so that they have a good understanding of the event. The team observed discussion of OE in all training observed during the OSART mission. The team identified this as good performance.

The team observed excellent instructional techniques and adult learning principles applied by plant instructors during training delivery. The instructors were observed explaining to trainees why the training was applicable to them, asked the trainees for their experiences, ensured all trainees were engaged in the discussion, reviewed applicable human performance techniques and reinforced plant expectations such as peer coaching. The team identified this as good performance.

The training instructors refresh their technical skills through various internal training and work closely with plant departments to discuss changes, OE, and work practices. However, the team noted that there are no expectations or formalized processes for plant training instructors to ensure that their technical knowledge and skills accurately reflect plant practices through regular secondments or attachments to the plant. As such they are not provided the time to be in the field to maintain their technical knowledge, skills and familiarity with routines and work practices at the workplace. The team made a suggestion in this area.

2.3. RECORDS AND REPORTS

The training department developed and implemented an integrated multi-functional and multi-plant series Training and Skills Management Tool that provided employees and managers a vision of the training, skills, coaching, observations and development plans of their teams. The tool also enabled managers and the training organization to understand and forecast their future training needs and demands. The team identified this tool as a good practice.

DETAILED TRAINING AND QUALIFICATION FINDINGS

2.2. QUALIFICATION AND TRAINING OF PERSONNEL

2.2(1) Issue: The plant training instructors are not systematically seconded to the plant for field activities to maintain their technical knowledge, skills and familiarity with routines and work practices at the workplace.

The team observed the following facts:

- There is no expectation for the plant training instructors to be seconded or attached to the plant on a regular basis
- There is no formalised process or procedure for plant training instructors to maintain their technical knowledge and skills through regular secondments or attachments to the plant
- The plant training instructors are not provided time on a regular basis, to be seconded or attached to a line department

By not ensuring that its plant training instructors are seconded to the plant and participate regularly in field activities, plant instructors' technical knowledge may not be updated, and this could adversely affect the quality of training.

Suggestion: The plant should consider assigning sufficient time for plant training instructors to be seconded in the field to maintain their technical knowledge, skills and familiarity with routines and work practices at the workplace.

IAEA Bases:

SSR -2/2 (Rev.1)

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

NS-G-2.8

5.31. Training instructors, on and off the site, should have the appropriate knowledge, skills and attitudes in their assigned areas of responsibility. They should thoroughly understand all aspects of the contents of the training programs and the relationship between these contents and overall plant operation. This means that they should be technically competent and show credibility with the trainees and other plant personnel. In addition, the instructors should be familiar with the basics of adult learning and a systematic approach to training and should have adequate instructional and assessment skills.

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

2.3. RECORDS AND REPORTS

2.3.(a) Good Practice: Training and Skills Management Tool (OPFC) application

Purpose:

OPFC is an integrated multi-functional and multi-plant series Training and Skills Management Tool that makes it possible to manage the needs expressed by managers regarding the training, skills, coaching, observations, development plans and training demands of their teams.

OPFC provides the manager and the employee with a vision of all the structured skills courses (training and assessment stages) planned, completed and required with the chronology of all the actions for the employees professional development including training, coaching and on-the-job observations. The tool creates multi-year individual and team skills maps.

Description:

The application consists of two modules:

'Training' section that is used to:

- Effectively manage the tracking of training and refresher training depending on the needs expressed by managers in training surveys and the expectations for maintaining qualifications and authorisations.
- Effectively manage the progress of reactive training depending on the complementary needs expressed in the Training Committees by the teams, with archives of evidence of completed sessions.
- Manage completed training sessions in a simplified way, by linking up with the MY HR (Human Resources application that manages enrolment for training) and entering semi-automatically any completed training sessions.

'Skills' section that is used to:

- Build and visualise skills development by Skills Area:
- Consists of training phases and Assessment phases: Coaching File (FC) and On-the-Job Observations (OST) for the delivery of skill levels (N1: Taking charge, N2: Proficient and N3: Advanced) to track the employee's professional development for each skill.
- These skill levels provide input for individual skills maps and help to correlate the number of levels and targets (defined by the Manager) required to "have the right skill at the right time".
- The correlation of these targets and levels is used to establish a collective skills map for each team for the current year, as well as to simulate longer-term skills maps based on the skills developments planned for the following 5 years and the eventual transfer of employees to other positions. This enables the production of effective Skills and Succession Forecasts (GPEC) reviews with optimised resources and skills.

Benefits

- An integrated approach to manage training and skills within departments.
- Professional development effectively managed due to clear programmes that are constructed to train and develop the skills of the functional groups.
- An effective method that managers can use for skills management, tried and tested by the I&C Department at Tricastin since 2021.

3. OPERATIONS

3.3. OPERATING RULES AND PROCEDURES

The plant has developed a set of operating documentation that included technical specification, operating procedures, emergency operating procedures, surveillance programmes, circuit diagrams, fire plans etc. Although the operating documentation was available to plant operators, there were some cases where unauthorized technical aids were found at MCR local panels and at other locations around the plant and the team made a suggestion in this regard.

3.4. CONDUCT OF OPERATIONS

The plant developed a small magnetic box with a flashing LED visible from a distance which the MCR operator can easily position near the indicator or recorder which has to be carefully monitored during an activity. The team considered this a good performance.

The OSART team observed field personnel conducting regular plant tours to check the status of equipment and to identify any abnormal operational conditions. During these rounds, operators used smartphones equipped with a specifically designed application that allowed them to enter specific equipment parameters. However, during walk-downs, the operators missed some specific plant equipment deficiencies that were observed and noted by the OSART team. The team made a recommendation in this regard.

3.6 FIRE PREVENTION AND PROTECTION PROGRAMME

The plant developed a tool to assist with the planning of work with a potential fire risk by making it easier to identify such risk-sensitive jobs. The tool was accessible to all plant personnel and by asking a set of straightforward questions, the calculator assigns a score that reflected the likelihood and potential severity of job-related fire hazards. During the work-execution phase, significant and high-impact jobs can then be closely tracked. At regular intervals determined by the risk assessment, a risk-prevention technician checks that the mitigation measures are adequate and in place. The team considered this a good practice.

The plant utilizes trained operations personnel to provide the first level response to the activation of a fire alarm. The plant was in the process of procuring a new fire truck to transport the required equipment to enable the operations personnel to quickly set up the equipment for responding to the initial stages of firefighting. The team encourages the plant to complete the procurement of the new fire truck and to provide the necessary training to enable the effective and efficient deployment of the firefighting equipment.

DETAILED OPERATIONS FINDINGS

3.3. OPERATING RULES AND PROCEDURES

3.3(1) Issue: The plant arrangements for the control and authorization of Operator Aids are not always applied.

The team noted the following:

- In Unit 2 MCR on the chart recorder for the control rod system parameters (2RGL401EN), due to a problem with the chart recorder, there was a post-it with unauthorized handwritten instructions detailing which channels were recording the correct parameters. Furthermore, there was no temporary instruction in place to support this change.
- In Units 1 and 2 there were unauthorized operator aids for fire detection system (1JDT007HK and 2JDT02HK) which were not listed in the approved list of operator aids detailed in instruction D5120/CDT/NS/110002.
- In the Main Control Room (MCR) there was an unauthorized operator aid for the meteorological monitoring system for the determination of the water temperature in the water intake canal adjacent to the site boundary.
- In Unit 1 MCR there was an unauthorized operator aid for the operation of the interface computer which displays the position of the control rods.
- In Unit 2 there was an unauthorized operator aid relating to the disconnection of the equipment on 2GSY001GQ grid connection system.
- In Unit 2 Turbine Hall there was an unauthorized instruction on the control panel for the condenser system (2CVI001CR), instructing personnel to open drain valve when the pump starts.
- In Unit 1 MCR there was an unauthorized guide on the operation of the non-industrial fire detection system.
- On a panel for the nuclear island liquid radwaste monitoring and discharge system, there was a set of nine line-up instructions engraved on a label without any controls to confirm if these instructions were still valid and correct.

Without the strict adherence to the plant arrangements for the control and review of Operator Aids the likelihood of human error and risk to safety increases.

Suggestion: The plant should consider enhancing the arrangements for the control and review of Operator Aids.

IAEA Bases:

SSR-2/2 (Rev.1)
Requirement 26: Operating procedures

7.5. A system shall be established to administer and control an effective operator aids programme. The control system for operator aids shall prevent the use of non-authorized operator aids and any other non-authorized materials such as instructions or labels of any kind on the equipment, local panels, boards and measurement devices within the work areas. The control system for operator aids shall be used to ensure that operator aids contain correct information and that they are updated, periodically reviewed and approved.

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6.16. Operator aids include sketches, handwritten notes, curves and graphs, instructions, copies of procedures, prints, drawings, information tags and other information sources that are used by operators to assist them in performing their assigned duties

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

3.4. CONDUCT OF OPERATIONS

3.4(1) Issue: The conduct of operator field walkdowns are not always carried out with the expected level of rigor to ensure deficiencies are identified in a timely manner.

The team noted the following:

Field Activities

- During preparation checks before starting the back up diesel (GUS) surveillance test, the documentation required the field operator to carry out visual checks to look for any leaks. However, the field operator did not notice an oil leak on the generator shaft of the diesel.

Field Operator Walkdowns

- During an observation of a field operator round, the field operator did not report the following deficiencies:
  - In Unit 4 there were foreign materials such as nuts, washers, loose chain, wing nut, bolt, small metal bracket in Unit 4 train A and train B emergency diesel rooms. The foreign materials were all within 1 meter of the main diesel engine.
  - In Unit 3 there was an unauthorized temporary modification with a handwritten note stating not to remove water collection bottles from a temporary modification which was in place to collect water from a leak on the MCR ventilation chiller unit.
  - In Unit 4 within temporary storage area adjacent to 4LLS700AR, there was dust, cardboard and a discarded mop.
  - In Units 3 there were open Fire Panel doors in: 3JDT007CR, 3JDT005CR, and 4JDT001CR fire panels in Unit 4.
  - In Unit 4 Turbine Hall, there was a 30cm flexible pipe left in the bund of the filter unit stator cooling water system (4GST009SP) and a damaged shaft shroud was visible on the conventional island closed cooling water system pump (4SRI001PO).
  - In Unit 3 MCR there was a cable hanging vertically from the MCR ceiling without the correct identification label or cable restraint in place.

Unreported Plant Defects

- During the OSART team walkdown the following defects were not reported by field operator:
  - In Unit 2 in the radiologically controlled area (RCA), at the chemical and volume control system pump 2RCV003PO, there was an unreported oil leak near the pump shaft and a loose bolt on the floor adjacent to the pump and a manometer was positioned the wrong way so the reading could not be read. The area is subject to daily field operator rounds.
  - In Unit 4 train A emergency diesel, there was an unreported oil leak on compressor 4LHP001EO.

- Inappropriate leak management was observed in the vicinity of the grid connection system (3GSY001RF). These included oil on cables in cable trays with no absorbent matting in place, and oil leaks outside of the areas covered by absorbent matting.

- In the Auxiliary building in the Caustic tank room, (1EAS009LD) a small-bore pipe to a process instrument showed evidence of a caustic leakage. There was no defect tag attached to the leaking component or evidence of leak management.

- In Unit 1 Turbine Hall there was an unreported water leak from 9ASG806BC on the auxiliary feedwater system and a leak on 2STR019VV on the auxiliary steam distribution system in Unit 2 Turbine Hall.

- In Unit 2 Turbine Hall, a condensate extraction pump weighing some 30 tons, laid horizontally on support stand but the lifting sling was being used to prevent metal to metal contact between metal support stand and the pump.

- In Unit 3 Turbine Hall there was unreported inappropriate housekeeping inside fenced off area for the generator hydrogen supply system (3GRV) with paper, loose metal parts, and a section of air hose left in the area.

- There was no insulation on two small sections of the heat exchanger and valve of the turbine driven emergency feedwater pump (8SEC) which can reach temperatures of up to 160 degrees Celsius.

- On Fire Panels 1JDT201HK and 2JDT201HK in Unit 1 and 2, tape had been placed over the alarm speakers to reduce the sound level.

