NSNI/OSART/208F/2022

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IAEA | Operational Safety Review Team | OSART

REPORT

OF THE

OPERATIONAL SAFETY REVIEW TEAM

(OSART)

MISSION

TO THE

CIVAUX

NUCLEAR POWER PLANT

FRANCE

30 SEPTEMBER TO 17 OCTOBER 2019

AND

FOLLOW UP MISSION

9 to 13 MAY 2022

DIVISION OF NUCLEAR INSTALLATION SAFETY
OPERATIONAL SAFETY REVIEW MISSION
IAEA-NSNI/OSART/208F/2022

PREAMBLE

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

This report also includes the results of the IAEA's OSART Follow-up mission which took place 32 months later. The inputs resulting from the Follow-up mission can be found in the following chapters: last paragraph in the Executive Summary, Self-assessment of the Follow-up mission by the host organization and Follow-up Conclusions by the IAEA Follow-up team in the Introduction and Main Conclusions sections. In addition, the Plant response/action and IAEA comments and Conclusion are under each Recommendation and Suggestion. The status of each issue is in the Summary of Status of Recommendations and Suggestions and the Follow-up team composition can be found at the end of the report.

The purpose of the Follow-up mission was to determine the status of all proposals for improvement, to comment on the appropriateness of the actions taken and to make judgements on the degree of progress achieved.

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

FOREWORD by the
Director General

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

An OSART mission, carried out only at the request of the relevant Member State, is directed towards a review of items essential to operational safety. The mission can be tailored to the particular needs of a plant. A full scope review would cover eleven operational areas: management, organization and administration; training and qualification; operations; maintenance; technical support; operating experience feedback; radiation protection; chemistry; emergency planning and preparedness 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 for 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 at Civaux Nuclear Power Plant in France from 30 September to 17 October 2019.

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

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

The mission was coordinated by an IAEA Team Leader and Deputy Team Leader and the team was composed of experts from Argentina, Bulgaria, Czech Republic, Hungary, Korea Republic of, Romania, Sweden, the United Arab Emirates, the United Kingdom, the United States of America and two IAEA staff members. The collective nuclear power experience of the team was 376 years.

The team identified 18 issues, resulting in 4 recommendations and 14 suggestions. 6 good practices were also identified.

Several areas of good performance were noted:

- The plant has implemented ultraviolet treatment of cooling tower drain water with the purpose of limiting releases of amoeba,
- The use of smoke simulation masks to enhance the realism and safety of fire-fighting exercises,
- EDF, in association with CGN in China and EDF Energy in the United Kingdom, have jointly created and made available TMI, Chernobyl and Fukushima major accident showrooms for the young nuclear generation in order to develop a Strong and Nuclear Safety Culture.

The most significant areas of improvement were:

- The plant should establish and implement a system to ensure that operator aids used by plant personnel are authorized and controlled,
- The plant should enhance the processes and practices to manage modifications,
- The plant should enhance the effectiveness and timeliness of corrective actions implementation and use of operating experience.

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

In 2019, the original OSART team developed five recommendations and 13 suggestions to further improve operational safety of the plant. At the time of the follow-up mission, some 30 months after the OSART mission, 61% of issues had been resolved, 39% had made satisfactory progress. No issue was assessed as having made insufficient progress to date.

CONTENTS

INTRODUCTION AND MAIN CONCLUSIONS

INTRODUCTION

At the request of the government of France, an IAEA Operational Safety Review Team (OSART) of international experts visited Civaux Nuclear Power Plant (NPP) from 30 September to 17 October 2019. The purpose of the mission was to review operating practices in the areas of Leadership and management for safety, Training and qualification; Operations; Maintenance; Technical support; Operating experience feedback, Radiation protection; Chemistry, Emergency preparedness and response, Accident management and Human, technology and organization interaction. In addition, an exchange of technical experience and knowledge took place between the experts and their plant counterparts on how the common goal of excellence in operational safety could be further pursued.

The Civaux NPP OSART mission was the 208th in the programme, which began in 1982. The team was composed of experts from Argentina, Bulgaria, Czech Republic, Hungary, Korea Republic of, Romania, Sweden, United Arab Emirates, United Kingdom, the United States of America and the IAEA. The collective nuclear power experience of the team was 376 years.

Before visiting the plant, the team studied information provided by the IAEA and the Civaux NPP 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.

Civaux NPP is in the French Nouvelle Aquitaine administrative region, 35km south west of Poitiers. The main plant comprises two pressurised water reactors of France's 'N4' design each driving a single turbine generator with a nominal output of 1450 MW electrical. The only other units of the same design are at Chooz B near the French-Belgian border. Construction of Civaux NPP started in 1988, Unit 1 was connected to the French electricity grid in 1998 and Unit 2 in 1999. Both units are flexible in operation according to the needs of the grid operator and can ramp from 30% to 95% of full power in only 30 minutes. The control rooms of the N4 plants are highly automated and take account of lessons learned from the Three Mile Island accident in the USA. The Human-Machine-Interface is designed to assist the control room operators through enhanced clarity of information and on-screen diagnostic information.

The plant is located on the Vienne river whose flow varies significantly over the year. This resulted in constraints on the interactions of the plant with the river in terms of water extraction, discharges and river water temperature. Additional effluent storage tanks allow the plant to continue operating when river flow is low. The main circulating water system is cooled using natural draught cooling towers. Civaux is also equipped with 10 days of autonomous cooling capability for the Essential Service Water Systems. These systems are air cooled with make-up water drawn from the river.

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

- The plant has implemented ultraviolet treatment of cooling tower drain water with the purpose of limiting releases of amoeba.
- The use of smoke simulation masks to enhance the realism and safety of fire-fighting exercises.
- The use of participative showrooms (in association with CGN in China and EDF Energy in the United Kingdom), to help the young nuclear generation to develop an effective Nuclear Safety Culture.

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

- The plant should establish and implement a system to ensure that operator aids used by plant personnel are authorized and controlled.
- The plant should enhance the processes and practices to manage modifications.
- The plant should enhance the effectiveness and timeliness of corrective actions implementation and use of operating experience.

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

CIVAUX PLANT SELF ASSESSMENT FOR THE FOLLOW-UP MISSION

In October 2019, an international team of experts led by the IAEA conducted a review at Civaux NPP during which the station was assessed against international best practices.

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

The OSART mission identified six good practices, four recommendations and fourteen suggestions. Measures taken to address these weaknesses have enabled the station to continue its progress towards safer plant operation while constantly striving to achieve excellence.

Within a period of 31 months following the OSART mission, in connection with the health crisis COVID-19, significant improvements have been made at the station. Some examples of these are provided below:

- The limitation of the interactions with the Main Control Room to minimise distractions in the Main Control Room.
- The system to ensure that operator aids used by plant personnel are authorized and controlled.
- The vigilance of all the personnel to potential fire hazards to ensure compliance with existing prevention measures.
- The effectiveness of the Manager in the Field (MiF) programme.
- The reporting of minor deficiencies, reinforcing high expectations and ensuring that all personnel utilize the new processes.

- The effectiveness and timeliness of corrective actions implementation and use of operating experience.
- The radioactive contamination control practices to ensure effective protection against unauthorized release of radioactive material from the RCA.
- The effectiveness of radiological barriers used to ensure that the radiation dose is optimized.
- The scope of the practical training, exercises and drills to ensure an adequate level of proficiency of the personnel involved in the implementation of the severe accident management guidelines at the plant.
- The scope of the severe accident management guidelines to include multi-unit severe accidents and severe accidents involving fuel in the spent fuel pools.
- In addition to specific action plans, our response to the recommendations and suggestions issued by the OSART team has drawn heavily on these fundamental programmes. All levels of management and all departments have been involved in the resolution of issues identified by the OSART team with a view to embedding sustainable improvement programmes.

Progress has already been accomplished in all the areas. We were able to measure the improvement of the safety culture of the employees and the managers between 2019 and 2021 through the results of the WANO Guideline PL 2013-1 “Traits oh a Healthy Nuclear Safety Culture” questionnaires and the positive performance trends.

Year 2022 will provide Civaux with a major opportunity to have its efforts assessed on the occasion of two reviews that will take place in May and June, the OSART Follow-Up and a WANO Peer Review. The OSART Follow-Up is a particular importance to Civaux NPP as it is a rare opportunity to gather insights from recognized IAEA experts regarding our initiatives, which will help us make further strides towards the achievement of excellence.

For each recommendation and each suggestion, the plant self-assessment is based on the following scale:

A	Satisfactory progress made	Goals are achieved
B	Some progress made and must continue	Goals are partially achieved
C	Specific attention from management required	Goals are very partially achieved
D	No significant progress	No goal reached

AREA	RECOMMENDATIONS & SUGGESTIONS	Self Assessment
LM	1.1(1) **Suggestion:** The plant should consider improving the effectiveness of its Manager in Field (MiF) programme.	B
TQ	2.2(1) **Suggestion:** The plant should consider upgrading full scope simulator modelling to provide control room operators realistic training on controlling the plant during planned reduced inventory conditions and postulated severe accident conditions.	B
OP	3.3(1) **Recommendation:** The plant should establish and implement a system to ensure that operator aids used by plant personnel are authorized and controlled.	B

OP	3.4(1) **Suggestion:** The plant should consider revising its policies on managing interactions with the Main Control Room to minimise distractions in the Main Control Room.	C
OP	3.6(1) **Recommendation:** The plant should enhance the vigilance of all personnel to potential fire hazards to ensure compliance with existing prevention measures.	A
MA	4.5(1) **Suggestion:** The plant should consider improving the leak management programme to be more comprehensive and effective at reducing active leaks.	B
MA	4.6(1) **Suggestion**: The plant should consider enhancing its foreign material exclusion programme to eliminate the risk of foreign objects entering plant equipment and systems	B
TS	5.4(1) **Suggestion:** The plant should consider enhancing the process for managing ageing effects to provide a systematic approach for identification of SSCs and degradation mechanisms to guarantee that required safety functions are fulfilled during the life of the plant.	A
TS	5.7(1) **Recommendation:** The plant should enhance the processes and practices to manage modifications, with temporary modifications limited in time and in number and improving the process for timely updates to permanent electronic operating instructions to minimize the cumulative safety significance.	B
OE	6.3(1) **Suggestion:** The plant should consider improving the reporting of minor deficiencies, reinforcing high expectations and ensuring that all personnel utilize the new processes.	B
OE	6.7(1) **Recommendation:** The plant should enhance the effectiveness and timeliness of corrective actions implementation and use of operating experience.	B
RP	7.2(1) **Suggestion:** The plant should consider improving its radioactive contamination control practices to ensure effective protection against unauthorized release of radioactive material from the RCA.	A
RP	7.4(1) **Suggestion:** The plant should consider enhancing the effectiveness of radiological barriers used to ensure that the radiation dose is optimized.	A
CH	8.6(1) **Suggestion:** The plant should consider improving its process and practices for managing chemical substances to ensure equipment and personnel safety.	B
EPR	9.2(1) **Suggestion:** The plant should consider enhancing the process for emergency classification, documentation, notification times and notification equipment.	A
AM	10.1(1) **Suggestion:** The plant should consider extending the scope of the practical training, exercises and drills to ensure an adequate level of proficiency of the personnel involved in the implementation of the severe accident management guidelines at the plant.	B
AM	10.2(1) **Suggestion:** The plant should consider broadening the scope of the severe accident management guidelines to include multi-unit severe accidents and severe accidents involving fuel in the spent fuel pools.	B
HTO	11.1(1) **Suggestion:** The plant should consider enhancing its process for the control, communication, monitoring, tracking and recording of organizational changes.	C

CIVAUX NPP OSART FOLLOW-UP TEAM MAIN CONCLUSIONS

An IAEA OSART Follow-up Team visited Civaux NPP from 9-13 May 2022. There was clear evidence that the plant had gained significant benefit from the OSART process. The IAEA Safety Standards and benchmarking activities with other NPPs were used by the NPP during the preparation and implementation of their corrective action plans.