- In the gas storage facility, there was a rack of 10 nitrogen bottles stored in the enclosure without the required earthing connection, adjacent to a rack of 10 full hydrogen bottles.

- In the Unit 4 Turbine Hall there was a hot working area set up with a large wooden box temporarily stored adjacent to the hot working area.

- In the Auxiliary Building there was combustible material left behind 8LKF 999 AR electric cabinet at the RP checkpoint.

- During a plant walkdown, the area around CO2 extinguisher 4JDT005CR was not marked as an area where materials should not be stored.

- In the Unit 1 Turbine Hall within an approved permanent storage there were a number of empty cardboard boxes were stored alongside other material. The plant expectation is that combustible material which is not required should be removed from the plant as soon as possible.

- In the Unit 2 Turbine Hall there was an unapproved temporary modification consisting of a pipe taped at one end to make a temporary connection on the condenser system (2CVI038VC).

- Several examples of missing labels were found, for example there was a missing label on a valve close to suction of the feedwater pump turbine in Unit 3 (3AGR) close to (3APP127VL) valve.

Without identifying and reporting deficiencies in the field in a timely manner, the reliability of plant systems and equipment may be affected.

Recommendation: The plant should enhance the rigor with which operators' carry out field walkdowns to ensure deficiencies are identified in a timely manner.

IAEA Bases:

SSR-2/2 (Rev.1)
Requirement 28: Material conditions and housekeeping.

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.

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4.34. Rounds should be conducted regularly by operators to identify actual and potential equipment problems and conditions that could affect the functioning of the equipment.

4.36. Factors that should typically be noted by shift personnel include:
– Deterioration in material condition of any kind, corrosion, leakage from components, accumulation of boric acid, excessive vibration, unfamiliar noise, inadequate labelling, foreign bodies and deficiencies necessitating maintenance or other actions should be reported.

4.49. The shift crews should routinely monitor the condition of systems and components and should record appropriately the plant status and parameters and all automatic or manual acts. Every change in the status of systems or components should be appropriately documented and should be communicated to the main control room in a timely manner.

5.50. Deficiencies in equipment should be clearly identified to make them apparent to the operations personnel who conduct plant rounds and make observations. A system of tagging for deficiencies and/or cautions should be implemented to mark problems with equipment. Deficiencies which are identified should be assessed for their safety significance and should be prioritized for their correction.

3.6 FIRE PREVENTION AND PROTECTION PROGRAMME

3.6.(a) Good Practice: Calculator for Identifying Fire Risk-sensitive Jobs

Purpose:

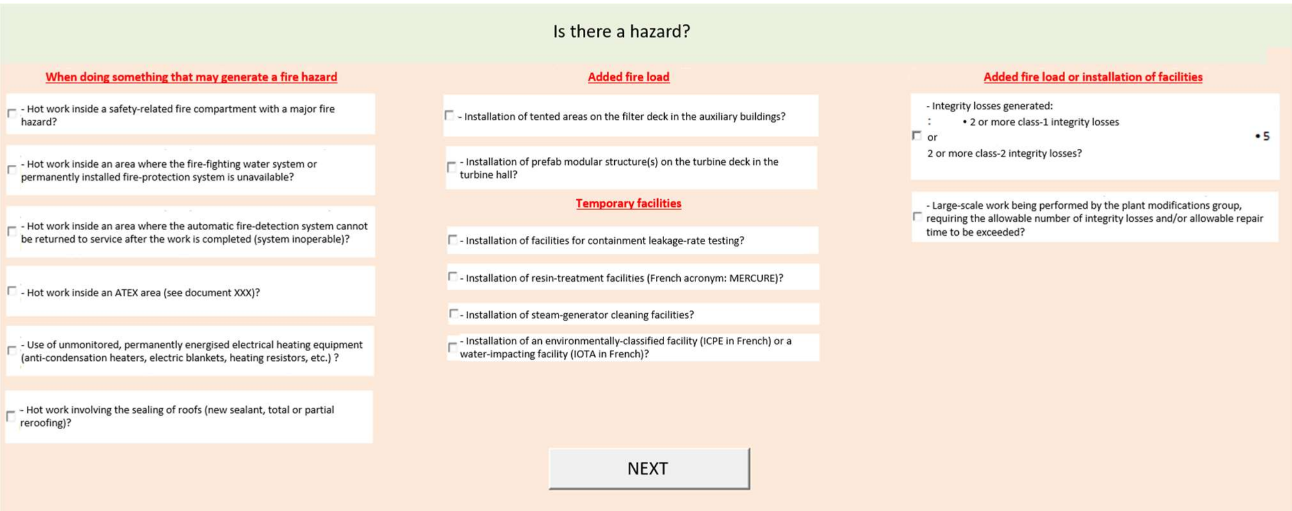
The tool assists with the planning of high-impact work by making it easier to identify fire risk-sensitive jobs.

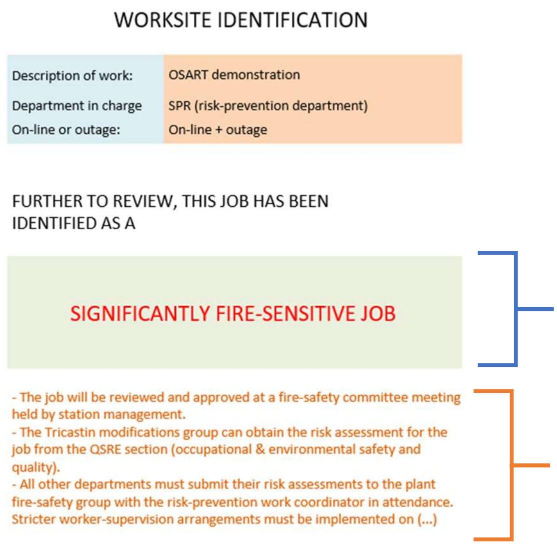
Description:

Accessible to everyone via the plant's IT network, the calculator is used from the planning phase onwards to identify jobs with specific fire-related hazards. By asking a set of straightforward questions, the calculator assigns a score that reflects the likelihood and potential severity of job-related hazards.
The higher the score, the more strictly the job will be controlled. A fire-safety specialist is placed at the disposal of the plant group in charge of the job to help compile the risk assessment for the job in question.
For high-impact jobs, the work package is signed off by a member of plant management at a special committee meeting, in order to ensure that all risks have been clearly understood and to secure accountability for implementing the agreed mitigation measures.

During the work-execution phase, regular oversight is provided by personnel from the risk-prevention department.

Identification of a hazard





Depending on the answers to the questionnaire, the calculator assigns a score (three possible levels).

The calculator tells the user how to proceed, depending on the score.

Benefits:

- Work controls are determined well in advance: Fire-safety aspects are addressed right at the start of the planning phase
- Categorisation of risks: The calculator asks straightforward questions in order to identify aspects of the job that could present fire hazards, in order to produce a comprehensive risk assessment.
- Hands-on assistance for plant groups: For significant and high-impact jobs, a fire-safety specialist is made available to assist workers with the compilation of the risk assessment.
- Regular oversight in the field: During the work-execution phase, significant and high-impact jobs are closely tracked. At regular intervals determined by the risk assessment, a risk-prevention technician checks that the mitigation measures are adequate and in place. The technician may be called upon at any time to provide the plant group with support in the area of risk management.
- The use of this system had also improved the fire safety awareness and culture amongst the maintainance personnel.

4. MAINTENANCE

4.2. MAINTENANCE FACILITIES AND EQUIPMENT

The plant developed a tool for testing the tightness of specific valves. These types of valves need to be leak-tight to maintain the condenser vacuum. If tightness was impaired, plant efficiency would be affected significantly, with an average loss of 2MW/h per unit. A special tool was designed to test the tightness of these types of valves. After maintenance on these valves, the test was carried out to confirm the valve's functionality. The valve can be maintained, coupled and calibrated at the workshop, or close to the area where the valve is located in the plant. The team identified this as a good performance.

4.5. CONDUCT OF MAINTENANCE WORK

The team noted that the maintenance work preparation does not systematically identify all cross-functional interactions to ensure high quality maintenance work. The team observed several examples of maintenance work with insufficient preparation due to poor planning. In addition, the plant had experienced a number of safety significant events with insufficient maintenance preparation as a causal factor. The team has made a suggestion in this area.

4.7. WORK CONTROL

The team noted that the target for the number of work requests due to equipment deficiencies was established by the corporate organization and the plant had achieved this target, but the plant had not set a more challenging target. However, the work management target for schedule adherence, (week-1 to week 0) during unit operations had not been met since January 2021. The total work request backlog in November was 3478 work requests, including 1586 important for safety. In addition, there were 145 leaks including 37 safety-related ones. Although the total number of leaks was below the corporate expectation, the plant did not specify a new, more ambitious challenging target in order to further reduce the number of leaks. The team has made a recommendation for the plant to enhance its work management system to ensure that work is completed in accordance with the schedule and maintenance backlogs are minimized.

DETAILED MAINTENANCE FINDINGS

4.5. CONDUCT OF MAINTENANCE WORK

4.5(1) Issue: The maintenance work preparation does not systematically identify all cross functional interactions to ensure high quality maintenance work.

The team noted the following:
- When performing the exchange of servo on valve 3-DEL-054VD for safety related chilled water to cool down the main control room, the servo could not be disconnected from the valve due to the inadequate tagging. The issue was not identified in the preparation phase of the work. A Limited Condition of Operations had to be raised to expand the tagging scope and perform the activity.
- The need for strong and formal coordination was not identified in the preparation phase of the activities 3-DEL-054VD that resulted in lack of activity leadership in the field (mechanical, electrical and project involved) and delayed the start of the activity. This operating experience (OE) was identified by the workers during the debriefing and tracked in the OE database.
- The installation of cyber cable on Unit 4 (tagging 8DU12515) was postponed due to weaknesses in work preparation, the wrong size cable hole was opened to perform the job.
- The main contributor to safety significant events (ESS) from non-quality of maintenance (NQM) was weakness in risk analysis (ADR) during work preparation. Thirteen ESS NQM occurred during the period from 2019 to August 2022 due to poor risk analysis.
- The main contributors to non-quality events in 2022 for the I&C department (SAU) were lack of work package preparation and work package familiarization. Eight NQM events out of 19 were related to poor preparation of work packages and eight NQM events out of 19 were related to poor familiarization of work packages.
- The main contributors to non-quality events in 2022 for the Static Machine and valves department (MSR) was a lack of work package familiarization. Three NQM events out of 12 were related to poor familiarization of work package.
- The main contributor to non-quality events in 2022 for the rotating machine and electricity department (MTE) are lack of work package preparation and work package familiarization (appropriation). 40% of the 33 NQM events were related to poor preparation of work packages and the other 40% of the 33 NQM events were related to poor familiarization of work packages.

Shortfalls in identification of cross-functional interactions in preparation of work packages may have negative impact of quality of maintenance and reliability of safety systems.

Suggestion: The plant should consider enhancing its work preparation regarding cross functional interaction to ensure high quality maintenance works.

IAEA Bases:

SSR-2/2 (Rev. 1)
Requirement 31: Maintenance, testing, surveillance and inspection programmes

8.11. Coordination shall be maintained between different maintenance groups (e.g., maintenance groups for mechanical, electrical, instrumentation and control, and civil equipment). Coordination shall also be maintained between maintenance groups, and operations groups and support groups (e.g., groups for fire protection, radiation protection, physical protection and non-radiation-related safety). The operating organization shall make arrangements with the external grid operator to ensure that appropriate procedures are applied in maintaining the connections of the plant to the external grid.

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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.

5.23. Because of the complexity of a nuclear power plant, the activities of different units of the plant's management interface with one another in ways that are significant to safety. In addition, the allocation on and off the site of the resources necessary for effective MS&I is an important activity, owing to the many special components to be maintained. MS&I activities should therefore be planned in the context of overall plant management, and MS&I personnel should work in close consultation with other plant management staff. It is usual practice for the plant management to establish a planning unit to co-ordinate all activities. MS&I personnel should schedule their own work in accordance with the overall plan. It should be ensured that adequate maintenance personnel is available and on call to provide urgent remedial maintenance as necessary.

5.24. Effective co-ordination should be established:
(a) Among different maintenance groups (mechanical, electrical, instrumentation
and control, and civil engineering maintenance groups);
(b) Among the operations, radiological protection and MS&I groups;
(c) Among the plant departments and contractors.

5.25. The MS&I group should ensure efficient and effective implementation and control of activities. The organization and staffing of the relevant departments, as well as the responsibilities of different groups of staff, should be defined and communicated in such a way that they are understood by all those involved.

4.7. WORK CONTROL

4.7(1) Issue: The work management process does not always ensure that work is completed to schedule and maintenance backlogs are minimized.

The team noted the following:

Work scheduled

- The work management system allowed a large proportion of work to be re-scheduled. Since January 2021, the schedule adherence of week-1 to week 0 was 65% which was below the corporate expectation (80%). No analysis was performed in 2022 to identify the root cause of the rescheduling activities. The cause analysis was planned for 2023.
- On average, 20% of activities were not carried out the day they were scheduled. The main cause was due to delays in the completion of previously scheduled work (53%) and 18% were due to unavailability of personnel.
- During the first week of the OSART mission (week 48), 55% of the I&C activities were not performed on the day they were scheduled and 40% were postponed to the next week. The main reasons were identified as the turbine trip on Unit 3 and the restart of Unit 1.

Maintenance backlog

- On the 7 December 2022 during the OSART mission, there were 47 permanent alarms in the main control room for the four Units and 18 were due to work requests for 3 Units. The work management process was not able to reduce the number of alarms below the site objective of five alarms per unit.
- Since December 2021, the overdue preventive maintenance (PM) backlog items were around 500 for safety related equipment and around 1200 for non-safety equipment. After the analysis was conducted by the maintenance department, the actual backlog of overdue safety related PM was 46 PM overdue, since the other ones were passed the planned scheduled date but not yet overdue.
- Two safety significant events were caused by overdue PM related to technical specification requirements. One was in 2018 on containment spray system and the other one was in 2019 on fuel building ventilation system.
- On 30th November at the time of the OSART mission, the total work request backlog for outage and online was 3478 which had decreased from 4878 in October 2021.
    - Out of the 3478 work requests identified, 1462 were related to equiment deficiencies. Out of the 1462 work defects, 690 were important for safety (IPS)
    - 17 priority 2 work orders (required to be completed within 15 days) were overdue of which five work orders were important for safety
    - 98 priority 3 work orders (required to be completed within eight to 10 weeks) were overdue of which five work orders were important for safety.
    - 467 work orders were overdue in total.
    - The oldest one on equipment important for safety (IPS), which was dated from 2012 on nuclear island chilled water system (IPS), was the request to replace the stud and bolts due to corrosion.
    - 664 work orders are at least two years old which included 285 work orders important for safety.
- Five priority 3 work requests with operational impact were overdue on the 7 December 2022:
    - One was on a safety related compressor dated 3 October 2022: oil leak.
    - One was on safety related firefighting distribution system dated 20 October 2022: leak.
    - One was on electrical building fire protection system: leak.
    - One was on reactor coolant system recorder.

- The current backlog of leaks is 145 which included 37 safety related leaks and 108 non safety related leaks for the four Units which includes:
  - Nine safety related leaks older than one year.
  - Three on Emergency diesel generator which are older than five years with a scheduled date in 2025 for two and one in 2026.
  - 12 safety related leaks are allocated to a past project window and need to be rescheduled.

Lack of an effective work management process may result in compromising the safety of the plant by the cumulative effects of backlog and postponed activities.

Recommendation: The plant should improve its work management process to ensure that work is completed to schedule and maintenance backlogs are minimized.

IAEA Bases:

SSR-2/2 (Rev. 1)
Requirement 28: Material conditions and housekeeping

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.

Requirement 31: Maintenance, testing, surveillance and inspection programmes

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

8.14. Corrective maintenance of structures, systems and components shall be performed as promptly as practicable and in compliance with operational limits and conditions. Priorities shall be established, with account taken first of the relative importance to safety of the defective structures, systems and components.

NS-G-2.6

5.14. A comprehensive work planning and control system applying the defence 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.

5.19. 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.

5. TECHNICAL SUPPORT

5.1 ORGANISATION AND FUNCTIONS

The team found scaffolds and other moveable objects in the field that were not in compliance with the plant rules and expectations with regards to potential seismic interactions. Several cable trays appeared to be overloaded beyond their design capacity, and the plant was not able to provide seismic qualification analyses. Other deficiencies found for instance through the ten-year periodic safety review or through operating experience feedback, highlighted that the plant programmes ensuring the seismic qualification of structures, systems and components, are not always rigorously implemented and controlled to minimize potential threats. The team made a suggestion in this area.

5.2 SAFETY ASSESSMENT

The plant had developed a 3D cartography of the reactor building, that could be navigated in a 'street view' manner. Around 1000 pictures have been taken to model all rooms in the reactor building. The model is projected on a two-meter touch screen where the user can navigate through corridors and rooms. It enables plant staff to identify the location of equipment and the easiest route to reach them. In particular, this tool is very useful when the reactor building is not accessible for in-situ walkdowns. It contributes to minimizing dose uptake to workers. The team considers this as a good performance.

5.6 SURVEILLANCE PROGRAMME

The plant has developed a unique integrated IT system that collates inputs from different monitoring tools to facilitate the early detection of adverse trends. This tool is used every day during the morning engineering meeting, to assess the threats on safety related SSCs and functions. It provides automatic generation of pre-alarms, early automatic detection of adverse trends, an automatic visualization of preventive and corrective works directly on flow diagrams, and summary screens presenting in real time, a 'bird eye' vision of systems or functions. The team considers this as a good practice.

5.7 PLANT MODIFICATION SYSTEM

A number of deficiencies in plant permanent modifications showed that plant controls to confirm that permanent modifications have been correctly implemented, were not always effective. Examples include incomplete modifications, incomplete update of the operational documentation, insufficient training for the users of the modifications and some mistakes during the modification implementation that were not detected by the plant controls. In addition, the plant control of temporary modifications does not minimize their number and duration. The team observations highlighted that plant modifications are not always effectively controlled to ensure that plant operations are consistent with the intended design change and that the number and duration of temporary modifications are minimized. The team made a recommendation in this area.

5.8 REACTOR CORE MANAGEMENT (REACTOR ENGINEERING)

The plant implemented an innovative method for the safe, simple, and reliable opening of the sipping vessel without usage of spent fuel crane. Instead, the operator uses a hydraulic mechanism to remove the sipping vessel lid. This strengthens nuclear safety by reducing the risk of failure to open the sipping vessel lid. The team recognized this as a good performance.

The plant has a foreign materials exclusion (FME) programme in place with targets and rules. However, small metallic items are still found in the fuel after most outages. Some metallic foreign materials have been found in steam generator tubes and in the reactor vessel. Deficiencies were found in the application of the FME programme and in the FME barriers. The team observations highlighted that the plant FME programme is not always effectively implemented to prevent intrusion of foreign objects into fuel. The team made a suggestion in this area.

DETAILED TECHNICAL SUPPORT FINDINGS

5.1 ORGANISATION AND FUNCTIONS

5.1(1) Issue: The plant programmes ensuring Structures, Systems and Components (SSCs) qualification for seismic events, are not always rigorously implemented and controlled to minimize potential threats.

The team found the following:

- The following scaffolds and items were found to be not in compliance with the plant rules and expectations with regards to potential seismic interactions:
  - In 4BLE (electrical auxiliary building) +7,00m room L446, mobile scaffolds were too close to the safety-related electrical board 4LLE.
  - In 4BLE +7,00 m, scaffolds were fixed to the floor and ceiling but too close to the safety-related electrical board LLB and LLJ.
  - In 4BLE room containing 4KRT094-96-98CR, control room ventilation system ducts (DVW and DVC), a scaffold was fixed to the floor and ceiling but at a distance less than 10 cm from safety-related pipes, ducts and cable trays, and was in contact with the equipment at some places. One of the scaffolds has been in place since 27 January 2022 and was planned to be removed by 15 February 2022, and the other has been in place since 3 September 2022.
  - In room w542 in 4BLE (electrical auxiliary building), a scaffold was fixed to the floor and ceiling but less than 10 cm from electric cabinets 4BLF and 4LND, both marked with ‘reactor trip risk’ warning signs, and in direct contact with a cable tray. Moreover, the scaffold had a metallic rod attached which was loose, with the potential to interact with the cabinets in the event of an earthquake.
  - In 3BK+6,00m, a scaffold was fixed to the floor and ceiling but less than 10 cm from spent fuel cooling system (PTR) pipes at several places.
  - In 1BLE+0.00m, a scaffold was fixed to the floor and ceiling but at less than 10 cm from 1ASG003PO emergency feedwater system turbopump and from a connection box to be used in the event of an emergency.
  - In room K017 (3BK-8.50m), a large unapproved storage area with lots of heavy scaffolding parts was stored in an unsecured manner and was too close (less than one meter) to a seismically qualified containment spray system (EAS) pipe.
  - In the corridor behind the Unit 3 main control room (MCR) panels, back panels are missing. An unsecured ~1.8mx1.2m plastic plate was lying vertically against the wall, near unprotected bare electronic components at the back of the MCR main control panel. In case of an earthquake, it could fall and damage electronic components of the MCR panels.
  - An unsecured mobile scaffold in room W230 (auxiliary feedwater pump room) in 1BLE+0.00m (only with brakes on wheels) was less than 10 cm from 1DVG004ZV (emergency feedwater ventilation system).
  - A mobile scaffold that was left in a corridor at ~80 cm from JPL202VE (fire protection of electrical building), was not properly secured (only secured with the wheel brakes).
  - On 28 January 2020, an unsecured scaffold was found by the plant too close to reactor protection cabinets in Unit 2. The scaffold had been in place for more than seven days.
  - There was an unsecured trolley in the main control room Unit 1 (brakes were not used).

- In-situ labelling of seismically qualified SSCs is not required by the plant. Only a few seismically qualified electric cabinets are labelled.
- As part of the fourth periodic safety review, the plant was reviewing the actual load of seismically qualified cable trays and associated supports. It concluded that the load of about 450 seismically qualified cable tray supports on the site has been progressively increased during the last ten years. Most of these cable trays were overloaded beyond 100% (up to 200%) of their design capacity. Currently, about 100 cable tray supports have been identified as needing strengthening in Unit 4. All the necessary strengthening has been implemented during the fourth ten-years revision in Units 1 to 3. However, the team found:
  - In room L647 in 4BLE+15.50m, overloaded cable support, several overloaded cable trays (some even with cables overspilling), some cables not supported, and some cables attached to a plate that was not prevented from unrestricted movement (lightly fixed and only on one end).
  - In room L545 in 4BLE+11.50m, there were 3.2 meters-long vertical cables without support.
  - Cables were not robustly supported and lying loosely in room L649 in 4BL.
  - In room K017 (3BK-8.50 m), overloaded cable trays and cables hanging loosely were not well supported.
  - There was an overloaded cable tray in room L646 in 2BLE+15,50 m.
  - There was an overloaded cable tray in room L608 in 8BLE+15,50 m. In the same room, a modification tag for strengthening cable trays (PNXX1737) has been in place since 20 November 2013.
- Though the following facts were found by the plant (for instance through operating experience feedback from other sites or through the ten-yearly periodic safety review), they were latent deficiencies not identified through the routine plant programme:
  - On 5 November 2020, the nuts of four out of the six anchors of the essential service water system pump 2SEC006PO were found corroded. The analysis concludes that their seismic qualification was no longer guaranteed, and that in case of an earthquake it could lead to flooding in the room and loss of the second pump of the same safety train. The nuts were replaced on 18 February 2021.
  - In August 2019, following operating experience feedback from Paluel NPP, the plant found that blocking systems were still left in place on an expansion pipe of the safety injection system (RIS) of Units 2, 3 and 4. This blocking system was meant to protect the equipment during transport and to be removed during the initial installation. The analysis concluded that, in case of design basis earthquake (DBE), the tightness of the pipe would not be maintained.
  - In December 2019, following French operating experience feedback it was identified that the thickness criteria used for checking the seismic qualification of some pipes of the essential service water system on all units was incorrect, due to an earlier calculation error (INES level 1 event). The analysis showed that a DBE might, in the worst case and using conservative hypotheses, have led to a complete loss of ultimate heat sink.