The plant thoroughly analysed the OSART recommendations and suggestions and developed appropriate corrective action plans. In some instances, these corrective actions covered broader scopes than the original OSART recommendations and suggestions. The willingness and motivation of plant management to use benchmarking, consider new ideas and implement a comprehensive safety improvement programme was evident and clearly indicated the improvement in operational safety at the Civaux Nuclear Power Plant.

The plant had fully resolved issues regarding the effectiveness of its Manager in the Field (MiF) programme, authorization and control of operator aids used by plant personnel, management of interactions with the Main Control Room personnel, vigilance of the plant personnel to potential fire hazards, enhancement of the plant leak management programme, improvements in the reporting of minor deficiencies, effectiveness and timeliness of corrective action implementation, radioactive contamination control practices, effectiveness of radiological barriers, enhancement of the process for emergency classification, documentation, notification times and notification equipment, and extension of the scope of the practical training, exercises and drills.

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

In the training and qualification area while the plant had taken action to enhance control room operator training in reduced primary system inventory conditions, the enhanced training was still classroom based. The full scope simulator was not expected to be upgraded to provide more realistic simulations of open vessel conditions until 2025. The corporate organization was responsible for simulator upgrades and there was no plan to upgrade the full scope simulator to provide more realistic postulated severe accident management conditions as this was considered such an unlikely event, and they deemed the current training methods as being adequate.

Within the area of Foreign Material Exclusion (FME), due to the performance of all personnel and the initiative of the FME manager, the Key Performance Indicators on FME were gradually improving and no safety critical FME events had occurred since 2020. However, the plant had just introduced new training, such as a practical training using mock-ups for plant staff and contractors and dedicated training for the FME counterparts in each department, to improve FME awareness. The plant plans to evaluate the effectiveness of these actions over the next few years.

With regard to the ageing management programme, the team confirmed that the plant had ageing management programmes in place for mechanical, electrical and instrumentation equipment. The plant also had plans to develop plant-specific degradation mechanism sheets, including reference to Time Limited Ageing Analysis, consistent with the IAEA Safety Standards. The plant expected the plant-specific degradation mechanism sheets to be completed within the next few years.

Regarding the issue on temporary modifications, the plant had developed a database for temporary modifications to improve the traceability of temporary modifications and the associated electronic temporary procedures used by operators. The plant had also introduced an annual re-assessment process to analyse the cumulative impact of the temporary modifications. These improvements have gradually begun to reduce the number of temporary modifications, however, the team observed that there were many temporary modifications that would remain in place until the next planned maintenance outages in 2024 and 2025. The effectiveness and sustainability of the improvements in reducing both the number and duration of the temporary modifications had not yet been fully demonstrated.

Regarding the Chemistry issue the plant had developed and implemented an action plan, including organizational and technical measures aimed at improving its management system in terms of processes and practices for the handling of chemical products. As part of the action plan, the plant had created documents to develop awareness through ‘safety messages’ to be delivered to the plant staff twice a year. A set of training sessions was planned for the chemical hazard ‘champions’ in May – June 2022 involving the corporate, as well as plant specific training courses dedicated to safe practices for handling chemical products. The plant had significantly improved the chemical product register, listing 342 chemical products used during daily operations, verified, and validated by the medical department and responsible representatives of the plant management. However, the plant still needed time to embed the new approaches for the handling of chemicals.

EDF Corporate organization and Civaux NPP had a plan to expand the scope of the Severe Accident Management guidance to include multi-unit severe accidents and this plan will have been implemented by the year 2024. In addition, EDF Corporate organization did not envisage providing Severe Accident Management guidance for the Spent Fuel Pools because their justification was that the risk of fuel melt in the Spent Fuel Pools was not sufficient to warrant such formalized guidance.

In the human, technology and organization interactions area, based on a benchmarking with several NPPs from the EDF fleet, the plant developed a methodology for improved impact assessment and coordination of major projects. Project leaders were coached on using the new methodology and it had been tested on a number of projects. The new methodology was assessed as being beneficial, however, it had not been fully utilized to better understand what projects need to be assessed using the new methodology to improve the impact assessment and coordination of major projects.

No issue was assessed as having made insufficient progress to date.

In 2019, the original OSART team developed four recommendations and 14 suggestions to further improve operational safety of the plant. At the time of the follow-up mission, some 31 months after the OSART mission, 61% of issues had been resolved, 39% had made satisfactory progress.

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

1. LEADERSHIP AND MANAGEMENT FOR SAFETY

1.1. LEADERSHIP FOR SAFETY

The plant has developed a Manager in the Field (MiF) programme, which addresses behaviours of plant personnel and contractors in the field and concentrates on communications as well as technical aspects of the work. This programme is a way to instil plant expectations into day-to-day work in the field and contributes to enhancing the plant's safety performance. The annual MiF target for each manager is determined in annual contracts. About 97 managers from Site Director to first-line managers participate, with a 2019 target of 2,085 observations. However, the effectiveness of the MiF programme has not been regularly evaluated and the annual average achievement rate of the target is about 59 % as at September 2019. The team observed several facts indicating that the programme had not always been effective in improving performance in several areas, including housekeeping, fire prevention, management of chemical substances and industrial safety. The team made a suggestion in this area.

1.2. INTEGRATED MANAGEMENT SYSTEM

The plant has been using the 'Evolean' management method since 2018 in most departments to motivate and encourage team members to improve performance by interactive communication. One of the 'Evolean' management methods is an 'Evolean' morning meeting within each department. The safety message and daily Operational Focus information issued by the Shift Manager are delivered and discussed during the meeting. These morning meetings align personnel with Operational Focus on day-to-day work and contribute to enhancing plant safety performance. The team considered this as a good performance.

1.4. DOCUMENT AND RECORDS MANAGEMENT

The temperature and humidity of the document and records storage facility has not always been controlled as required. The long-term document storage room does not have records of temperature and humidity up to 2018. The temperature and humidity of this room exceeded the required value for 89 days from 24/06/2019 to 19/09/2019. The temperature and humidity of this room have been recorded once a week since 2019. The team made an encouragement in this area.

DETAILED LEADERSHIP AND MANAGEMENT FOR SAFETY

1.1 LEADERSHIP FOR SAFETY

1.1(1) Issue: The implementation of the Manager in Field (MiF) programme is not always effective in identifying equipment and behavioural deficiencies in the field.

The team noted the following:

- MiF observations are conducted by the site director, deputy director, senior managers, department managers and first-line managers. The annual MiF target for each manager except for the site director is determined in annual contracts. About 97 managers participate in MiF and a target of 2,085 has been set for 2019. However, the annual average achievement rate of the MiF target is about 59 % as at September 2019.
- The effectiveness of MiF has not been regularly evaluated.
- The team observed multiple facts indicating that MiF programme had not been effective in several review areas including: housekeeping, fire prevention, management of chemical substances, industrial safety, leak identification and foreign material exclusion areas.
- An unplanned reactor trip occurred due to low steam generator water level when a member of the control room staff operated equipment on the wrong train. No analysis or authorization of the intended operation took place in advance, and there was no supervision of the action;
- In a corridor (Room NA085) where hearing protection is required several workers (including managers) performing a walk down were observed not wearing hearing protection; when challenged by the counterpart, the workers corrected their behaviour.
- A worker was observed descending a 4m high ladder in room NB0525 while using one hand to carry several pieces of equipment. Several managers observed this without intervening. When challenged by the reviewer, managers then intervened to correct the behaviour;
- Cigarette butts were implicated in a fire event in 2019 due to a cigarette not extinguished properly, and the team noted several examples indicating smoking outside authorized areas.

Without effective implementation of the MiF programme, the plant could miss the opportunity to correct equipment and behavioural deficiencies in a timely manner. This could adversely affect the safety performance of the plant.

Suggestion: The plant should consider improving the effectiveness of its Manager in the Field (MiF) programme.

IAEA Bases:

SSR-2/2 (Rev.1)

4.35. Monitoring of safety performance shall include the monitoring of: personnel performance; attitudes to safety; response to infringements of safety; and violations of operational limits and conditions, operating procedures, regulations and 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.

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. Standards should therefore be set within the organization for aspects that are important for safety.

Plant Response/Action:

OSART 2019	**1.1(1) Issue:** The implementation of the Manager in Field (MiF) programme is not always effective in identifying equipment and behavioural deficiencies in the field.
LM area	

MP 1	**Strategic Coordinator**	**Operational Coordinator**

Action / Deliverable	Owner	Deadline
Conduct refresher training on MIF observations	Operational coordinator	Completed 31/09/2021
Create MIF templates in Cameleon for priority observations	Operational coordinator	Completed 31/09/2021
Conduct quarterly analyses of MiF and present them in the weekly Corrective Action Programme Managerial Meeting (RMPAC-H)	Operational coordinator	Completed 31/09/2021
Brief managers on feedback (managers' workshop with the Transformer worker population)	Operational coordinator	Completed 31/09/2021

Root Cause Analysis:

- Difficulties in obtaining justification of managers' presence in the field.
- Software change (TERRAIN to CAMELEON).

Progress of the action plan:

- "MIF refresher training" developed.
- Templates created in Caméléon for priority observations at the station.
- Quarterly analysis of MiF, presented in RMPAC-H.
- Coming soon: extension of training to managers on "office activities" and feedback.

Related performance measurement since 2019:

- 4 ‘KIBANA’ Dashboards have been created to coordinate field presence:
  - Quantitative template/department analysis;
  - Quantitative and qualitative analysis of templates;
  - Analysis of observable/department/template details;
  - Monitoring of contracts by area;
- 110 managers have been trained on MIF observations. Training on what to look at and what to say;
- 56 field observation templates have been created (HU tools, FME, industrial safety, essentials, etc.).
- The results are in line with more than 94% of the station's targets. The targets have been revised downwards, to adapt to the different health crises experienced.
- The various quarterly and then half-year presentations have helped to coordinate field observations by refocusing them on the priorities defined. An excessively large proportion of "observe a meeting" and “blank MIF" templates were used. The proportion of these templates used have decreased, while maintaining a good level of use of the priority templates that are linked to the four site essentials (HU tools, FME, Activity preparation and tagging). In 2021, there was a slight reduction in the use of FME templates. This was because the priority had been emphasized in 2020 and the situation has been improving steadily. In 2021, there were no significant safety events with an FME-related cause, nor to date in 2022.
- Given that the volume of templates used in 2020 and 2021 can be considered to be constant, the reduction in the number of “observe a meeting” and “blank MIF” templates used means that more industrial safety type (Handling, Height, Lifting, Electrical) templates have been used, thus contributing to good results in these areas.

Type of evidence to be provided:

- MIF results (half-year analyses).
- Cross-functional field team reports in Outage
- Coach the coach MIF (to be confirmed: there are plans to cancel recordings of MIF coaching actions)

MP1 Annual Review

IAEA Comments:

Based on the self-assessment conducted by the plant following the OSART mission, gaps in the leadership training on ‘Management in the field’ (MiF) was identified as the main root cause of the issue. Another contributor was the change of software application used for the administrative control of the MiF programme, which resulted in the decline of management observations at the time of the OSART mission. Since the OSART mission, transfer from the original ‘Terrain’ application to ‘Cameleon’ has been completed.