Without always rigorously implementing and controlling plant programmes ensuring SSCs qualification for seismic events, plant safe operation could be degraded during a seismic event.

Suggestion: The plant should consider rigorously implementing and controlling plant programmes to ensure SSCs qualification for seismic events, to minimize potential threats.

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.

4.48. […] effective and practicable methods shall be used to upgrade and preserve equipment qualification. A programme to establish, to confirm and to maintain required equipment qualification shall be launched from the initial phases of design, supply and installation of the equipment.

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. […] These walk-downs may serve many purposes, such as: […] 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.

SSG-77 (for information)

II.4. The operating organization should maintain the seismic qualification of equipment required to perform safety functions during and/or after an earthquake. This could be achieved through implementation of an inspection programme to identify potential deviations, such as defects due to ageing or inadequate system configuration following maintenance or modification. Before an earthquake, the operating organization should observe the principles of good housekeeping to ensure that earthquake damage is not propagated or increased by temporary and/or loose items. This action should include securing items (through seismic restraints) that might cause damage to items important to safety during a seismic event.

5.6 SURVEILLANCE PROGRAMME

5.6(a) Good practice: The plant has developed unique monitoring tools to facilitate routine engineering scrutiny and early detection of plant performance degradation (VIFE-VIGIE-NOVA)

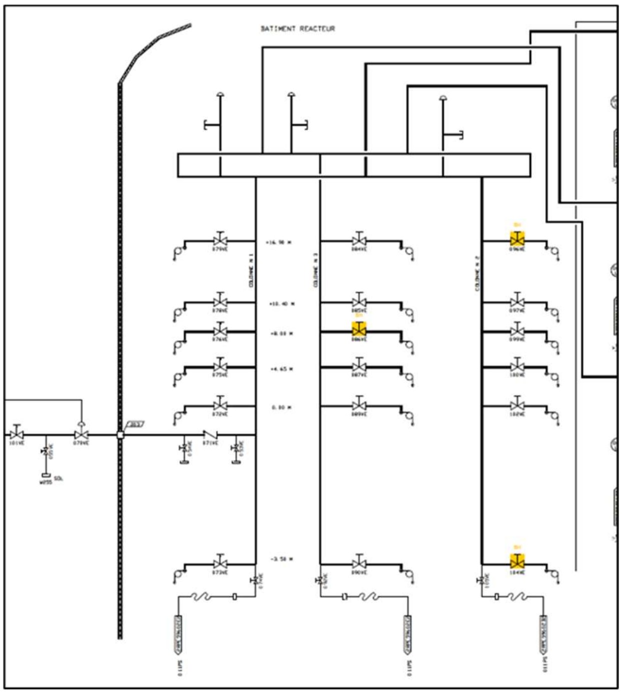
Purpose

The goal of this tool is to facilitate the early identification of equipment adverse trends, using all available online measurements, work orders, giving an aggregated 'bird eye' vision of safety related systems. The ultimate goal is improving the availability and reliability of plant safety systems.

Description

The plant has developed a unique integrated IT system that collates inputs from different monitoring tools to facilitate the early detection of adverse trends. This tool is used every day during the morning engineering meeting, to assess the threats on safety related SSCs and functions. It includes the following components:

- An automatic generation of pre-alarms for each system, that enables easy visualization of situations that could degrade the reliability of SSCs, before it could ultimately lead to actual alarms in the MCR or to equipment unavailability. Pre-alarms are based on sensors or calculated combination of sensors. Additional measurements are added when needed. The system provides the history of pre-alarms, accurate monitoring of sensors, and recording the results of the assessment performed by the engineering department.
- An automatic detection of slow adverse trends.
- An automatic visualization of preventive and corrective works directly on flow diagrams, which allow for easy detection of higher threats on specific systems or trains and for example, can trigger a re-prioritization of maintenance activities.
- Synoptic screens present in real time, a 'bird's eye' vision of systems or functions. Synoptics facilitate the overall assessment of safety systems reliability during the morning engineering meeting.



Visualization of works on flow diagrams

The interface of this tool is easy to use.

Benefits

This system allows easy detection of adverse trends and issues in safety related systems. Actual early detections of issues are recorded as 'Victories' and put in an honor panel in the morning meeting room. Example of recent victories:

- Identification of a pressurizer level measurement that was about to fail. The sensor was replaced before its failure thanks to the engineering feedback.
- A main steam flow sensor that slowly started to drift and could be handled before it led to an actual problem.
- The detection of a wrong line-up on the reactor building ventilation system during outage, was identified based on early detection of the temperature evolution.

This tool contributed to the significant improvement of safety systems reliability over the last few years.

5.7 PLANT MODIFICATION SYSTEM

5.7(1) Issue: The plant modifications are not always effectively controlled to ensure that plant operations are consistent with the intended design change and that the number and duration of temporary modifications are minimized.

The team found the following:

Plant controls to confirm that permanent modifications have been correctly implemented were not always effective:

- In the corridor behind the Unit 3 Main Control Room (MCR) main control panels, modifications were implemented during the fourth ten-years outage (VD4). However, the VD4 modifications have been completed but the back protective doors of the MCR control panels have not been put back in place. Some temporary protective plastic panels have been left in place. The same problem was also present in Unit 1 and 2. Meanwhile, the plastic panels have been removed and the plant still needs to assess whether and how to re-close the back of the MCR panels. The modification implemented does not allow the original back doors to be put back easily.
- On 1 July 2021, an intermediate range nuclear power measurement became unavailable due to its erratic behaviour. The investigation identified an imperfect fastening of a connector during the implementation of modification PNPP1842 in 2017. It also concluded that the works were not performed rigorously enough and that the associated technical control was incorrectly implemented.
- Permanent modification PNP1243 added a temperature regulation on the MCR ventilation cooling (DEL054VD). During requalification tests in 2022, some deficiencies were observed. The plant found incorrect settings were input into the regulation parameters during the implementation of the modification.
- In June 2019, during implementation of the modification PNPE1152 (replacement of ultimate turbo-generator LLS by ultimate diesel generator DUS), a cable inversion occurred. It was observed by the contractor, but not corrected. At the end of the work, the requalification tests did not spot the error as only a simplified requalification tests were undertaken. On 9 November 2019, the cable inversion was detected during a surveillance test on Unit 1. The inversion led to preventing the functioning of an automatic starting signal of two component cooling system pumps for approximately five months.
- In December 2021, during spent fuel cooling system (PTR-bis) modification works, the plant noticed that position switches of several PTR valves were damaged in Unit 3 and 4 and had to be repaired.
- In January 2022, surveillance tests highlighted that the modification PNPP1541 EASU (addition of an ultimate containment spray system) had been incompletely implemented in Unit 2.
- In the corridor leading to the entrance of Unit 3 MCR, three modifications have been implemented in the ceiling (fire detection JDT modification, ventilation modification, new screen with information messages) for several months. However, the suspended ceiling has not been put back in place, and cables are hanging loosely from the ceiling.

In terms of controlling temporary modifications in number and duration:

- Currently, temporary maintenance-related modifications (DDC) are not recorded in a central IT system for temporary modifications. There is no master list of these. The plant does not know how many DDC’s are active at a given moment. DDC have no process owner. The plant plans to change its organization around mid-2023 to tackle this.

- There are currently 156 temporary modifications (MTI) on equipment important for safety. In September 2022, the plant has started monthly meetings to try to reduce the number of MTIs, but at the time of the mission the number of temporary modifications had not been reduced.
- 15 MTIs are eight years old and 25 are at least five years old. Among the oldest MTIs:
  - 35 MTIs concern the in-core instrumentation. Most MTIs on core exit thermocouples are expected to remain in place till the end of life of the plant without being solved or replaced by a permanent modification, whereas in-core flux sensors are replaced only in batches once in a while.
  - four modifications of the evacuation alert system in the reactor building and the nuclear auxiliary buildings, have been in place since 2014 and are not solved or replaced by a permanent modification due to low priority.
  - two modifications of the evacuation alert system in the nuclear auxiliary buildings, have been in place since 2014. A permanent modification had been proposed to close the MTI, but the proposed technical solution has not been judged satisfactory.
- On 27 May 2022, an MTI was created to replace the in-core thermocouple 2RIC046MT by 2RIC047MT. However, the calculation of the azimuthal power unbalance was not adapted accordingly. This led to incorrect monitoring of this core parameter for about two months, until the anomaly was identified.
- Between 12 November 2020 and 7 April 2021, due to missing integration of a temporary modification of the RGE (Operational Limits and Conditions) into operational procedures, a part of the surveillance test programme of RPN at Unit 1 was not performed.
- The plant does not assess the cumulated impact of all temporary modifications.

Without modifications being systematically well controlled, safety SSCs and their operation could be compromised.

Recommendation: The plant should effectively control modifications to ensure that plant operation is consistent with the intended design change and that the number and duration of temporary modifications are minimized.

IAEA Bases

SSR-2/2 (Rev.1)

Requirement 10: Control of plant configuration

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

4.38. Controls on plant configuration shall ensure that changes to the plant and its safety related systems are properly identified, screened, designed, evaluated, implemented and recorded. […]

Requirement 11: Management of modifications

The operating organization shall establish and implement a programme to manage modifications.

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

4.40. Modification control, in compliance with the requirements set out in SSR-2/1 [2], shall ensure the proper design, safety assessment and review, control, implementation and testing of all permanent and temporary modifications. Consequences of the modification for human tasks and performance shall be systematically analysed. For all plant modifications, human and organizational factors shall be adequately considered.

4.41. Temporary modifications shall be limited in time and number to minimize the cumulative safety significance. […] The operating organization shall establish a formal system for informing relevant personnel in good time of temporary modifications and of their consequences for the operation and safety of the plant.

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

4.43. Before commissioning a modified plant or putting the plant back into operation after modifications, personnel shall be trained, as appropriate, and all relevant documents necessary for plant operation shall be updated.

5.8 REACTOR CORE MANAGEMENT (REACTOR ENGINEERING)

5.8(1) Issue: The plant Foreign Materials Exclusion (FME) programme is not always effectively implemented to prevent the intrusion of foreign objects into fuel assembles.

The team found the following:

In terms of operational activities in reactor and spent fuel buildings:

- In April 2022, in Unit 2, a 10mm-diameter spherical aluminum foreign object was found on top of fuel element FXPA23.
- In October 2022, a small foreign material of unknown origin was found on the upper core plate of Unit 3. Foreign materials were observed below 15 fuel assemblies. Part of these foreign materials were small metallic items originating from a lack of respect of the FME programme expectations.
- In December 2022, a ~45x2x1mm stainless steel foreign item was found in steam generator tube 3RCP002GV-L01C69. A similar 80x1x1mm stainless steel foreign item was found in steam generator tube 3RCP001GV-L12C87.
- In April 2022, in Unit 1, foreign materials were observed below nine fuel assemblies. According to the report, part of these foreign materials was due to non-compliance with the FME programme expectations.
- On average, about eight/nine small (size ranging from four mm to few cm) metallic foreign materials were found every outage in fuel assemblies during the televisual inspection performed after core defueling. About 60% were debris from fuel assembly grid springs. The rest were small metallic objects of unidentified origin (example: metallic wire).
- In October 2020, foreign materials were found in 29 fuel assemblies in Unit 1. The majority were debris from fuel assembly grid springs and the report does not address the origin of the remaining metallic foreign items.
- In October 2020, during a televisual inspection, two one-cm-diameter stainless steel balls were observed missing in a tool used for lifting plug rods in the spent fuel pool of Unit 1. The missing balls were not retrieved.
- In May 2020, a small shock absorber that fell from the spent fuel pool bridge Unit 2 was found in the pool used for fresh fuel reception and spent fuel dispatch.
- In the reactor building of Unit 1, the team found more than 50 metallic bolts, nuts, screws and pieces of metallic wire of different sizes. These items were found scattered on the gratings outside the permanent FME zones, mostly in the peripheral corridor, on all elevations.
- In August 2020, during Unit 4 reactor refueling outage, foreign material was found on the bottom internal core plate while trying to insert a fuel element. The item found was a screw from thermal insulation, that fell into the vessel during the outage. The investigation highlighted several deficiencies in the plant FME programme:
  - The temporary FME nets installed around steam generator areas during the outage were not properly put in place. Their layout did not prevent intrusion of objects inside the FME zone or even into the vessel.
  - The temporary FME nets installed around steam generator No. 3 were damaged with numerous holes.
  - The daily control of the FME zone by the responsible person did not cover all FME barriers, in particular the temporary nets installed around steam generators areas during the outage.

  - The FME zone cleaning procedure was not comprehensive enough. It did not cover the refueling machine platforms.
- In spent fuel pool building 3BK+20.00m, the FME barrier (curtains) around the spent fuel pool has some gaps. Dirt traces can be observed at the bottom of the spent fuel pool.

In terms of prevention of foreign materials by adequate fuel manufacturing and control:

- Due to corrosion on fuel assembly grid spring welds, metallic debris are found every outage in fuel assemblies during the televisual inspection performed after core defueling. Their size typically varies from a few mm to two cm. The plant assessment concludes that the risk of cladding damage due to fretting is not very likely (no actual fuel leakage to date), but possible. This problem was detected for the first time in 2008 (in Civaux NPP).
- In 2019, only one week after startup following refueling outage, a fuel leakage was detected. The origin of the leak was a fresh Mixed Oxide Fuel (MOX) element that was already leaking after one week due to wear of the cladding by a trapped clad shaving. Around 2000, a modification of the fuel cladding material was introduced. This led to an increased risk of clad damage during the assembly process. The root cause of the fuel leakage is fretting caused by a trapped clad sliver generated during fuel manufacturing. This issue was identified first in 2008 in France. However, this problem was still present in Tricastin NPP and was still being investigated by the corporate engineering unit.
- In 2020, a fuel cladding defect was detected through the evolution of the radiochemistry parameters of the reactor coolant system. During core defueling, the leaking assembly was identified and removed from use. Though the assembly was unloaded in March 2020, there is still no further examination 21 months later. To date, the cause has not been identified.

Without an effective FME programme, foreign objects could come in contact with fuel assemblies and damage to fuel cladding could occur.

Suggestion: The plant should consider improving the FME programme effectiveness to prevent intrusion of foreign objects into fuel assemblies.

IAEA Bases

SSR-2/2 (Rev.1)

Requirement 30: Core management and fuel handling

The operating organization shall be responsible and shall make arrangements for all activities associated with core management and with on-site fuel handling.

7.18. Provision shall be made to ensure that only fuel that has been appropriately manufactured is loaded into the core. […]

NS-G-2.5

3.9. The areas for the handling and storage of fresh fuel should […] controlled at all times to exclude chemical contaminants and foreign materials.

4.2. The steps necessary to assemble fresh fuel and to prepare it for use in the reactor should be specified in the procedures, including any arrangements for holding it in intermediate storage. Only approved fuel should be loaded into a reactor core. Checks should be carried out to confirm that the fuel has been assembled correctly. In all procedures for fuel handling and maintenance, it should be ensured as far as possible that no foreign material is introduced into the reactor.

5.19. A policy for the exclusion of foreign materials should be adopted for all storage of irradiated fuel. Procedures should be in place to control the use of certain materials such as transparent sheets, which cannot be seen in water, and loose parts.

6.8. […] Maintenance programmes should include procedures to prevent the introduction of foreign materials into the reactor.

6. OPERATING EXPERIENCE FEEDBACK

6.1. GENERAL

The plant has established a comprehensive programme covering all types of Operating Experience (OE) information for reporting, screening and analysis. Various elements of the OE programme are currently in place and cover several parts of OE associated with Integrated Management System (IMS) macro-processes and subprocesses. Thus, the main roles, responsibilities, lines of communication and interfaces are well established in accordance with the IMS. However, the IMS documents did not describe an organizational structure or define objectives for the entire OE programme. The plant did not have a unified database for monitoring all OE findings, and the plant did not systematically assess the overall OE programme's effectiveness. The team encouraged the plant to consider application of an integrated approach for the various OE elements and centralised coordination of the OE programme to allow for overall monitoring, comprehensive OE programme evaluation and identification of common precursors and contributors to events and findings at the plant level.

6.5. INVESTIGATION

A comprehensive EDF Corporate Guide was established for root cause analysis (RCA) methodology and associated training. In total, about 50 employees were trained in RCA methodology which consisted of five days training including human factor training and interviewing skill training. Real events and facts were used during the training. This approach for RCA and guidance provided by the EDF Corporate organization required application of the '5 Whys' method. It is supplemented by a tool 'Cameleon' and an active OE representatives' network, which involved all departments. However, the team observed that the event and trend analyses were not always conducted in sufficient depth to identify ultimate root causes and enable effective corrective actions to be set to prevent event reoccurrence. The '5 Whys' method was not consistently used, causes of adverse trends were not always determined and the extent of causes and conditions were not defined in all cases. The team made a suggestion in this area.

6.8. COMMUNICATION, USE, DISSEMINATION AND EXCHANGE OF INFORMATION

The team also observed a number of positive OE findings, reported through the instrumentation and control (I&C) operating experience database (called 'Barlet template'), that was used to ensure dissemination and reinforcement of the wider application of best practices and good performance, which make up approximately five percent of the total number of reports. A 'Table of Honour' was launched in the specific computer application to encourage individuals to contribute ideas for improvement and best practices (including troubleshooting, modification, questioning attitude, etc.). This 'Table of Honour' was presented at each section meeting (every two weeks), all the good practices were reviewed and the contributors were announced and applauded at the end of the meeting. This was recognized by the team as a good performance.

DETAILED OPERATING EXPERIENCE FEEDBACK FINDINGS

6.5. INVESTIGATION

6.5(1) Issue: The plant event and trend analyses are not always conducted to a sufficient depth in order to identify the root causes and enable effective corrective actions to be set to prevent event reoccurrence.

The team noted the following:

- Analysis of some significant events are not deep enough and therefore, root causes identified remain generic and corrective actions did not address real root causes. The corporate guideline requires use of '5 Whys' methodology. However, in some cases (in 29 out of 50 reviewed event reports) mostly two to four 'Whys' were used, examples:
  - event 0-001-22 (Radiation Protection Significant Event (ESR)) - one 'Why' for different root causes.
  - event 2-001-21 (ESR) - two and three 'Whys' for root causes #3 and #2.
  - event 8-001-22 (ESR) - two and three 'Whys' for different root causes.
  - event 1-001-22 (Nuclear Safety Significant Event (ESS)) - three or four 'Whys' for different root causes.
  - event 2-001-22 (ESS) - three 'Whys' for root causes.
  - event 2-004-22 (ESS) - three or four 'Whys' for root causes.
  - event 9-001-22 (ESS) - three or four 'Whys' for root causes.
  - during analysis of event 2-006-22 (ESS), only one root cause was identified and for the other two branches of possible causes, the analysis was stopped on the first 'Why'.
- There were examples where the analysis report focused on what had happened rather than establishing the reason why. For example, for the significant radiation protection (RP) event 0-002-21 (ESR), the following root causes were identified:
  - Root cause #1a: The display of access conditions is not up to date and signs remain obsolete without reason.
  - Root cause #1c: The workers had no experience in working in this part of the controlled area and no training was provided.
  - Root cause #2a: The RP technician is inexperienced.
  - Root cause #2b: The RP technician does not have a great RP culture.

  The analysis report did not address 'WHY' the display of access conditions was not up to date, 'WHY' workers lacked training, 'WHY' RP technician was inexperienced or 'WHY' RP technician did not have an expected/required culture.
- OE adverse trends are not entered in 'Cameleon' data base as findings to analyse causes and address them.
- There is no formal evaluation of effectiveness of root cause analysis methodology training.
- The event analysis report does not include analysis of the extent of causes and conditions.

- Trend analyses are not performed on actions generated as a result of technical committees' review of instrumentation and control related technical expertise sheet (FET) and document change requests (PA DED) even though they are recorded in an Excel file.
- The probabilistic safety analysis (PSA) is not used during significant event analysis to determine potential consequences.
- Housekeeping deficiencies are reported to the 'Exocet' tool with action tracking when required, but trend analysis is not performed.
- Analysis of non-radiation-related safety events use typology of accidents while there is no cause coding system for simplified analyses to trend the causes.

Without conducting event and trend analysis to the sufficient depth, the plant may miss opportunities to identify the root causes and address them to prevent event reoccurrence.

Suggestion: The plant should consider improving the depth of event and trend analyses to identify the root causes and enable effective corrective actions to be set to prevent event reoccurrence.

IAEA Bases:

SSR-2/2 (Rev.1)

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.

5.28. 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.

5.29. 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.

SSG-50

2.31. In order to apply a graded approach to operating experience, identified issues should be screened in a timely manner to evaluate their significance on the basis of their actual or potential consequences for safety.

2.33. Screening criteria should include the actual or potential consequences of reported issues for nuclear safety, radiation protection, protection of the environment and non-radiation-related safety.

2.39. The results from the screening of all operating experience (internal and external) should be recorded and may be used for evaluation in subsequent self-assessments, periodic safety assessments or peer reviews.

2.41. The operating organization should implement procedures with criteria specifying the type of investigation that is appropriate for any category of event. The type of investigation should be commensurate with the actual or potential consequences of an event and the likelihood of its recurrence. Events should be investigated using appropriate analysis techniques.

2.42. The level of investigation and analysis applied should be commensurate with the significance of the event. For example:

(a) In the case of an event with the potential to provide major lessons (e.g., an event with severe actual or potential consequences, or significant consequences and a high likelihood of repetition), a formal root cause analysis, tailored to the type of event, should be performed. The root cause analysis should be conducted by a team with appropriate skills and knowledge relevant to the nature of the event.

(b) For an event providing fewer and/or less important lessons (e.g., an event with moderate actual or potential consequences), the apparent causes should be identified and corrected.

(c) Adverse trends, including those consisting of minor issues, should be reviewed for safety significance and, when necessary, investigated using appropriate techniques to identify causes and generic implications.

2.46. The investigation should be started as soon as practicable, consistent with maintaining the safety of the installation, to ensure that important information is not lost, invalidated or removed.

2.47. In the case of events for which root cause analysis is necessary, the analysis should document the following:

(a) The complete event sequence (what happened, including how the event developed);

(c) An assessment of the safety significance (what could have happened);

(f) A strategy for the determination of effectiveness of the corrective actions;

(g) An evaluation of the extent to which similar conditions are present in other structures, systems and components or processes at the installation, or in human performance in the organization (‘extent of condition’);

(h) An evaluation of the extent to which similar specific root or underlying causes could affect the safety of other structures, systems and components or processes at the installation, or in human performance in the organization (‘extent of cause’);

(i) An evaluation of the potential for common cause failures or common mode failures.

2.48. If a previous similar event is found to have occurred at the installation, then the corrective actions taken should be reviewed to identify why the event recurred and to identify more effective corrective or preventive actions.

2.57. An appropriate review should be conducted in response to identified adverse trends. The level of analysis in the review should be based on the safety significance of the events or issues and the nature and speed of the changes that constitute the trend. For significant trends, root cause analysis should be conducted.

7. RADIATION PROTECTION

7.1. ORGANIZATION AND FUNCTIONS

The plant had reinforced the arrangements for the access to the radiologically controlled area (RCA) by installing the 'Have you got the lot' box which uses artificial intelligence to prevent personnel from forgetting their dosimeters in the hot changing room prior to entering the RCA. The team considered this as a good performance.

7.3. RADIATION WORK CONTROL

A very strict procedure was developed on how to issue a work permit and how to validate it before use by the authorized persons depending on the radiation risk of the activities assigned. For radiation work control (RWP) of level NC3 (the highest radiological risk) the RWP was issued after an ALARA Committee was held and had to be approved/validated by a person from the senior management staff in charge of non-radiation-related safety and Radiation Protection (at least the Senior Advisor for Risk Prevention Macro-Process coordinator of MP4). The team considered this as good performance.