Several actions were put in place to address the issue: these included:

- The MiF refresher training package was developed with support from Corporate. The training had been delivered by qualified trainers from the plant and covered all key aspects of the programme, focusing on proper observation practices. At the time of the follow up mission, 90% of 110 managers and supervisors involved in the programme have received the training.

- New observation templates were developed to support the conduct of MiF and the subsequent statistical analysis and dashboards, e.g. templates for observation of HU tools usage, FME and industrial safety practices.
- Several dashboards (available to all personnel on the plant intranet) have been created to monitor and coordinate field presence, e.g. plant and department MiF statistics and various quantitative and qualitative analyses of observations. These dashboards have significantly contributed to improving the implementation of the programme.

A quarterly analysis of the MiF programme implementation is presented to a plant management review board. Similar statistical reports are also discussed at department levels.

All statistics reviewed during the follow up mission showed positive trends in the implementation of the MiF programme, e.g., in 2021, 2203 MiF observations were conducted, representing about 95% fulfilment of the annual target. A similar performance was observed for 2020.

The latest report on the development of nuclear safety culture at the plant shows that the employees' perception of the MiF programme improved from 59% in 2019 to 62% in 2021. Human performance indicators also confirm the effectiveness of the MiF programme, e.g., number of significant events with human performance issues decreased from seven in 2018 to four in 2021.

Conclusion: Issue resolved.

2. TRAINING AND QUALIFICATION

2.1. ORGANIZATION AND FUNCTIONS

Department organizational structure, responsibilities, levels of authority and functions are clearly defined and communicated. The team noted that trainer technical expertise is valued by line organizations, and trainers continuously seek out methods to raise their technical, leadership and pedagogical skills. To meet this challenge, twice-weekly meetings are designed to align the department on the needs of the plant and improve skills to meet those needs. Results are tangible, and include analysing performance gaps, creating just-in-time training, developing mock-ups and strengthening interpersonal skills. The team considered this a good performance.

2.2. QUALIFICATION AND TRAINING OF PERSONNEL

Corporate procedures define structured initial training requirements for operations, leadership and maintenance and technical programmes. Training delivery includes instruction by classroom lecture that can be supplemented with hands-on laboratory activities with mock-ups, simulators, and table top exercises, as applicable. While most fixed-periodicity refresher training requirements are determined by the corporate organization, plant training committees analyse worker performance and direct flexible training topics. These training committees (at the team, department and executive manager levels) monitor prescribed training requirements for completion. Team observation of a logistics and fuel handling training team committee meeting concluded that attendees were engaged during discussions and all desired outcomes were met. The team recognized this as a good performance.

The plant full scope simulator models the plant, in most respects. Notable exceptions are the thermohydraulic modelling for reactor coolant system mid-loop conditions and severe accident conditions with core exit temperature greater than 1,100°C. In these cases, trainer manipulation of computer code is required to partially replicate plant response. The team made a suggestion in this area.

The team noted strong performance by trainers during multiple classroom and simulator training observations. Activities were structured and interactive, and all training objectives were achieved. Additionally, team observation of a simulator evaluation confirmed that grading criteria includes technical knowledge and skills together with demonstrated application of operator fundamentals. The team recognized this as a good performance.

DETAILED TRAINING AND QUALIFICATION FINDINGS

2.2 QUALIFICATION AND TRAINING OF PERSONNEL

2.2(1) Issue: The plant full scope simulator modelling does not ensure that control room operators are provided with realistic training on controlling the plant during planned reduced inventory conditions and postulated severe accident conditions.

- Plant full scope simulator modelling does not replicate the thermohydraulic model for reactor coolant system mid-loop conditions or reactor core temperatures greater than 1,100°C. Plant operations personnel agree that these computer system limitations are a shortfall in the conduct of training.

Examples of simulator limitations are listed below:

- Modelling for reactor coolant system mid-loop conditions is not reliable for thermohydraulic phenomena. To compensate, trainers substitute artificial data to partially simulate response to system level, temperature and pressure perturbations. Classroom training is the primary venue for refreshing on manoeuvring the plant in this reduced inventory condition. Refuelling outage mid-loop configuration is an infrequently performed evolution every four or five years.

- Modelling for severe accident conditions is unreliable at temperatures exceeding 1,100°C. Between 1,100 and 1,200°C, trainers manipulate coded reference values to isolate temperature sensors, but when temperatures go above 1,200°C, the computer programme terminates. Severe accidents produce reactor core temperatures greater than 1,100°C.

Without capabilities of the plant full scope simulator to replicate planned reduced inventory conditions or postulated severe accidents, timely control room operator response to nuclear safety events could be inhibited.

Suggestion: The plant should consider upgrading full scope simulator modelling to provide control room operators realistic training on controlling the plant during planned reduced inventory conditions and postulated severe accident conditions.

IAEA Bases:

NS-G-2.8

4.15(c). Initial and continuing simulator based training for the control room shift team should be conducted on a simulator that represents the control room. The simulator should be equipped with software of sufficient scope to cover normal operation, anticipated operational occurrences and a range of accident conditions.

4.18. The training of control room operators should include, as a minimum, classroom training, on the job training and simulator training. Simulator sessions should be structured and planned in detail to ensure adequate coverage of the training objectives and to avoid possible negative training due to the limits of simulation.

4.37. Plant emergency response using emergency operating procedures (EOPs) should be practiced in the simulator, to provide operating personnel with the necessary knowledge and skills to demonstrate competent emergency actions. Specific in-depth training in EOPs should be provided to overcome the degradation of operating personnel's performance that can occur in stressful situations.

NS-G-2.15 (Superseded by SSG-54)

3.101. Possible methods for validation of severe accident management guidelines (SAMGs) are the use of a full scope simulator (if available), and engineering simulator or other plant analysis tool, or a table top method. The most appropriate method should be selected. On-site tests should be performed to validate the use of equipment. Scenarios should be developed that describe a number of fairly realistic (complex) situations that would require the application of major portions of emergency operating procedures and SAMGs. These scenarios encompass the uncertainties of the magnitude and timing of phenomena (both phenomena that result from the accident progression and phenomena that result from recovery actions).

SSG-54 (Supersedes NS-G-2.15)

3.64. Possible methods for the validation of the SAMGs and background documents include: (a) an engineering simulator including a full scope simulator (if available) or other plant analysis tool, and (b) a table top method. The most appropriate method or combination of methods should be selected, taking into account the role of each functional group of personnel in an emergency.

Plant Response/Action:

<table>
<tr><td>OSART 2019</td><td colspan="3" rowspan="2">2.2(1) Issue: The plant full scope simulator modelling does not ensure that control room operators are provided with realistic training on controlling the plant during planned reduced inventory conditions and postulated severe accident conditions.</td></tr>
<tr><td>TQ area</td></tr>
<tr><td>MP 6</td><td>Strategic Coordinator</td><td colspan="2">Operational Coordinator</td></tr>
<tr><td colspan="2">Action / Deliverable</td><td>Owner</td><td>Deadline</td></tr>
<tr><td colspan="2">Obtain a multi-year programme for changes to the simulator for the N4 plant series and the associated rationale.</td><td>Joint Training Department (SCF)</td><td>Completed 31/05/2021</td></tr>
<tr><td colspan="2">Incorporate changes to the Cathare 2 thermal-hydraulic code as part of the "Renovation of N4 simulators" project to incorporate the ‘reactor vessel open’ reactor mode.</td><td>Joint Training Department (SCF)</td><td>2025</td></tr>
</table>

Root cause analysis:

Updating the thermodynamic model of the full scope simulator is a corporate DPN decision, to which the station has no input.

Progress of the action plan:

Response from the coordinator from the national simulator governance body (PCC): On the N4 simulator, the simulation code used is Cathare Simu, which only covers reactor modes where the vessel is closed. For reactor modes where the vessel is open, an additional model (MCPE) is used to replace it. These codes remain limited and do not simulate all ‘reactor vessel open’ modes or severe accident conditions. However, an option has been added on the 1300 and the N4 plant series to include operations with conditions where a potential steam bubble could form, by installing local commands. This enables shutdown to be performed while simulating a bubble under the vessel head.

Plans have been developed to replace the current codes (Cathare Simu and MCPE) by the Cathare 2 thermal-hydraulic code. This modification will be installed as of 2025 as part of the Renovation of the N4 series simulator (TCDi16007). This new code makes it possible to train in ‘vessel open’ conditions, but limitations of this version mean it is not possible to enter severe accident conditions. No provisions for this update have been made by the DPN’s Fleet Performance project (no project with budget, entity resources, and revenue) but Cathare 2 has all the required native potential.

To date, the N4 plant series structure has not made a request to extend the scope of severe accident simulation as part of the modification scheduled for 2025. Skills can be developed and maintained in these areas through appropriate training.

Related performance measurements completed since 2019:

Since 2019, no safety events have been linked to the representativeness of the simulator in severe accident conditions.

No deviations (safety significant events, operations-induced quality deficiencies (NQE), etc.) caused by problems updating the simulator.

Evidence to be provided:

Training and refresher training materials:

- DRACOCA4 T-43851001-2020-018316
- DRACOCA1 T-43852007-2020-000153
- DRACRGC T-43852007-2020-000030 /
- DOPCRGC T-43852007-2020-000062

Training programme:

- TOTEM for safety engineers, shift managers and deputy shift managers
- NT200 / NT300
- D5057NSCDT04 standard training plan for deputy shift managers

IAEA Comments

The plant identified that the root cause was due to limitations in the thermodynamic model used within the full scope simulator and changes to the thermodynamic model were controlled by the corporate organization.

Since the OSART mission the plant introduced a classroom-based module into the operator refresher training (APE NF) on open vessel conditions. At the time of the follow up mission, 70% of the operations personnel had completed this refresher training. In addition, the plant developed an e-learning course on reactor coolant mid-loop conditions and had provision for just-in-time operator refresher classroom training prior to the entering reactor coolant mid-loop conditions. Following an event at the plant in 2021, operating experience was shared during the APE NF refresher training. Additional operating experience from plants of the same design was also shared during the APE NF Training. Currently, classroom training remains the primary venue for refreshing operators on plant manoeuvres in reduced inventory conditions. Furthermore, in 2021, an instructor developed an educational guide specific for the outages of the N4 series. This guide identifies and details the various risks and mitigation for the open vessel conditions. However, in

2025, the plant plans to upgrade the full scope simulator so that open vessel training can be provided using the full scope simulator.

The plant identified that the deputy shift manager and the safety engineers had not received severe accident management training, and at the time of the follow-up mission this training had been completed for both groups. Furthermore, the plant used the 'Mistral' simulator to familiarise personnel with plant parameters during severe accident conditions and refresher training for Emergency Response team members in severe accident conditions was provided every three years and will include a specific severe accident exercise in September 2022. However, the corporate organization does not have any plans to upgrade the full scope simulator to simulate more realistic severe accident conditions.

The plant had enhanced its mitigation measures to compensate for the fidelity issues in the full scope simulator for the specific plant conditions of open reactor vessel and severe accident conditions.

In addition, the plant planned to upgrade the full scope simulator in 2025 so that operators can be trained under more realistic open vessel conditions. The plant had trained all the required personnel in severe accident conditions and had plans to enhance the operator initial full scope simulator training for plant conditions approaching severe accident management conditions.

Since the OSART review the plant had enhanced its mitigation measures for providing control room operator training in reduced inventory conditions and postulated severe accident management conditions. However, the full scope simulator was not expected to be upgraded to provide more realistic simulations of open vessel conditions until 2025 and no full scope simulator upgrade for severe accident conditions was planned as this training was provided via other means.

Conclusion: Satisfactory progress to date

3. OPERATIONS

3.3. OPERATING RULES AND PROCEDURES

The team noted operator aids mounted on equipment throughout the plant including the Main Control Room, the turbine hall, the auxiliary and diesel generator buildings. Although, in most cases, the operational aids had been verified, validated and approved the plant was unaware of how many of these aids were currently on the plant, whether they were still justifiable in terms of approved plant procedures or if their potential safety impact had been recorded. Without an approved procedure for producing, controlling and applying operator aids there is no traceability in terms of quality control. This could lead to personnel operating the plant in a way that could potentially affect nuclear safety. The team made a recommendation in this area.

3.4. CONDUCT OF OPERATIONS

The team noted that at certain times of day the Main Control Room Lead Operator was very busy dealing with Main Control Room customers. These interactions are part of the Main Control Room planned and unplanned activities as identified in the plant management policies and expectations. The Lead Operator is, by definition, an experienced operator with the knowledge and technical understanding to be able to support other members of the shift crew. During this time of high customer interaction, the Lead Operator’s situational awareness is reduced and overall, this degrades the Main Control Room defence in depth. The plant recognizes the importance of minimizing Main Control Room distractions in order to maintain operator situational awareness. However, many of the plant management policies demand Lead Operator interaction and this conflicts with minimizing Main Control Room distractions. The team made a suggestion in this area.

The team acknowledged the operation department’s efforts to improve the operators’ knowledge of the five operator fundamentals. The team encouraged the plant to enhance use of the five operator fundamentals in normal day-to-day operator procedures and processes.

The team noted, during field observations that plant degraded material condition and leaks had not always been reported using work requests. This is a deviation from the management expectations. The team encouraged the plant to emphasize the importance of effective verification, awareness and reporting of degraded plant conditions.

3.6. FIRE PREVENTION AND PROTECTION PROGRAMME

The plant has established processes to evaluate, authorize and control combustible materials. Permanent storage areas are controlled and risk assessed and procedures for compliance have been established. Temporary storage of combustible material is allowed with time limitations, the storage areas are registered and tracked in a data system called ‘Epsilon’, this system is used to record figures for permitted combustible material fire load. The plant expectation is that smoking is only permitted in designated areas. However, the team observed that combustible materials are not always stored in accordance with plant standards and expectations. Potential ignition sources, such as cigarette butts, have been found outside designated smoking areas and it was noted that discarded cigarette butts have resulted in smoke release. The team concluded that collective plant fire risk awareness does not result in behaviours that ensure fire hazards are managed in accordance with the plants procedures and combustible materials are not always stored within the plant regulations. The team made a recommendation in this area.

Historically fire exercises at Civaux have been conducted using a smoke machine. On occasions smoke has spread to neighbouring rooms and caused fire dampers to automatically close. This has then led to unnecessary distractions for the Main Control Room operators. To overcome this issue the plant has purchased smoke simulation masks that enable augmented reality in exercise scenarios. This has several benefits including enhanced safety for exercise participants and the elimination of smoke spreading from the exercise area. The team regarded this as a good practice.

3.7. CONTROL OF PLANT CONFIGURATION

The logistics and protection department (PLS) has established procedures to ensure that the latest revisions of operational documents are used. The latest revisions are distributed to all designated applicable satellite document locations. However, the team noted two significant examples of deviations from this configuration control process, a satellite procedure location was not identified in the plant's routine for document update and an archive containing basic system plant documents was not being kept up to date. The team encouraged the plant to ensure that only current versions of documents are used by plant personnel.

3.12 PERSONNEL

The team observed a Shift Manager performing an 'in the field' observation of a Lead Operator. The observation lasted over an hour and included observing the Lead Operator during shift hand-over, conducting the start of shift brief, then dealing with customers. During the observation the Shift Manager made many notes as well as completing many of the minimum standard completion boxes. The Shift Manager identified strengths and areas for improvement. Although the team did not witness the resulting critique the observation appeared thorough and professional. The minimum requirement for this type of observation is once per year per operator. The team encouraged the plant to continue or enhance this practice and consider including data from simulator observations for the same purpose.

DETAILED OPERATIONS FINDINGS

3.3. OPERATING RULES AND PROCEDURES

3.3(1) Issue: The plant has not established and implemented a system to ensure that operator aids used by plant personnel are authorized and controlled.

The team noted the following facts:

- The plant does not have written guidance to authorize and control operator aids posted in the plant. Observations by the team include uncontrolled warning instructions, handwriting on schematics and supplementary information.
- Examples of uncontrolled aids observed by the team are listed below:
  - on Unit 1&2 Turbine describing break vacuum sequence.
  - in Auxiliary Building giving guidance on an oil lubricator drain.
  - on Unit 1 & Unit 2 Main Control Room alarm panel.
  - on Reactor Safety System instrument panel.
  - in Auxiliary Building describing line up procedure on auxiliary feed water tank.
  - on Unit 1 Train A diesel generator.
  - in demineralised water station.
  - on Unit 2 Station Blackout Diesel (DUS).
  - on reactor protection cubicle 15 meter level in vicinity of Main Control room unit 2.

Without an effective system that ensures the operator aids are authorized and controlled the plant might be operated outside normal parameters.

Recommendation: The plant should establish and implement a system to ensure that operator aids used by plant personnel are authorized and controlled.

IAEA Bases:

SSR-2/2 (Rev.1)

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.

NS-G-2.14

6.15. Operator aids [13] may be used to supplement, but should not be used in lieu of, approved procedures or procedural changes. Operator aids should also not be used in lieu of danger tags or caution tags. A clear operating policy to minimize the use of, and reliance on, operator aids should be developed and, where appropriate, operator aids should be made permanent features at the plant or should be incorporated into procedures. [13] 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.

6.16. An administrative control system should be established at the plant to provide instructions on how to administer and control an effective programme for operator aids. The administrative control system for operator aids should cover, as a minimum, the following:

– The types of operator aid that may be in use at the plant;

– The competent authority for reviewing and approving operator aids prior to their use;

– Verification that operator aids include the latest valid information.

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

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

Plant Response/Action:

OSART 2019		**3.3(1) Issue:** The plant has not established and implemented a system to ensure that operator aids used by plant personnel are authorized and controlled.	
OP area			
MP 2	**Strategic Coordinator**	**Operational Coordinator**	
Action / Deliverable		Owner	Deadline
Identify the technical posters at the station that require quality assurance Note: action postponed from 2020 to 2021 following the health crisis and industrial workload (outages delayed due to the health crisis).		Operational Coordinator	Completed April 2021 Done on 16, 17 and 18 April
Produce a document "Management of operations department signs in the field" (D5057NSCDT87), which lists the requirements for in-field displays of Ops Dept. operational documents, their implementation process and all documents displayed in the field.		Operational Coordinator	Completed April 2022
Apply the method defined to technical displays present at the station on units 0, 9, 1, 2		OPERATIONS DEPARTMENT (CDT): Benoît LABOURDERE MAINTENANCE DEPARTMENT (SMT): David ALADENISE	Completed May 2021 June 2021

	I&C AND ELECTRICAL DEPARTMENT (IAE): Yannick Gottvalles NUCLEAR LOGISTICS AND ENVIRONMENT DEPARTMENT (LNE): Martial MORISSE	

Root Cause Analysis:

There is no process for managing the technical assistance documentation for workers on the plant (operating procedures, diagrams, industrial safety instruction, etc.). Not having a quality-assured process can lead to operations or maintenance errors.

Related performance measurements since 2019:

No deviations related to the use of incorrect support documents in the field. No deviations detected during periodic internal checks on technical displays.

Progress of the action plan:

Following the April 2021 inventory, the technical displays available in the field only concern the operations department. The analysis of the displayed documents did not identify any errors that could generate a risk on the plant.

The observations only indicated some improvements to be made with regard to the format and quality assurance of technical displays.

The operations department has created and implemented a document “Management of operations department signs in the field" (D5057NSCDT87), which lists the requirements for in-field displays of Operations department, operational documents, their implementation process and all documents displayed in the field.

Evidence to be provided:

Procedure and displays under quality assurance in various rooms, including those observed in 2019 (turbine hall, main control rooms, nuclear auxiliary building, safeguard auxiliaries building, diesel generators, station blackout diesel generator, demineralization plant, etc.).

IAEA Comments

The plant identified that the root cause was having no procedure to control the contents, authorization and location of permanent and temporary operator aids.

The plant carried out an internal audit to verify that the technical content of operator aids was correct and then produced a procedure to control the contents, authorization process and to record the locations for all in-field operator aids.

The operations procedure ‘Management of operations department in-field based operator aids’ (D5057NSCDT87) was checked and found to contain the requirements for operator aids and also listed the locations for the 34 operator aids in Unit 1, 35 operator aids in Unit 2 and 4 operator aids in the common plant systems. A sample check of six operator aids in Unit 1, confirmed that they all complied with the requirements contained in the procedure Management of operations department signs in the field (D5057NSCDT87).

A check of the Unit 1 Shift Log containing Temporary Operating Instructions showed one operator aid associated with a temporary instruction and the location and contents of this operator aid was found to be correctly displayed on the plant.

Following the implementation of the new procedure, the plant had put in place arrangements to verify the effectiveness of the actions taken to control the content, authorization and to verify the location of operator aids. Checks are required to ensure that all operator aids are in place prior to plant restarts and compliance with the procedure D5057NSCDT87 is reviewed routinely every two years.

Conclusion: Issue resolved

3.4. CONDUCT OF OPERATIONS

3.4(1) Issue: The plant's policies and expectations for managing interactions with the Main Control Room are not always effective in minimising Main Control Room distractions.

The plant's policies for managing Main Control Room activities during normal operation include but are not limited to:

- Addressing emergent enquiries.
- Delivering pre job briefs and setting appropriate expectations.
- Granting final permissions for tasks to commence.
- Granting final permissions for work to resume.
- Supporting and role playing during emergency drills.

The team made the following observations in the Main Control Room:

- In March 2019 a reportable event occurred during a load reduction from 100% to 40%. The control rod positions exceeded the allowed insertion limit. Root Cause analysis by the plant revealed that one potential barrier, Main Control Room supervision, had failed to prevent the event.
- On 03/10/19 the unit 1 Main Control Room Lead Operator was busy dealing with customers from 08:45 to 10:00. For most of this busy period the Lead Operator was facing the opposite direction from the Main Control Room.
- On 10/10/19 the unit 2 Main Control Room Lead Operator 2 was busy dealing with customers from 09:43 to 10:35. For most of this time the Lead Operator was facing the opposite direction from the Main Control Room. There was still a queue of customers waiting outside the Main Control Room when the observation stopped. The Lead Operator stated that he had been very busy dealing with customers from 08:30.
- Although the duties of the Main Control Room Lead Operator have been significantly reduced following implementation of automatic issuance of work orders, many customers are still required to attend the Main Control Room for task final Pre Job Brief and approval. This increases the burden on the Main Control Room Lead Operator.
- During an interview a Lead Operator stated that between the hours of 08:30 to 11:30 Mon to Friday the level of supervision he can maintain in the Main Control Room is greatly reduced.
- On 11/10/19 between 08:37-10:45 an observer analysed all the Main Control Room Lead Operator transactions with customers both by telephone and in person. These transactions included those required by the work week plan and miscellaneous emergent transactions.

Without effectively managing distractions in the main control room the Lead Operator's ability to maintain oversight of key parameters and configuration changes, to ensure nuclear safety and event prevention, might be challenged.

Suggestion: The plant should consider revising its policies on managing interactions with the Main Control Room to minimise distractions in the Main Control Room.