There were several examples of radiometric equipment which had been out of service for extended periods of time at the entrance and exit from the RCA and out of service equipment at the site pedestrian exit. The team encourages the plant to improve its arrangements for the timeliness of the repair of radiometric equipment.

To minimize external exposure due to radioactive equipment and materials, specific protection measures are taken in the workplace, such as control of the occupancy period or shielding. In areas containing materials with relatively high activity concentrations, physical barriers (tapes) and warning signs (for hot spots) were provided. However, the rules for appropriate labelling were not always strictly implemented (usually from the contractor responsible for mapping and labelling). Even though the plant had an organization for walkdowns on a regular basis, enhancements to the controls was needed to be carried out as the signage was not always correct. The team made a suggestion in this area.

During the self-assessment for the preparation for the OSART mission, the plant identified a self-identified issue on the radiation protection arrangements related to contamination control identified by the large number of C3 (site exit) gantry alarms triggered by contamination detected on workers clothing. This self-assessment determined that enhancements to the contamination-control practices, were required. The plant provided a self-identified issue with an action plan in this area.

DETAILED RADIATION PROTECTION FINDINGS

7.3. RADIATION WORK CONTROL

7.3(1) Issue: The implementation of the plant's radiological programme does not always ensure that the controls of radiological values on signs in the field, radiological barrier management and cleanliness of workspaces in the radiological area are sufficiently rigorous.

The team noted the following:
- At the auxiliary building BAN9 NA234 (Unit 1, level 0,00) four containers with separated radioactive waste are temporarily stored ready to be taken out of the radiation-controlled area (RCA). These were observed to be unlocked, not properly labelled and did not have sufficient information written on the signs for radiological risk (the value of equivalent dose rate (DER) is not written). In addition, the boundary tape for radiological hazards was missing.
- There is no checklist to define the types of checks radiation protection technicians should be undertaking in the RCA.
- There were examples of radiation warning signs at identified hotspots with hardly readable written values of dose rates.
- There were several cases where contamination warning signs had been removed from their designated places.
- Several workplaces in the 'Orange' zone (areas where the dose rate is above 2mSv/h and not exceeding 100mSv/h) were found covered with unknown sand like substances, for example temporary workplace labelled as orange zone, situated in the corridor nearby BAN9 Access BR, was found covered with a large amount of sand-like substance, scattered from a torn sack with potentially radioactive wastes.
- Used plastic gloves and disposable slippers were found around the workplaces and not in the designated waste bins.
- A poorly fixed door handle on the door №1 HW0206 PD entrance to the orange zone room Unit 1 BK 0,00 W215 with a hot spot, created a risk that a person could be inadvertently locked in the room which contains an area with a high dose rate.
- The door 9HNC 0234 PD was leaning on a hose with radioactive liquid and the hose closest to the door had begun to deform.
- At several worksites, at the barrier between an area of higher contamination inside the workplace, the contamination meter was provided for contamination check upon leaving the area. However, the alarm on the contamination meter, was triggered by the high background which prevented its correct use.

  Over the past two year the plant reported the following events:
  - March 2021, Unauthorized removal of a partial 'Orange' area marking. (ESR 7a: Deficient demarcation and signage, red and radiography areas)
  - March 2022, during the Outage of Unit 3, after filling Steam Generator No. 1 with water (SG1), the electronic dosimeter alarm of a worker was activated upon a High Dose Equivalent Rate (DER) and resulted in exposure exceeding 1.6 mSv/h that was not authorized by the Radiological Work Permit for 9 minutes and a dose uptake of 0.325 man.mSv. The display at the access point used by the worker had missing information about the radiological survey and the access conditions. (ESR 10: any other event that could affect radiological safety and that is deemed significant by the licensee or the regulator)

Shortfalls in the implementation of radiological programme increases the risk of spread of contamination and radiation exposure to personnel.

Suggestion: The plant should consider reinforcing the implementation of its radiation protection programme to ensure the controls of radiological values on signs in the field, radiological barrier management and for cleanliness of workspaces in the radiological area are sufficiently rigorous.

IAEA Bases:

GSR Part 3
Requirement 24: Arrangements under the radiation protection programme.
Employers, registrants and licensees shall establish and maintain organizational, procedural and technical arrangements for the designation of controlled areas and supervised areas, for local rules and for monitoring of the workplace, in a radiation protection programme for occupational exposure.

SSR-2/2 (Rev.1)
Requirement 20 Radiation protection

5.16 The radiation protection programme shall ensure control over radiation dose rates for exposures due to activities in areas where there is radiation arising from or passing through structures, systems and components, such as in inspection, maintenance and fuel handling. It also addresses plant chemistry activities as well as exposures due to radioactivity of substances in the fuel coolant (liquid or gas) and associated fluids. The programme shall make arrangements to maintain these doses as low as reasonably achievable.

GSG-7
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.

9.4 Temporary engineered controls, such as temporary shielding, containment devices and portable or auxiliary ventilation, may need to be used during non-routine operations such as maintenance, modifications, and decontamination and decommissioning. Planning for non-routine operations should include an evaluation of the potential for the spread of contamination and an evaluation of the effectiveness of the engineered controls in reducing such potential.

7.3(2) Self-Identified Issue: The plant's contamination control practices are not always implemented to prevent the spread of contamination.

The plant personnel identified the following facts:

The annual target for the rate of contamination monitor C2 alarms is to remain below 0.3%. This target has been met since 2019. However, since 2019 the plant has seen a downward trend in performance with regard to C3 pedestrian site exit alarms:
- Four C3 alarms in 2019
- One C3 alarm in 2020
- 10 C3 alarms in 2021, including five where the worker had worked on a worksite in an area classified as an RCA, but not located in the nuclear island.
- In 2022, as of August 31, there has been one C3 alarm and it was related to a worksite classified as an RCA but not located in the nuclear island.

The cause of these alarms was that contamination was detected on workers' clothing.

With regard to significant radiation protection events related to contamination control, the plant reported:
- Three events in 2019, 2 of which were related to skin exposure above one-quarter of the annual regulatory limit
- no events in 2020
- One event in 2021 not related to skin dose
- no events in 2022.

No roadway contamination spots above 100 kBq have been detected since January 2019. However, the number of roadway contamination spots between 800Bq and 100kBq are as follows:
- 11 in 2019
- 13 in 2020
- Seven in 2021
- Three up to mid-2022.

The rate of clear rooms on site (classified as 'clean nuclear' or conventional) in a monitored areas or RCAs outside the Reactor Building has remained relatively stable since 2019, fluctuating between 83% and 88%.

Without systematic implementation of contamination-control practices, radioactive contamination could spread outside the radiologically controlled area.

Suggestion: The plant should consider implementing actions to improve practices and means of controlling contamination in order to minimize the risk of spreading contamination.

IAEA Bases:

GSR Part 3
Requirement 21: Responsibilities of employers, registrants and licensees for the protection of workers

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

Requirement 22: Compliance by workers

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;

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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.

The plant Action Plan

A reinforced action plan has been in progress since 2021 and focuses around two main topics: equipment and organization.

Action	Progress	Due date	Performance criteria
EQUIPMENT:			
Improvement of monitoring facilities (purchase of smart SAM over 2021-2022, positioned at the RCA exit; installation of hand-foot monitors at the reactor-building exit).	Completed		C2 alarms rate
Implementation of a computerized networking of C2 monitors for real-time use of alarm data.	In progress	15/12/2022	C2 alarms rate
Improvement of equipment layout arrangements at exits from nuclear waste production areas (EDF acronym: ZPPDN) over 2021-2022.	Completed		Number of roadway contaminations
Purchase of a roadway monitor in 2022 for immediate use.	Completed		Number of roadway contaminations
ORGANISATION:			

Reduction of the threshold for initiating reactive investigations following C2 alarms	In progress	31/12/2022	C2 alarms rate
Investigation and implementation of actions to resolve repeat C2 alarms	Completed – implemented since summer 2022		C2 alarms rate
Joint daily in-field walkdowns by logistics department in-field supervisors (GNU department) and RCA area managers from the risk prevention department (SPR) during outage. The aim is to facilitate the detection of deviations in the field and to have them addressed by contractors working for the logistics/radiation protection departments	Completed – implemented since the latest Unit-3 ten-year outage.		C2 alarms rate
Rearrangement of the reactor building exit to 'force' personnel to monitor themselves immediately before reaching the final RCA exit	Completed – implemented during Unit 1 refueling outage in 2022		C2 alarms rate number of skin dose contaminations
Communication campaign on 5-point checks	Completed – implemented in the course of 2022		C2 alarms rate number of skin dose contaminations
More stringent daily checks of suction devices	Completed – implemented in the course of 2022		C2 alarms rate
Clarification of signs on tented areas	Completed – implemented in the course of 2022		C2 alarms rate
Clarification and simplification of signs displaying worksite access conditions	Completed – implemented since late 2021		C2 alarms rate number of skin dose contaminations
Simplification of logistics/RP interfaces at contract company premises with a view to addressing deviations found in the field immediately	In progress – test phase during refuelling outage in Unit 1 in 2022	01/07/2023	C2 alarms rate

Checks performed on roads upstream/downstream of paths where large components have been mobilized	Completed – since the beginning of 2022		Number of roadway contaminations
Revise the process applied to work performed in nuclear waste production areas outside of the nuclear island: decision-making aid for the different plant groups; more time spent in field by RP personnel, revision of procedures for the use of scaffolding in these areas	Completed – implemented since January 2022		Number of roadway contaminations Number of C3 pedestrian site exit alarms
Improved tightness of packages containing large components coming out of the equipment hatch	In progress	01/07/2023	Number of roadway contaminations
Assessment of C3 monitor performance (spurious alarms, equipment obsolescence)	Completed – implemented in the course of 2022		Number of C3 pedestrian site exit alarms

8. CHEMISTRY

8.2. CHEMISTRY PROGRAMME

Strategies for optimizing the plant chemistry and for actions when chemistry parameters are out of required range are well developed and applied. The plant discharges of effluents into the environment were properly controlled and improved through a new method of catalytic removal of residual hydrazine in water discharges. The team recognized this as a good performance.

As part of the anti-corrosion measures, the power plant implemented a very simple method of protecting the carbon steel structure of the raw water clarifier using a sacrificial anode. The team recognized this as good performance.

8.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

The management of process chemicals, auxiliary chemicals and lubricating oil was described in appropriate procedures. Storage conditions for chemicals in the warehouses are appropriate and well controlled. Great attention is paid to the handling of hazardous chemicals. To better protect workers from exposure to carcinogenic hydrazine, the plant uses new hydrazine dosimeters. The team recognized this as a good practice.

DETAILED CHEMISTRY FINDINGS

8.6 QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

8.6(a) Good practice: Personal hydrazine exposure measurement.

Purpose

Monitoring of carcinogenic hydrazine personal exposure.

Description

In NPPs, carcinogenic hydrazine is used as oxygen scavenger. At the same time, the Personal Exposure Limit (PEL) for hydrazine (0.1 ppm for 8h) has been reduced by a factor of ten by the European Carcinogen and Mutagen Directive 2017/2398/EC, which has set a new binding regulatory PEL for hydrazine at 0.01 ppm for 8h (0.013 mg/m^3).

The plant uses a passive hydrazine dosimeter which accumulates the quantity of hydrazine absorbed and indicates in real time the PEL. The current means of measuring hydrazine vapors, both mobile and fixed, only measures the real-time concentration. To take into account the cumulative exposure to the vapors in accordance with the European directive, a new detector is used. This complies with the requirements of the directive on the Limit Value of Professional Exposure (VLEP).

Personal hydrazine exposure meter

Benefits

- Safety gain: reduction of the personnel's exposure to hydrazine
- Operational gain: the personnel is more serene during interventions because they can visually control their exposure in real time.
- Potential financial gain: early detection of exposure will avoid medical expenses in case of occupational disease.

9. EMERGENCY PREPAREDNESS AND RESPONSE

9.2 EMERGENCY RESPONSE

During the activation of the radiological safety on-site emergency plan (PUI-SR) the site muster points are activated. These muster points provide the necessary sheltering and attendance registration. If there is a mismatch between the number of people present on site, and the number of people registered at the muster points, the plant will initiate a request for a rescue operation. The emergency control center is equipped with the computer application to log the number of persons at each dedicated muster point. The team considered this as a good performance.