IAEA Bases:

NS-G-2.14

4.3 The management should ensure that distractions to the shift personnel are minimised to enable the crew to remain alert to any changes in plant conditions. Examples of distractions that should be minimised are excessive administrative burdens and excessive number of people allowed entry to the MCR. In particular, the need to minimise such burdens should be taken into account in shift arrangements for accidents and emergencies. This will facilitate maintaining the situational awareness of operators.

NS-G-2.14

4.11 During plant events and transient operational states, supervisors should ensure that parameters that are not expected to be affected by the event or the transient are not neglected by the responsible operators.

Plant Response/Action:

OSART 2019	**3.4(1) Issue:** The plant's policies and expectations for managing interactions with the Main Control Room are not always effective in minimizing Main Control Room distractions.
OP area	

MP 3	**Strategic Coordinator**	**Operational Coordinator**

Action / Deliverable	Owner	Deadline
Strengthen management reinforcement of disruption-free control room requirements:		Completed
– Strengthen the reinforcement of the WANO fundamental on control room monitoring and the related requirements by Deputy Shift Managers, Shift Managers, and heads of department via the MiF and coach the coach approach (MiF programme)	Operational Coordinator	May 2021 December 2021
– Manage the WANO fundamental on control room monitoring and the related requirements on a daily basis	Operational Coordinator	May 2021
– Issue a safety message at the station related to control room monitoring and hold a manager workshop	Operational Coordinator	2020-2021
– Update the organizational report on control room monitoring.	Operational Coordinator	2022
Limit face-to-face requests in the main control room		Completed
– Set up a control room access badge system (3 persons and 1 Safety engineer)	Operational Coordinator	November 2020
– Finish looking into how to decrease the number of face-to-face requests (working group)		June 2021
– Implement actions defined by the working group		2022
Limit number of requests made by phone calls to the control room:		Completed
– Finish looking into how to decrease the number of telephone requests (working group)	Operational Coordinator	March 2021
– Implement actions defined by the working group		2022

Limit the number of technical requests made in the control room: – Re-launch the department and station's CONTREX approach taking into account operating issues including alarms – Reduce the number of temporary operating instructions in a sustainable manner (Max 10 / unit), with the support of senior management to initiate mitigation actions within the functional groups.	 Operational Coordinator Operational Coordinator	Completed March 2021 (postponed to 2022) December 2021
Carry out an annual self-assessment on control room monitoring and its improvement action plan	Operational Coordinator	Completed April 2020: May 2021

Progress of the action plan:

Strengthen management reinforcement of requirements for a disruption-free control room:

The basic process of "control room monitoring" is presented at least once a year in the department management meeting.

Limit face-to-face requests in the main control room

Pending the implementation of definitive solutions, access to the main control room is limited to three people, in addition to the shift crew.

Evidence: Progress of the "disruption-free control room" working group in March 2022

In addition, the provision of a POM (operator workstation in observation mode) allows the functional groups to get the information they need without having to ask the control room. These arrangements will be facilitated when unit data is uploaded on-line using the NOVA software (April 2022).

Limit number of requests made by phone calls to the control room:

A call limitation solution is being implemented. It includes an "equipment" part and an "organization" part with a control room request flowchart and a checklist to prepare calls.

Evidence: Progress of the "disruption-free control room" working group in March 2022

Limit the number of technical requests made in the control room:

Reducing "Operating burdens" is achieved by processing of work requests (prioritization of work requests according to the burden incurred), addressing in-field technical issues by working with the reliability department, and addressing specific requests from the shift managers in operational focus meetings (Mondays). A more comprehensive approach that covers all types of burdens is being deployed.

The number of temporary operating instructions at the end of March 2022 was less than 10 per unit (5 in unit 0-9, 9 in unit 1, 8 in unit 2).

Evidence: Progress of the "disruption-free control room" working group in March 2022

Carry out an annual self-assessment on control room monitoring and its improvement action plan

The annual self-assessment is carried out and then factored into the "control room monitoring" basic process.

IAEA Comments

The plant identified the root cause as insufficient coaching and reinforcement of control room monitoring fundamentals and that control room serenity was not at the expected level resulting in distractions which caused control room operators to stop their routine activities and carry out alternative tasks.

The plant had improved the control room serenity by limiting the number of visitors to three persons at any one time, not allowing routine access to the control room during the period of the morning to afternoon shift handover and installing a voicemail system which enabled the operators to not accept any incoming routine calls during busy periods. A plant information computer (read only) was set up outside of the control room environment to enable personnel to access plant data without entering the control room. A booklet was produced which explained the protocol for contacting the control room and a terminal was set up to enable the retrieval of routine work permits without having to access the control room.

The plant had reinforced the use of its engineering process to identify and provide data to the engineering department to minimise or eliminate operator burdens such as re-occurring alarms. In addition, it set a limit on the number of Temporary Instruction to 10 per unit.

The effectiveness of the actions was monitored at departmental meetings and annual self-assessments on control room monitoring had been carried out for the past two years. The 2022 self-assessment was scheduled to be completed in June 2022. The self-assessments confirmed that actions to improve control room interactions and to minimise distractions would become further embedded into routine operations.

Furthermore, the scope of the Manager in the Field programme included checks on control room serenity and main control room interactions.

Conclusion: Issue resolved

3.6. FIRE PREVENTION AND PROTECTION PROGRAMME

3.6(a) Good Practice: Smoke Simulation Masks for safe fire-fighting exercises

Until a few months ago, fire exercises were performed using a smoke machine. This smoke could spread to neighbouring rooms or cause fire dampers to automatically close. This could result in confusion for operators in the Main Control Room where alarms would be activated.

Civaux has been equipped with 3D smoke simulation masks that enable augmented reality in exercise scenarios without the need to directly impact the plant.

Benefits include:

- No impact on plant (fire dampers not used, no tech spec LCOs);
- Now possible to perform exercises in large rooms;
- Now possible to perform exercises in ‘critical’ rooms (Main Control Room, fire safety compartments with high fire risk, offices, etc.);
- Emergency response staff trained in conditions that are close to reality in terms of visibility;
- No time-consuming and tedious smoke removal at the end of the exercise;
- Instructors can coach trainees without being hindered by smoke;
- Trainees wearing the masks can be observed and coached. Positive points and areas for improvement related to response in fire-affected area can be noted and a debrief can be completed at the end of the exercise;
- Multiple advantages of not having real smoke in rooms on the plant: no slippery floors or damage to equipment in the fire-affected room; at the end of the exercise the room is exactly as before the exercise;
- Teams who are not used to wearing self-contained breathing apparatus can become progressively accustomed to working in smoke-filled areas since the mask has varying levels of visibility,
- Positive feedback from field operators who have tested the masks;
- No longer necessary to regularly purchase smoke cartridges.


3.6(1) Issue: The vigilance of plant personnel to potential fire hazards does not always ensure compliance with existing fire risk prevention measures.

The team noted that:

- A fire occurred in the RCA on Unit 2 on 10 October 2019 during welding on a door where the insulation cover ignited.
- An open container containing approximately 10m^3 of wood was placed under a 400kV power line.
- Combustible material was stored under a ventilation intake to the turbine building area.
- A wooden cable-drum and other combustible materials were stored against a safety related building wall, which is contrary to plant expectations that stipulate maintaining a distance of 8 meters.
- The information card on a permanent storage area in unit 1 NA0806 describes the type of stored material and limited fire load weight of each material, but there was no sign of periodic inspections, showing who should inspect and when it was last inspected.
- Waste bag holders are used which do not have fire preventive shielding. Some of these litter boxes are in the vicinity of areas noted as having a high risk of core damage in the PSA, (e.g., the hallway outside of the MCR and SFS L 0997).
- There is a risk recorded in the Cameleon database from 24 September 2019 (C0000116027) regarding potential fire risk associated with cigarette butts in plastic bags in the hallway outside the MCR and SFS L 0997 at Unit 1 & 2. No mitigating actions have been recorded in response to these behaviours.
- On 8 October 2019 cigarette butts were observed in plastic bags in the hallway outside the MCR and SFS L 0997 at Units 1 & 2.
- The indication on a door showed the fire load for that area 1JSW921PD. However, the inventory of the room deviated and exceeded the indications on the door.
- During a fire drill on 4 October 2019, it was noted that temporary scaffolding and fire loads were stored in the escape route from the switch yard.
- Cigarette butts on the ground between security and the OSART office;
- Cigarette butts in plastic bags in proximity of the Main Control Rooms in areas where fire is a significant contributor to the station's overall core damage frequency, and which are 'non-smoking areas' on both units;
- Many people smoking outside a designated area during a local fire alarm muster;
- Smoking outside of designated smoking areas;

Unless plant personnel pay adequate attention to fire hazards and comply with existing prevention measures, safety might be affected.

Recommendation: The plant should enhance the vigilance of all personnel to potential fire hazards to ensure compliance with existing prevention measures.

IAEA Bases:

SSR-2/2 (Rev.1)

Requirement 22: Fire safety

The operating organization shall make arrangements for ensuring fire safety.

5.21. The arrangements for ensuring fire safety made by the operating organization shall cover the following: adequate management for fire safety; preventing fires from starting; detecting and extinguishing quickly any fires that do start; preventing the spread of those fires that have not been extinguished; and providing protection from fire for structures, systems and components that are necessary to shut down the plant safely. Such arrangements shall include, but are not limited to:

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

NS-G-2.1

2.12. Procedures should be established for the purpose of ensuring that amounts of combustible materials (the fire load) and the numbers of ignition sources be minimized in areas containing items important to safety and in adjacent areas that may present a risk of exposure to fire for items important to safety.

2.13. Effective procedures for inspection, maintenance and testing should be prepared and implemented throughout the lifetime of the plant with the objective of ensuring the continued minimization of fire load, and the reliability of the installed features for detecting, extinguishing and mitigating the effects of fires, including established fire barriers
(see Ref. [5], para. 403).

6.1. Administrative procedures should be established and implemented for effective control of combustible materials throughout the plant. The written procedures should establish controls for delivery, storage, handling, transport and use of combustible solids, liquids and gases. Consideration should be given to the prevention of fire related explosions within or adjacent to areas identified as important to safety. For areas identified as important to safety, the procedures should establish controls for combustible materials associated with normal plant operations and those which may be introduced in activities related to maintenance or modifications.

6.2. Written procedures should be established and enforced to minimize the amount of transient (i.e. non-permanent) combustible materials, particularly packaging materials, in areas identified as important to safety. Such materials should be removed as soon as the activity is completed (or at regular intervals) or should be temporarily stored in approved containers or storage areas.

6.3. The total fire load due to combustible materials in each area identified as important to safety should be maintained as low as reasonably practicable, with account taken of the fire resistance rating of the compartment boundaries. Records should be maintained that document the estimated or calculated existing fire load as well as the maximum permissible fire load in each area.

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

Plant Response/Action:

<table>
<tr><td>OSART 2019
OP area</td><td colspan="3">3.6(1) Issue: The vigilance of plant personnel to potential fire hazards does not always ensure compliance with existing fire risk prevention measures.</td></tr>
<tr><td>MP 3</td><td>Strategic Coordinator:</td><td colspan="2">Operational Coordinator</td></tr>
<tr><td colspan="2">Action / Deliverable</td><td>Owner</td><td>Deadline</td></tr>
<tr><td colspan="2">Develop managers’ knowledge of fire risk prevention requirements and their application in the field.</td><td></td><td>Completed</td></tr>
</table>

– Workshops on in-field observation techniques for managers in the area of fire compartmentation (2019), fire loads (2020) and actions to be taken by workers upon discovery of a fire outbreak (2021) – Continue to develop observation techniques for fire risk management in critical safety fire compartments, with the support of fire champions (PREV3, Fire Protection Officer, Fireman) during weekly cross-functional field team walkabouts. – Provide support for departments when carrying out quarterly internal inspections of storage areas (25/03, 22/06, 22/09, 08/12)	Operational Coordinator	2019- 2020-2021 2019- 2020-2021 December 2021
Develop the knowledge of operations personnel on fire risk prevention requirements and their application in the field. – Train Tagging Supervisors on the specific requirements for sensitive fire safety compartments and carry out fire drills in these specific areas – Provide eLearning sessions on fire protection observation techniques (fire compartmentation/fire loads) for field operators (target 100%) – Carry out two exercises and four fire drills for each operations crew member and site protection team member (target 100%) – Carry out “getting dressed and kitted out at fire truck" training for each crew, to improve the response times of emergency crews. – Update the surveillance test relating to the fire truck equipment inventory so that it is more accurate and guarantees that the truck is ready for action. – Set up monitoring of the observations conducted by the operations management team on operations crew fire drills. – Update the DOIS (fire and rescue procedure: transition to 2 first responders, update to fire action sheet FAI0	**Operational Coordinator**	Completed December 2019 December 2021 December 2021 December 2021 June 2021 January 2021 January 2022
Develop the knowledge of risk prevention staff in the area of fire protection and the application of related requirements in the field. – Implement the organisation “worksites with high fire risk" (checks during activity and when it starts and ends) – Ensure the checks the quality of hot work permit preparation – The fire officer carries out a monthly independent check on this topic. – Carry out checks using thermal camera once hot work permits have been returned in Power Operations	**Risk Prevention**	Completed January 2021 January 2021 December 2021 Completed

(Operations Dept.) and in Outage (Risk Prevention Dept.) and revise the back of hot work permits to add the template for clearing hold points – Incorporate all equipment involved in firefighting into a maintenance contract (connections, hydraulic parts, etc.)		March 2021 2022
Raise awareness of fire risk among all EDF & contractor workers to increase vigilance when applying prevention measures. Continue the 2018-2022 multi-annual programme to develop safety culture in the area of fire protection: - Issue Safety Messages on fire protection - Set up Function-specific Safety Groups on fire protection - Host a Fire Safety Day with input from WANO - Produce a communication campaign on equipment compliance (including fire doors) dialling 18 - Set up a working group on fire load management (short term/medium term) with the various staff involved - Brief contractors on fire risk during maintenance and prevention plans - Brief contractors on the fire risk during field observations (19/01) - Carry out building evacuation exercises and record/share operating experience by including site security and first responders - Carry out regional and fleet-wide peer reviews and operating experience sharing on fire protection (Belleville, Dampierre, Saint Laurent, Chinon, Civaux; N4 series) - Conduct observation technique briefings for contractor industrial safety champions	Senior Management	Completed 2018 to 2022 2019-2020-2021 2020-2021 February 2020 January 2021 2019-2020-2021 2019-2020 2021 2021 2019-2020-2021 2022
Engage managers in the continuous improvement process of fire risk management by contracting their actions as per the roadmap - To contract objectives and actions annually through the departments' Annual Performance Contracts/Departmental Target Contracts and the roadmap. - Establish a participation quorum for the fire protection committee/review - Produce a fire protection functional review and ensure maintenance is correctly performed on fire equipment (sprinklers, columns, floor drains, etc.) - Renovation of the JDT fire detection system - Implement a contract for the reactive maintenance of fire doors - Ensure that SDIN/field fire compartmentation database is properly functional - Adhere to the internal audit plan for the fire protection area	Senior Management Operations Departments System and Engineering Reliability Department (FSI) Operations Departments	Completed 2019-2020-2021 2021 2020-2021 2019 2019 2019-2020-2021 2021

Root cause analysis: The fire protection culture of workers at the station must be strengthened to better identify situations that incur risks for plant safety and the industrial safety of workers.

Progress of the action plan: The action plan focuses on the development of the fire protection culture among EDF and contractor workers in the areas of fire loads, fire compartmentation, hot work permits, fire-fighting and communication/awareness of high/low-level events.

Knowledge of fire risk prevention requirements is developed more specifically for managers, operations and risk prevention personnel, with the support of a fire protection champion.

All workers at the NPP (EDF and contractors) are briefed on the fire risk (biggest risk for station) and they are asked to be vigilant to guarantee compliance with existing fire prevention measures.

Managers are committed to continuously improving fire risk management by contracting their actions as per the roadmap in the three reliability areas (technical, organisational, human).

Fire risk management indicators (detection, prevention, training, fire-fighting) are tracked on a monthly basis and distributed to managers and fire protection representatives in the departments. Fire risk management is part of the permanent agenda of the Nuclear Safety Committee (CSN) and is part of follow-up actions of the Fire Protection roadmap.

A Working Group to simplify the fire protection process was held in 2019 with EDF and contractor staff to understand any difficulties encountered. The analysis conducted made it possible to define short and medium-term actions to facilitate compliance with the fire load management rules. The implementation of these actions will begin in 2020.

The 2018-2022 multi-year programme to develop the Civaux NPP safety culture incorporates the fire risk (safety message, newsflash, etc.). The safety day on 18 February 2020 was dedicated to fire risks with a view to increasing the vigilance and engagement of all staff in the prevention of this major risk. The different departments held stands on observation techniques to detect initiating events on electrical equipment and mechanical plant at the on-site training facility, as well as on the storage and temporary storage of fire loads, fire permits, fire compartmentation, fire fighting with Misty and Virtual Fire glasses, or toolbox chats with the fire brigade. In addition, conferences were held by a WANO fire expert, to look back at the circumstances and consequences of major fires such as Notre Dame de Paris in 2019, Grenfell Tower in 2017, as well as in the nuclear industry: Ringhals in 2011, Krummel in 2007, Vandellos II 1 in 1989 and Brownsferry in 1975, the parallels were drawn between the station's low-level events and the initiating events of these fires. Lessons learned from the WANO Peer Review OE were also shared (WANO Paris Centre Analysis of gaps to excellence in fire protection). This day is part of the action plan to address Area for Improvement (AFI) 2017 and the OSART recommendations in 2019. It also meets the WANO requirement "*FS.1 All staff are aligned to censor high standards of fire safety are implemented and maintained*."

Related performance measurements since 2019: Increase in the diversification of staff reporting findings and the number of low-level events recorded in the areas of fire compartmentation, fire loads, hot work permits and fire fighting.

Performance indicators	**2019**	**2020**	**2021**
Compliant storage areas	41%	58%	94%
Compliant temporary storage areas	35%	41%	97%
Compliant Hot Work Permits	66%	75%	98%
Departments reporting findings	12	12	12
Minor fires	2	3	3
Major or noteworthy fires	0	0	0

The Civaux NPP has not had any major or noteworthy fire events since 2016.

Since 2019, the "fire risk management" area is the subject of most of the findings reported by staff (EDF and contractors), which confirms their awareness of this major risk at a nuclear power plant.

Monitoring the number of work requests on fire doors:

	Number of work requests	Number of days	Number of work requests/calendar day
2018	39	199	0.2 Work request/day
2019	226	365	0.6 Work request/day
2020	238	310	0.79 Work request/day
Total	503	875	0.6 Work request/day

Type of deterioration observed:

	Major damage (impacting the structure)	Minor damage (affecting lock mechanisms)
2019	31	195
2020	51	259
2021	11	237

In 2021 compared to 2020, there is a decrease in the number of work requests, which could result from three factors:

- Decrease in damage,
- Work to reduce backlog in 2020,
- Less detection of damage.

Average time taken for maintenance on doors related to fire compartmentation between the date of the work request and the end of work

Processing time	**P1**	**P2 (14 days max)**	**P3 (90 days max)**	**P4 (cycle)**	**P5 (multi-year)**
2019	/	13.3 days	62.3 days	/	/
2020	/	+7.9 days	23.2 days	16.9 days	/
2021	/	+6.7 days	21.9 days	22 days	/

- **There has been a significant decrease in maintenance time between detection and repair.**

The damage to doors caused by careless workers is decreasing but remains at a high level with serious and repeated damage on some doors.

The detection level is stable with efforts to be continued on the quality of work requests.

Characterisation could be more accurate. Some cases can be streamlined.

Processing times have been greatly reduced or streamlined in accordance with NPP requirements.

IAEA Comments

The plant identified the root cause as being due to insufficient awareness amongst EDF personnel and contractors of fire prevention and fire response measures and insufficient focus on ensuring fire equipment defects were reported and resolved in a timely manner.

The plant carried out a series of improvements to enhance the awareness of fire prevention and response arrangements for all plant and contractor personnel. These included: briefings, training, workshops, changes to procedures and coaching in fire prevention measures. The plant also enhanced the controls for permanent and temporary combustible material storage areas and reduced the backlog of defects on fire prevention equipment notably fire door defects. In addition, the plant had enhanced its fire response measures through the observation of fire drills and provided regular checks on the availability of fire response equipment.

The fire risk management indicators were improved and these were tracked monthly and included in the Nuclear Safety Committee Agenda.

Workshops involving plant personnel had also been held to review the findings from significant industry fire related events.

The plant had reduced the time taken to repair fire door defects by more than 50% and the number of fire doors with damage impacting on the structure of the fire door had reduced from a peak of 51 in 2020 to only one at the time of the follow-up mission.

Plant awareness of fire prevention measures had increased as shown by an increasing trend of low-level condition reports related to fire prevention and response measures.

The percentage of compliant permanent combustible material storage areas had increased from 41% in 2019 to 94% at the end of 2021 and the percentage of compliant temporary combustible material storage areas increased from 35% in 2019 to 97% in 2021.

Similarly, the percentage of compliant Hot Works Permits increased from 66% in 2019 to 98% in 2021.

In February 2022, the plant had the best fire prevention and response performance compared to the rest of the EDF fleet.

The plant had not had any major or noteworthy fire events since 2016.

Conclusion: Issue resolved

4. MAINTENANCE

4.1. ORGANIZATION AND FUNCTIONS

The plant has developed a ‘valve book’ which is used when technicians perform maintenance activities with valves at the workshop. By using the instructions and operating experiences which are written in the book, there has been a reduction in the number of maintenance deficiencies and rework. The team identified this as a good practice.

The maintenance managers in the field programme is developed to help first line managers to observe and identify possible problems, deviations and deficiencies in the field, when technicians execute their activities. Improving the strategy and training of first line managers in the field programme the plant has improved the quality of the observations and the potential to recognize possible problems in early phase and in this way reduce non-quality maintenance work. The team identified this as a good performance.

4.5. CONDUCT OF MAINTENANCE WORK

The plant has established the group called Specialization Coordination Group (GAM) to bring together and promote cross-functional cooperation between different departments. The purpose of this group is to address cross-functional challenges. The GAM consists of experts from different teams, a project manager, a sub project manager, a work coordinator, a contractor control manager and the project engineer team. After establishing this group in early 2019, clear quality improvements have been made by simplifying complex process to record supervisory actions conducted in the field and over 1200 industrial models are incorporated to EAM database. The team has identified this as a good performance.

The team noted that the plant leak management process is not always effective at identifying and reducing the active leaks in the field. Without a comprehensive and effective leak management programme, equipment reliability and personnel safety cannot be assured. The team suggested that plant should consider improving their leak management programme to be more comprehensive and effective to reduce active leaks.

4.6. MATERIAL CONDITIONS

While the plant has put considerable effort to the realization of its FME programme in the recent past, the team noted that the foreign material exclusion programme is not always effective at eliminating the potential risk of foreign material entry into the plants systems. The team suggested that the plant should consider enhancing its foreign material exclusion programme to reduce the risk of foreign objects entering plant equipment and systems.