The plant had installed pressure differential indications between inner and outer spaces to ensure safe sheltering during radiological events. This equipment mounted at entrance doors can immediately indicate the pressure difference and it does not depend on availability of power supply. The team considered this as a good practice.

The plant has a strong and robust communication system which is equipped with different kinds of telephones with landline, faxes, local area network (LAN) and wide area network (WAN), fixed and mobile satellite telephones and voice power communication system. All these equipment are compatible with mobile equipment from the Nuclear Rapid Response Force (FARN) which can be established anytime, anywhere, to support the plant during an emergency event, within 24 hours after the event. The team identified this as a good performance

9.3 EMERGENCY PREPAREDNESS

The EPR has full time on-call duty teams throughout the plant, which is about 78 people per week. This team must be deployed within one hour. The site procedures and other emergency procedures were properly revised in a timely manner. All issued documents in the emergency preparedness centres were packed as work packages, sealed in special bags to maintain document control. The team observed a very strong organization, FARN who support the plant from off-site with emergency equipment and trained personnel.

The plant-based emergency equipment (MLC) was controlled by the dedicated plant procedure. This procedure defines the testing period requirements, the dedicated time for use, responsible departments, etc. However, there were abnormalities with the inventory control and housekeeping in several MLC locations that have not been identified and fixed by the plant. The team made a suggestion in this area.

The FARN organization take care of its off-site equipment with surveillance, predictive and corrective maintenance programme that ensure that the equipment will work properly when needed.

DETAILED EMERGENCY PREPAREDNESS AND RESPONSE FINDINGS

9.2. EMERGENCY RESPONSE

9.2.(a) Good practice: Differential pressure gauge indicating the pressure difference between inner and outer spaces mounted on the entrance door

Purpose:
Each room or building during radiological event shall be equipped with equipment or tools for differential pressure measurement.

Description:
The indication of the pressure difference between inner and outer spaces during radiological events is very important to ensure safe sheltering. This equipment mounted at entrance doors can immediately indicate the pressure difference and it does not depend on availability of power supply.

Benefits:

- Easy implementation
- Clear information
- Facilitates decision making
- Applicable to any place, where operation of large machinery may create overpressure in case of an emergency.

9.3. EMERGENCY PREPAREDNESS

9.3(1) Issue: The plant arrangements for the inventory control and monitoring of local emergency equipment (MLC) and tools are not always effective to ensure their availability and operability during on-site emergencies.

The team noted the following:

– The equipment MLC07 (portable gamma meter) has exceeded the expected one month repair due date.

– The inventory list at the local emergency equipment storage container states that there should be 25 hard fire pipes, meanwhile the emergency procedure states 23.

– The motor fire pump battery was not plugged in for charging, however the dedicated plant procedure calls for continuous charging of the battery.

– One out of two flow meters was missing in the local emergency equipment storage closet,.

– The mobile operation emergency vehicle (PCOM) was equipped with only one personal oxygen meter instead of equipped with oxygen meters for all the vehicle occupants.

– The cabinets containing emergency equipment and tools in the local emergency equipment (MLC) MLC019 container were not reliably sealed (sealed with a duct tape).

– The MLC flex tube was hanging at the incorrect drain system tube instead of being hung at the dedicated place as anticipated by configuration.

– The fire extinguisher was not properly fixed in the PCOM vehicle.

The deficiency of inventory control and monitoring of MLC equipment status can lead to unavailability and inoperability of equipment during an emergency.

Suggestion: The plant should consider improving its inventory control and status monitoring of emergency equipment and tools to ensure their availability and operability during emergency.

IAEA Bases:

SSR-2/2 (Rev.1)

Requirement 18: Emergency preparedness

5.7. Facilities, instruments, tools, equipment, documentation and communication systems to be used in an emergency, including those needed for off-site communication and for the accident management programmed, shall be kept available. They shall be maintained in good operational condition in such a manner that they are unlikely to be affected by, or made unavailable by, accidents.

Requirement 28: Material conditions and housekeeping

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 7

Requirement 8: Taking mitigatory actions

Any equipment that is necessary for actions to be taken in manual response and recovery processes shall be placed at the most suitable location to ensure its availability at the time of need and to allow safe access to it under the environmental conditions anticipated.

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.

10. ACCIDENT MANAGEMENT

10.2. OVERVIEW OF THE SEVERE ACCIDENT MANAGEMENT PROGAMME

The development and implementation of the plant severe accident management (SAM) programme has reached a consistent and nearly completed stage. The strategies and related plant modifications have been implemented to strengthen the prevention of severe accidents and to fulfil the essential severe accident safety functions (successful isolation of the containment, depressurization of the primary circuit, absence of energetic events, corium stabilization and containment overpressure protection). Emergency operating procedures define accident management measures in the preventive regime and the SAM guidelines in the mitigative regime. However, severe accident conditions may progress and have an impact on reactor core degradation during shutdown conditions. Since not all the plant shutdown conditions prevent reactor core degradation during severe accident conditions, it is necessary to prevent the core degradation in such situations as effectively and reliably as possible. The team encourages the plant to continue efforts to further enhance the prevention of any core degradation during the shutdown states.

The severe accident management programme does not fully cover all aspects of severe accidents taking place simultaneously in several units. The team made a suggestion in this area.

10.5. PLANT EMERGENCY ARRANGEMENTS WITH RESPECT TO SAM

The plant has taken into use the ‘TABATA’ board for keeping track of tasks being carried out by field operators during emergency conditions. It helps to prioritize and keep track of the in-field tasks being performed from the main control room. Operations personnel don’t need to search for instructions in the pile of documents and the control room operators obtain a quicker overview of line-up tasks in progress. The team consider this as a good practice.

DETAILED ACCIDENT MANAGEMENT FINDINGS

10.2. OVERVIEW OF THE SEVERE ACCIDENT MANAGEMENT PROGRAMME

10.2(1) Issue: The plant's severe accident management programme does not fully cover all aspects of severe accidents taking place simultaneously in several units.

The team noted the following:
- Situations where the plant faces severe accidents simultaneously in several units are not fully considered in the baseline for severe accident management (SAM).
- The plant has not planned and carried out exercises that cover onsite emergency response organization training for severe accidents that may take place simultaneously in more than one unit.
- The SAM guidelines and training do not provide information on how to cope with severe accidents taking place simultaneously in several units.
- Assessments of the habitability and accessibility of local SAM actions do not cover situations where the plant faces severe accidents simultaneously in several units.

Not considering all aspects of severe accidents taking place simultaneously in several units, mitigation actions may not be performed in an effective manner during the emergency.

Suggestion: The plant should consider enhancing its severe accident management programme to include all aspects of severe accidents taking place simultaneously in several units.

IAEA Bases:

SSR-2/2 (Rev 1)

Requirement 19: Accident management programme

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

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.

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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 (Rev. 1).

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.

2.67. Some events, especially natural hazards, may result in similar challenges to all units on the site. Therefore, staffing plans should take into account situations in which multiple units at the same site have been affected simultaneously and some plant personnel have been temporarily or permanently incapacitated.

2.73. The accident management guidance should address the possibility that more than one unit, or all units, might be affected concurrently by simultaneous accidents, including the possibility that damage will propagate from one unit to another or that damage to one unit will be caused by actions taken at another unit.

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.

3.66. Validation should be performed under conditions that realistically simulate the conditions present during an emergency and should include simulation of other response actions, hazardous work conditions, time constraints and stress. Special attention should be paid to the use of portable and mobile equipment, when such use is considered, and for multiple unit sites, to the practicality of using backup equipment that could be provided by other units.

10.5(a) Good practice ''TABATA' board in the main control room for keeping track of in-field tasks being carried out during emergency situations

Description

The 'TABATA' board comprises three columns in which the control room operators, the supervisor or field operators retrieve instructions for work to be carried out on plant.

Emergency operating procedures (EOP) and severe accident management guidelines (SAMG) refer to instructions for use on plant: RFLL (line-ups), RFLE (electrical work instructions) and RFAG (instructions to be applied in severe accident conditions).

Before 'TABATA', there was no specific system for shelving 'pending' instructions and having a concise overview of results and of the ongoing situation. Instructions are placed in three 'TABATA' columns:

- Pending: instructions are called up by procedures, but personnel are not available to respond to the request.
- In progress: control room operators, supervisors and personnel in charge of overseeing the application of EOPs or SAMGs can see, which instructions are being applied on plant.
- Result: Once an instruction has been completed, it is placed in the 'result' column, regardless of whether the task was successfully completed or not. This makes it easier for operators and supervisors to identify failed tasks.

Benefits

Pending instructions are classified by plant area (RCA, turbine hall, electrical building) and the type (RFLL or RFLE). Operations personnel don't need to search for instructions in the pile of documents and the control room operators obtain a quicker overview of line-up tasks in progress. 'TABATA' saves time in starting tasks on plant and in processing the outcomes.

The control room personnel involved in the application of EOPs have an immediate overview of tasks (pending, in progress or completed) making it easier for them to have a clear idea of plant status. The system makes it easier to fill the emergency/SAM management register and provides a more comprehensive record for shift crews, including hand-over periods.

11. LONG TERM OPERATION

11.1. GENERAL

The plant created a position titled regional liaison officer, to reinforce the plant's interaction with the general public of the region and establish a strategy for creating a network of allies to support Long Term Operation (LTO). As the first plant to undergo the 4th cycle of ten-year outage inspections in the 900MW fleet, the plant held the first public enquiry for the French nuclear fleet. The successful outcomes from this public enquiry will help other plants to prepare best documents for future public enquiries, supporting public acceptance of LTO. The team considered this approach as a good practice.

Tricastin is the first plant of the 900 MW fleet to be undergoing the 4th cycle of ten-year outage inspections with the purpose of a lifetime extension beyond 40 years. To concentrate resources on reaching the target and to learn lessons for the other plants approaching LTO, the plant created an organisational structure called Programme Management Office (PMO). The objectives of the PMO team were to develop a comprehensive list of all the activities and to ensure that the implementation of LTO modifications is harmonised while minimising the impact on operational performance. The structure consists of seven project managers and three technical experts who coordinate 70 projects. The team considered this as a good performance.

The plant practices for the identification of structures, systems and components (SSCs) to be included in the scope of ageing management (AM) were in some cases incomplete. Some areas lacked detailed guidance and some SSCs results were not fully documented. The plant conducted a set of walkdowns to confirm the equipment operability in case of seismic events, floodings, explosions and High Energy Line Breaks. However the analysis and documentation of the walkdown results for the purpose of AM scoping were not finalised. The team made a suggestion in this area.

11.8 EQUIPMENT QUALIFICATION PROGRAMME

The process of identification of SSCs, for the Equipment Qualification (EQ) programme, is organised and performed at the corporate level, according to National Regulatory standards and corporate requirements. However, maintaining the qualification is the responsibility of the plant. The team noted a case when Environmental Qualification report was based on measurements taken more than a decade ago. The decision on where and when the measurements and samples of SSCs for EQ have to be made, is taken by corporate engineering function without the engagement of plant personnel. The team encourages the plant to continue with its plans to improve the engagement of plant personnel in decision making regarding EQ assessements.

DETAILED LONG TERM OPERATION FINDINGS

11.1. GENERAL

11.1(a) Good practice: Set up of a position of regional liaison and communication officer, to reinforce the plant's interaction with the general public of the region, the elected officials and economic decision-makers, and to establish a strategy for creating a network of allies to support the long term operation of reactors in the future.

Purpose:

Tricastin NPP is the first plant to be undergoing the 4th cycle of ten-year outage inspections on the 900MW fleet. For this purpose, it had to prepare for the first public enquiry undertaken for the French operational nuclear fleet. This enquiry was called for by the Law of Energy Transition to Growing Green (TECV) act of 2015. The public enquiry is regarding modifications implemented, or planned to be implemented, in the scope of the fourth periodic safety review.

The successful outcome of this public enquiry will lay down the conditions for other future public enquiries, to be conducted at each power unit.