DETAILED MAINTENANCE FINDINGS

4.1. ORGANIZATION AND FUNCTIONS

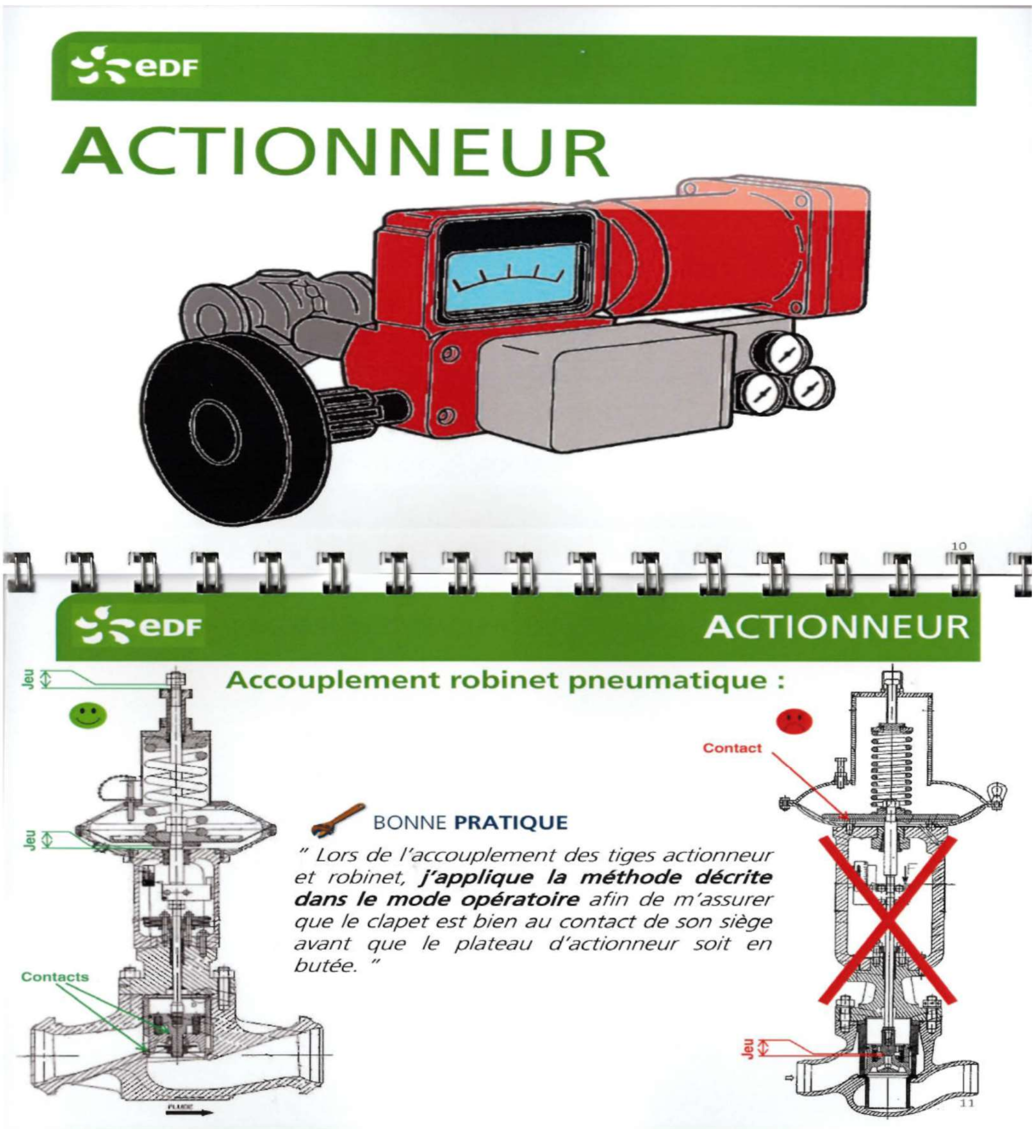
4.1(a) Good Practice: The use of a valve book when executing maintenance activities

A valve book has been developed by the plant which explains, with pictures, good practices and operating experiences from different types of valves. The valve book is used to identify possible challenges during the work and shows how the work should be performed in order to minimize mistakes.

It provides the following advantages:

- Easy identification of valve type and comprehensive collection of operating experiences,
- Establishes check list to minimize mistakes during executing the maintenance activities at the workshop,
- It guides technician to select the right tools to execute work.

Following the implementation of this approach, there has been a reduction in the number of maintenance deficiencies in valve maintenance activities.



4.5. CONDUCT OF MAINTENANCE WORK

4.5 (1) Issue: The leak management programme at the plant is not effective at identifying and reducing active leaks.

The team noted the following:

- The EDF Corporate expectation for the number of leaks is not being met, as document ‘Consigne Operationelle ou Fonctionelle’ expects 0 leaks while the Civaux objectives are set to less than 300 active leaks.
- At the date at the mission Civaux Nuclear Power Plant had 259 active leaks.
- 5 of the active leaks that are priority 1 or 2 have exceeded their expected repair times. Expected repair time is exceeded by between 2 and 11 months.
- The oldest leak record in the leak management system is dated 29/05/2013.
- Since the end of 2017; the trend of active leaks has increased as compared to situation 259 active leaks at end of August 2019, (222 active leaks were noted in December 2017).
- During the IAEA walk down at the plant, several leaks were observed that have not been identified and tagged by the plant
  - Oil leakage in station black out diesel
  - Several oil leaks at BAS 6.48 2RIS 031 PO
  - Several oil leaks at Emergency diesel generator Train ADG;
  - Leak observed at 1REA042PO
  - Leak and corrosion on a fire pump 2JPN001PO and in valve below
  - Leak on pipe 2PTR030VB tagged 12.02.16, not on the list of active leaks
  - 2EAS022PO, a leak at the water pipe has tag but the date of WR#277074 is since 14.07.2017, not in the list of active leaks
  - Oil leak form 22.06.2017, work request No 389971, not on the list of active leaks
  - 0LHT802RA, Signs of ongoing oil leakage (during operation) for longer period on combustion diesel, no local tags found to notify about deficiency
  - LD0310, Leak with defect tag 639635 dated 3 November 2018, not on the list of active leaks
  - LD0311, Drain valve 2 EAS 023 VB coated in boron crystals; the leak has dripped onto cables that supply movable emergency equipment
  - Boric acid pump, Boric acid pump Unit 2 with active leak, but no local deficiency tag.
  - 2 DMN 107PA, Oil leak from telfer drips on to floating cover of boric acid tank unit 1. no deficiency report
  - Steam leak on Aux feed pump LASG004PO defect 23 months old.
  - Valve stem steam leak at 2SVA037VV, no tag

Without a comprehensive and effective leak management programme, equipment reliability and personnel safety cannot be assured.

Suggestion: The plant should consider improving the leak management programme to be more comprehensive and effective at reducing active leaks.

IAEA Bases:

SSR-2/2 (Rev. 1)

Requirement 31: Maintenance, testing, surveillance and inspection programmes

The operating organization shall ensure that effective programmes for maintenance, testing, surveillance and inspection are established and implemented.

Maintenance, testing, surveillance and inspection programmes shall be established that include predictive, preventive and corrective maintenance activities. These maintenance activities shall be conducted to maintain availability during the service life of structures, systems and components by controlling degradation and preventing failures. In the event that failures do occur, maintenance activities shall be conducted to restore the capability of failed structures, systems and components to function within acceptance criteria.

GSR Part 2

Requirement 3: Responsibility of senior management for the management system

Senior management shall retain accountability for the management system even where individuals are assigned responsibility for coordinating the development, application and maintenance of the management system.

Requirement 10: Management of processes and activities

Processes and activities shall be developed and shall be effectively managed to achieve the organization's goals without compromising safety.

Plant Response/Action:

OSART 2019	**4.5 (1) Issue:** The leak management programme at the plant is not effective at identifying and reducing active leaks.
MA area	

Root Cause Analysis:

The leaks topic was not managed by a dedicated person, meaning it was not possible to make sufficient progress.

Progress of the action plan:

A lead has been appointed, who has been managing this topic since last summer. In addition, during each outage, valve rounds are completed, both in the turbine hall and in the reactor building, to identify any work requests that can only be completed in outage. And since we are in ten-yearly outage, the work request programme is much more ambitious.

Related performance measurement since 2019:

Dashboard was created to track the completion of leak-related work requests, by department

More than a hundred leak-related work requests have been integrated into our ten-yearly outage programme:

- Unit 1 (D1821): 64 leak-related work requests, 39 of which have been closed out to date
- Unit 2 (2D1822): 45 leak-related work requests

Type of justifications to be provided:

Since the 2nd half of 2020, we can see that the number of leaks has decreased from 400 to 250 today. Since some activities of the 2 ten-yearly outages are yet to be completed, the number is expected to drop further.

IAEA Comments:

The analysis identified that no one was actively monitoring leakages and taking concrete actions to further reduce them, because of the lack of clarity about who was responsible for reducing the number of leaks.

The plant has taken the following actions to address the issue:

- The leak manager was appointed in 2021. The manager's roles were: to perform the regular plant walkdown to detect all leaks in both units; to assess and prioritize the leakages to be corrected in the next outages or other nearest opportunities; to evaluate how the leakages could evolve; and report on leak management issues to the plant management team every month.
- More ambitious but realistic targets for the number of leaks were established in communication with the corporate. The current target for the number of leaks was 150 at Civaux with two reactors (50 per units plus 50 for common facilities). The original target of 'zero leakage' provided by the corporate was dropped, based on the policy that leakages should be reduced as much as possible, while less significant leakages could be tolerated but should be identified and continuously monitored.
- In 2021, a plant specific procedure for leak management (D5057CDTCOF1007) was established which incorporated the corporate procedure. The issue of leak management identified at Civaux NPP in the 2019 OSART mission, was being rolled out fleet-wide under the initiative of the corporate organization and similar approaches were being taken at other plants.
- An online dashboard for the plant leak management had been created to track the completion of leak-related work requests, together with clear and systematic expectations on the number of leaks. The time to repair the leak was determined depending upon the volume of leakage and type of fluid (oil, water). The dashboard also monitored so-called 'passive leaks', where there is no active leakage was visible, but traces of fluid was observed. This dashboard was linked online with the maintenance information database 'EAM,' used fleet-wide and could be included in a variety of other dashboards indicating plant status.
- In accordance with the agreed prioritization, leakages were repaired during planned outages and the number of leaks was expected to reduce to below 70 after the planned 10-year outages.

The effectiveness of the actions had been continuously monitored by the leak manager, using the newly produced dashboard. Since the second half of 2020, the plant confirmed the number of leaks had decreased from 400 to 250. As of 9 May 2022, the number of active leaks to be corrected by maintenance work was 155 compared to a target value of 150. The plant expected that the number of leaks will continue to be reduced to less than 60 once the ten-year outage had been completed on both units. The trend also shows that passive leaks had been reducing since 2020 with 122 on 9 May 2022. The oldest leaks on the dashboard were dated from April and October 2015 and they were on the conventional facility, of particularly less importance, and did not affect the function of the facilities.

During the Follow-Up Mission, a plant walkdown of the emergency diesel generator with the leak manager, identified several active leaks which had been captured within the plant leak management programme. However, a new oil leak from the small flange of the level gauge on the post-Fukushima diesel generator fuel tank (1LHU 120 LMB) was also identified and the work request was immediately raised by the manager.

In addition, the strong leadership by the plant senior management shows commitment to reduce the leaks sustainably, to encourage all plant personnel and to support the effort of the leak manager.