Opponents of the nuclear industry also participated in this first enquiry.

Description:

Tricastin NPP is located close to four administrative counties of France: Drôme, Vaucluse, Ardèche and Gard, and three administrative regions: Auvergne Rhône Alpes, Provence Alpes Côte d'Azur and Occitanie. As a consequence, there are numerous political and economic decision-makers, as well as significant socio-cultural differences from one region to another.

Taking each county individually, the plant started rolling out a strategy by setting up informal networks of allies, by:

- Meeting with all elected representatives of the 79 municipalities and counties making up the area covered by the plant off-site emergency plan (see map).
- Hosting tours of the NPP for municipal councillors.
- Redirecting the partnerships towards influential groups or Non-Governmental Organisations (NGOs) in the region.
- Informing and educating professional organisations about the challenges facing the Region. The plant is also actively involved in a number of committees run by these organisations.
- Involving the plant industrial partners (contractors) by holding regular information meetings.

Map of the area covered by the off-site emergency plan:

Benefits:

Learning lessons from the success of setting up this new position (regional liaison officer), to reinforce the plant's interaction with the region, other EDF plants started application of the same approach.

The first public enquiry took place successfully in January 2022, collecting more than 1800 opinions, of which more than 65% were in favour of the modifications made to Unit 1 and therefor to its continued operation for another 10 years.

The allied networks are easy to re-activate for the second public enquiry, which is currently underway and was due to be finalised until 16 December 2022.

Other EDF plants captured the operating experience from these initiatives.

11.1(1) Issue: The plant practices for the identification of structures, systems and components (SSCs) to be included in the scope of Ageing Management (AM) are not comprehensive enough and the results of work done are not always adequately documented.

The team noted the following:

- The corporate expectations are that all SSCs important for safety have to be included in the AM scope. However, post-Fukushima equipment has not yet been included in the scope.
- The corporate engineering department (UNIE) has recently introduced a dedicated paragraph for post-Fukushima SSCs in the Corporate Ageing Management Guideline. However, it was not applied to the already existing plant level Unit Ageing Analysis Report (UAAR) prepared for the fourth ten-year outage (VD4), as it was a recent modification.
- There is a 'Corporate' level document which generally defines the need for selecting non-safety related SSCs that may affect the function of safety systems, to be included in scope of AM. Detailed guidance, at plant or corporate level, on how to select relevant SSCs based on walkdowns has not yet been developed.
- AM scoping for SSCs is done according to corporate standards, based on several separate lists of equipment. There is no single database, nor comprehensive master list of SSCs in scope of AM at the plant.
- Corporate organization has prepared in 'Excel' format a generic, fleet-wide, master list of SSCs in scope of AM, but it has been composed without involvement of plant personnel, so its completeness and correctness cannot be demonstrated.
- The plant Enterprise Asset Management (EAM) database is used at the plant for Ageing Management; however, it was created for maintenance and does not fully correspond to AM purpose. It lacks the ability to extract a comprehensive list of SSCs in the scope of AM. It lacks data concerning 'ageing effect', or 'degradation mechanism'.
- A set of walkdowns has been performed at the plant, to complement corporate studies and confirm the SSCs operability in case of 'aggressor - target' interaction due to a seismic event, flooding, explosion, and/or High Energy Line Break (HELB). However, the results of these walkdowns have not always been documented for AM scoping.

Without a complete identification and documentation of the scope of SSCs for AM, the plant cannot demonstrate that all ageing effects of SSCs important to safety are properly managed and equipment reliability maintained.

Suggestion: The plant should consider ensuring that all relevant structures, systems and components (SSCs) are identified and included in the scope of ageing management (AM) and the results of work done are adequately documented.

IAEA Bases:

SSR-2/2 (Rev. 1)

Requirement 14: Ageing management

The operating organization shall ensure that an effective ageing management programme is implemented to ensure that required safety functions of systems, structures and components are fulfilled over the entire operating lifetime of the plant.

4.51. Long term effects arising from operational and environmental conditions (i.e. temperature conditions, radiation conditions, corrosion effects or other degradations in the plant that may affect the long term reliability of plant equipment or structures) shall be evaluated and assessed as part of the ageing management programme. Account shall be taken in the programme of the safety relevance of structures, systems and components.

Requirement 16: Programme for long term operation

Where applicable, the operating organization shall establish and implement a comprehensive programme for ensuring the long term safe operation of the plant beyond a time-frame established in the license conditions, design limits, safety standards and/or regulations.

4.54. The comprehensive programme for long term operation shall address:

(b) Setting the scope for all structures, systems and components important to safety;

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5.14. A systematic scope setting (also called 'scoping') process to identify SSCs subject to ageing management should be developed and implemented.

5.15. A list or database of all SSCs at the nuclear power plant (such as a master list of SSCs) should be made available before the scope setting process is commenced.

5.19. In addition to the analysis of plant documentation, dedicated plant walkdowns should be used to check the completeness of the list of SSCs whose failure may prevent SSCs important to safety from performing their intended functions.

5.21. After the scope setting process, a clear distinction between SSCs within the scope and those out of the scope should be evident.

5.25. A process to identify relevant ageing effects and degradation mechanisms for each structure or component should be established, and the programmes to manage the identified ageing effects and degradation mechanisms should be in place (see Fig. 4). This process should cover the following steps:

(3) If the ageing of structures or components is managed by existing ageing management programmes, it should be verified that the ageing management programmes are consistent with the nine attributes shown in Table 2.

(4) If the ageing of structures or components is managed by other plant programmes, such as maintenance, it should be verified that these programmes are consistent with the nine attributes shown in Table 2.

SUMMARY OF RECOMMENDATIONS AND SUGGESTIONS

AREA	RECOMMENDATIONS & SUGGESTIONS
LMS	1.1(1) **Suggestion:** The plant should consider ensuring that the management expectations are systematically set and consistently reinforced to ensure that observed performance deficiencies are addressed in an effective and timely manner.
TQ	2.2(1) **Suggestion:** The plant should consider assigning sufficient time for plant training instructors to be seconded in the field to maintain their technical knowledge, skills and familiarity with routines and work practices at the workplace.
OPS	3.3(1) **Suggestion:** The plant should consider enhancing the arrangements for the control and review of Operator Aids. 3.4(1) **Recommendation:** The plant should enhance the rigor with which operators carry out field walkdowns to ensure deficiencies are identified in a timely manner.
MA	4.5(1) **Suggestion:** The plant should consider enhancing its work preparation regarding cross functional interaction to ensure high quality maintenance works. 4.7(1) **Recommendation:** The plant should improve its work management process to ensure that work is completed to schedule and maintenance backlogs are minimized.
TS	5.1(1) **Suggestion**: The plant should consider rigorously implementing and controlling plant programmes to ensure SSCs qualification for seismic events, to minimize potential threats. 5.7(1) **Recommendation**: The plant should effectively control modifications to ensure that plant operation is consistent with the intended design change and that the number and duration of temporary modifications are minimized. 5.8(1) **Suggestion**: The plant should consider improving the FME programme effectiveness to prevent intrusion of foreign objects into fuel assemblies.
OEF	6.5(1) **Suggestion:** The plant should consider improving the depth of event and trend analyses to identify the root causes and enable effective corrective actions to be set to prevent event reoccurrence.
RP	7.3(1) **Suggestion:** The plant should consider reinforcing the implementation of its radiation protection programme to ensure the controls of radiological values on signs in the field, radiological barrier management and for cleanliness of workspaces in the radiological area are sufficiently rigorous. 7.3(2) **Suggestion:** The plant should consider implementing actions to improve practices and means of controlling contamination in order to minimize the risk of spreading contamination.

CH	NONE
EPR	9.3(1) **Suggestion**: The plant should consider improving its inventory control and status monitoring of emergency equipment and tools to ensure their availability and operability during emergency.
AM	10.2(1) **Suggestion:** The plant should consider enhancing its severe accident management programme to include all aspects of severe accidents taking place simultaneously in several units.
LTO	11.1(1) **Suggestion:** The plant should consider ensuring that all relevant structures, systems and components (SSCs) are identified and included in the scope of ageing management (AM) and the results of work done are adequately documented.

DEFINITIONS

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 standards 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 a safety improvement not directly related to inadequate conformance with the IAEA safety standards. 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 operating organizations 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 in other organizations); and does not contradict an issue. Normally, good practices are brought to the attention of the team on the initiative of the host organization. An item may not meet all the criteria of a 'good practice', but still be worthy to take note of. In this case it may be referred as a 'good performance' and documented in the text of the report

Good performance

A good performance is a superior objective that has been achieved or a good technique or programme that contributes directly or indirectly to operational safety and sustained good performance, that works well at the nuclear installation. However, it might not be necessary to recommend its adoption by other nuclear installations, because of financial considerations, differences in design or other reasons.

Self-identified issue

A self-identified issue is documented by the OSART team in recognition of actions taken to address inadequate conformance with the IAEA safety standards identified in the self-assessment made by the host organization prior to the mission and reported to the OSART team by means of the Advance Information Package. Credit is given for the fact that actions have been taken, including root cause determination, which leads to a high level of confidence that the issue will be resolved within a reasonable time frame. These actions should include all the necessary provisions such as, for example, budget commitments, staffing, document preparation, increased or modified training, or equipment purchases, as necessary.

Encouragement

If an item does not have sufficient safety significance to meet the criteria of a 'recommendation' or 'suggestion', but the expert or the team feels that mentioning it is still desirable, the given topic may be described in the text of the report using the phrase 'encouragement' (e.g., the team encouraged the host organization to…).

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-2.2 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-2.13 Evaluation of Seismic Safety for Existing Nuclear Installations

NS-G-2.14 Conduct of Operations at Nuclear Power Plants

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

SSG-61 Format and Content of the Safety Analysis report for Nuclear Power Plants

For information only:

SSG-70 Operational Limits and Conditions and Operating Procedures for Nuclear Plants

SSG-71 Modifications to Nuclear Power Plants

SSG-72 The Operating Organization for Nuclear Power Plants

SSG-73 Core Management and Fuel Handling for Nuclear Power Plants

SSG-74 Maintenance, Testing, Surveillance and Inspection in Nuclear Power Plants

SSG-75 Recruitment, Qualification and Training of Personnel for Nuclear Power Plants

SSG-76 Conduct of Operations at Nuclear Power Plants

International Labour Office publications on industrial safety

Guidelines on occupational safety and health management systems, International Labour office (ILO), Geneva, ILO-OSH 2001

Safety and health in construction, International Labour office (ILO), Geneva, ISBN 92-2-107104-9

Safety in the use of chemicals at work, International Labour office (ILO), Geneva, ISBN 92-2-108006-4

TEAM COMPOSITION OF THE OSART MISSION

IAEA

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REVIEWERS

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Company: Paula Maguire International Consulting Inc., Canada
Review Area: Training and Qualification

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Company: Enconet Consulting GesmbH, Austria
Review Area: Operations 1

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Company: ENEC, United Arab Emirates
Review Area: Maintenance

NOEL, Marc, Belgium Years of nuclear experience: 21
Company: EC JRC, Belgium
Review Area: Technical Support

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Worley Nuclear Services, Bulgaria
Review Area: Operating Experience Feedback

HRISTOVA, Bogdana, Bulgaria Years of nuclear experience: 10
Company: Kozloduy NPP, Bulgaria
Review Area: Radiation Protection

HANUS, Václav, Czech Republic Years of nuclear experience: 29
Retiree, previously working at CEZ, a.s. (until 2014), Czech Republic
Review Area: Chemistry

BEVC, Mirko, Slovenia Years of nuclear experience: 32
Company: Nuklearna Elektrarna Krško – NEK, Slovenia
Review Area: Emergency Preparedness and Response

TUOMISTO, Harri, Finland Years of nuclear experience: 45
Company: Fortum, Finland
Review Area: Accident Management

POLYAKOV, Oleksiy (Alex), Ukraine Years of nuclear experience: 37

Company: WANO MC, Russian Federation

Review Area: Long Term Operation

Observer:
SOMER, Mohamed, United Arab Emirates Years of nuclear experience: 12
Company: ENEC, United Arab Emirates