Conclusion: Issue resolved

4.6. MATERIAL CONDITIONS

4.6 (1) Issue: The plant implementation of the foreign material exclusion (FME) programme is not always effective in eliminating the risk of foreign objects entering the plant systems.

The team noted the following:

- During the interviews it appeared that several of plant personnel are not aware of the importance of FME.
- There is no specific FME training programme for personnel or contractors.
- FME indicator demonstrating efficiency of FME programme, indicator was 83.1% at 2017 and 2018 indicator was 85.8% while the target is 90%.
- The planned outage in 2018 was extended by one day due to foreign material.
- In 2018 two FME-related significant safety events were reported to the French regulatory, (D5057RE21807 and D5057RE21802).
- FME covers were not properly installed on open equipment in the pumping station.
- No FME covers are used for the on-site mobile emergency equipment hoses.

Without an effective FME Programme, equipment reliability and plant safety might be jeopardized.

Suggestion: The plant should consider enhancing its foreign material exclusion programme to eliminate the risk of foreign objects entering plant equipment and systems.

IAEA Bases:

SSR 2/2 (Rev. 1)

Requirement 28: Material conditions and housekeeping.

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

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

NS-G-2.5

3.9; The areas for the handling and storage of fresh fuel should be maintained under appropriate environmental conditions (in respect of humidity, temperature and clean air) and controlled at all times to exclude chemical contaminants and foreign materials.

3.19; Inspections should neither damage the fuel nor introduce any foreign material into it. Inspectors should identify any foreign material already present in the fuel and should remove it.

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.

4.19. The following are examples of specific issues which should be taken into consideration for reactors that are refuelled off-load:

- Measures for radiological protection and supervision during the refuelling process should be established

- Containment or confinement integrity should be as specified for refuelling;
- Air cleaning systems should be operable as specified;
- A reliable power source should be available;
- Start-up range neutron flux detectors and related alarms should be operable;
- Control rods should be inserted into the core and disconnected to render them inoperable, borated water with the specified boron concentration should be circulated and positive measures should be taken to prevent dilution (lockout of pure water control valve; locking of all borated water systems likely to be used in the vicinity of the reactor);
- The reactor vessel and pool storage water levels should be maintained above specified minimum levels;
- The reactor should be subcritical for a minimum specified period and by a minimum amount before fuel discharge is commenced;
- Appropriate interlocks should be in the correct configuration and the necessary functional checks and calibrations should be carried out on the control rod drive circuit, the reactor protection system and the refuelling equipment;
- At least one shutdown cooling loop should be in operation with appropriate emergency cooling capability available;
- Appropriate procedures should be established to prevent foreign materials from being introduced into the reactor vessel;
- Measures should be taken to prevent any unnecessary handling of components or tools over the reactor pool while handling a fuel assembly;
- Adequate communication links should be established between the control room and the fuel loading area;
- An authorized person should be in charge throughout the entire refuelling process;
- A final check should be carried out before vessel closure to ensure that the core has been correctly loaded (checking fuel and core component identification) and, if possible, a video recording should be made for subsequent verification;
- Emergency procedures should be provided for fuel handling faults.

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. Where appropriate, programmes should be established for the surveillance and maintenance of core components during service. Checks should be made for physical changes such as bowing, swelling, corrosion, wear and creep. These programmes should include examination of components to be returned to the core for further service and examination of discharged components in order to detect significant degradation during service. Maintenance programmes should include procedures to prevent the introduction of foreign materials into the reactor.

Plant Response/Action:

OSART 2019	**4.6 (1) Issue**: The plant implementation of the foreign material exclusion (FME) programme is not always effective in eliminating the risk of foreign objects entering the plant systems.	
MA area		
MP 2	**Strategic Coordinator**	**Operational Coordinator**

Action / Deliverable	Owner	Deadline
Re-launch the network of FME representatives to define specific progress actions for the Unit 2 ten-yearly outage		Completed
- Reactivate the network of representatives, asking each functional group to appoint a contact person	Head of the Nuclear Logistics and Environment Department	December 2021
-Based on FME operating experience from Unit 1 ten-yearly outage and previous maintenance outages, ensure the FME network defines an action plan to prevent the repetition of similar events and to revamp the FME approach at the station	FME Operational Coordinator, with representatives	March 2022
-Present this action plan to the Generation Committee for approval, and define methods for monitoring the proposed actions	Generation Management	April 2022
Engage managers to focus on FME		Completed
-Hold a manager workshop dedicated to the FME risk, with the aim of proposing managerial actions to improve our performance in this area	Generation Management	March 2022
-Include these proposals in the overall FME action plan to be presented to the Generation Committee	Generation Management	April 2022
Set up a multi-year action plan to reduce the use of tape in the radiologically controlled area (RCA)		Completed
Define an action plan with 2 time frames: - the 1st will aim to eradicate the use of tape around the reactor cavity and the spent fuel pool as of the Unit 2 ten-yearly outage	FME Operational Coordinator, with representatives	March 2022
- the 2nd will aim to propose means to significantly reduce the use of tape in the RCA, by identifying how it is used and defining alternative replacement methods		December 2022

Root Cause Analysis:

The FME issue is properly taken into account by all staff: the issue is known, and the requirement to place covers on any open sections of systems is properly understood. However, the application of FME rules is still insufficient, owing to training and observation techniques that need to be reinforced.

Progress of the action plan:

The FME issue is one of the Operations and Maintenance Quality Control (MQME) essentials, and as such, the subject is promoted properly within the teams. Efforts have been made to mark out FME areas around the reactor cavity and spent fuel pool in line with the actual risk: above all, room KX1000 (fuel building at 22m) was considered an FME area, but it was only marked out around the pool. On the other hand, FME advisors are appointed during outages, and turn their attention to some worksites to help workers with FME issues, thus bringing real added value. The progress made was recognized by the follow-up of the peer review in 2020.

However, due to a number of events considered as significant in 2021, including a pin that was dropped in the pressurizer, and feedback from peers who alerted us to the significant amount of tape around the reactor cavity and the spent fuel pool, a decision was taken in the Station Strategic Review (RSU) to focus on the FME issue in 2022.

As a result, a network of FME representatives in the departments has been reinitiated; this network is to produce an action plan to make progress with regard to FME. At the same time, a managers' workshop was held to ensure managerial input to this action plan. It will be approved in the Generation Committee in April 2022.

Related performance measurement since 2019:

In 2019, there were no significant events related to FME issues

In 2020, a significant safety event occurred that was identified as having an FME cause, and resulted in a loss of 10.5 full power days. The unit went into shutdown conditions (hot shutdown mode) because of the functional loss of an auxiliary feedwater system (ASG) pump that occurred after its temperature increased. After investigation, grooves were observed on the bearings, which generated loose parts, resulting in blocked oil filters and an increased bearing temperature. It was assumed that these grooves were caused by a foreign material in the system, but this is yet to be proven.

In 2021, there were no significant safety events caused by FME issues. However, 1.2 power days were lost owing to a problem on the hydraulic speed controller of an ASG pump. After investigation, it transpired that the regulator delivered to the station before being assembled on the pump, was defective because of an FME issue at the manufacturing plant. This event was counted as an FME event, even though the FME issue did not actually occur at the station.

In 2022, at the time that this document was issued, no significant FME events had occurred.

IAEA Comments

The plant described the issue as inadequate and insufficient application of the rules and described the root cause as insufficient practical training to recognize the importance of FME and to make relevant personnel aware of deficiencies related to FME.

The plant has taken the following actions to address the issue:

- A new practical annual FME training programme has commenced within the mock-up training facility for plant staff and contractors, with six different maintenance scenarios (valves, mechanics, electric, piping, chemistry and logistics) to improve observation techniques of relevant personnel. Both internal and international operating experience was integrated in each scenario. To date (May 2022), one mock-up training had been delivered for contractors.

- As a result of the manager workshop in February 2022, attended by around 40 managers, the following actions were planned by managers to enhance management presence in the field regarding FME risks;
  - Appoint an FME lead in each department, with dedicated training, to support their department on any FME related issues.
  - Improving FME awareness through FME talks in each team, organized by the managers and the assigned FME leads.
- The monthly meeting of FME leads, had organized two field visits which were attended by a total 8 workers assigned to fuel building, to improve FME awareness.
- The plant had introduced specific FME controls and equipment to protect safety components from foreign objects. For example, the FME covers for open flanges, the recording and verification to confirm all tools used in FME areas had been withdrawn from the area upon completion of the work.

The effectiveness of the actions will be monitored using the KPI on FME. Since 2020, the plant confirmed that the number of reported low level events had been increasing, and the plant considered this as evidence that personnel awareness of the importance of maintaining FME control had increased. No safety critical FME events had occurred since 2020.

During the Follow-Up Mission, a plant walk-down in Unit 2 around the FME areas of the spent fuel pool and the reactor cavity with the FME operational lead, revealed that while overall FME management had improved, there were some examples of non-compliance with the FME standards. For example:

- In the vicinity of the FME area in the reactor cavity of Unit 2 (outside the area), the cable connection panel of the Control Rod Drive Mechanism was incompletely wrapped with pink vinyl sheets and white tape. The FME operational lead has already started discussion on the need for this vinyl sheet with the relevant department.
- A piece of white tape had fallen within the FME area markings around the spent fuel pool in Unit 2. In addition, white tape was used on the ventilation duct in the fuel building of Unit 2, instead of the silver tape that was permitted to be used. The FME operational lead immediately recorded this deviation and requested its resolution.
- A set of red plastic chairs and table with no screws has been installed in the vicinity of the spent fuel pool in Unit 2. This was an improvement advised as a result of an international peer review.

The plant had improved the implementation of the FME arrangements. However, the practical FME training using mock-ups had only just started and the plant plans to evaluate the effectiveness of these trials within the next few years.

Conclusion: Satisfactory progress to date

5. TECHNICAL SUPPORT

5.4. AGEING MANAGEMENT

The plant does not have a formal ageing management programme. Tasks associated with ageing management are implemented in different plant programmes, such as Basic Preventive Maintenance Programme, Observation of I&C Ageing, Surveillance Tests, Reliability Management, Complementary Investigations Programme (PIC), Unit Compliance Review (ECOT), Multiyear Legacy Programme and Conclusion Report of the Reactor Safety Review. Some of these tasks are carried out only on a 10-year basis.

The scope of ageing management corresponds to the scope of the different programmes previously identified. However, completeness cannot be verified due to the different methodologies and approaches of the programmes.

No reference is made to Time Limited Ageing Analysis in the plant programmes associated with ageing. There is also no document identifying the degradation mechanisms applicable to the scope of this activity during the life of the plant. Although there is a corporate document which contains a matrix with degradation mechanisms, this document has never been applied in the plant.

The team made a suggestion in this area.

5.7. PLANT MODIFICATION SYSTEM

The plant has procedures which are intended to identify, execute and monitor temporary modifications. These modifications are monitored every three months in the field and every month through a dedicated database (AIC). For all temporary modifications, there is a requirement to produce a risk analysis and a need assessment report for their implementation. However, the procedure does not explicitly limit temporary modifications in terms of time and number.

The plant extends temporary modifications once the deadline has been reached but does not perform a new risk assessment and only verifies the validity of the original assessment. The cumulative effect of existing temporary modifications on the plant safety has not been analysed.

The team also observed that many of the Main Control Room electronic operating procedures, the primary source of procedure for the Main Control Room operators, require updating with new information. To address this issue for the short term the plant has implemented a temporary (paper based) amendment process to supplement the identified electronic procedure shortfalls.

Although there is a process for incorporating these changes to the electronic operating procedures it relies upon the Corporate Engineering Division. Some of these procedural temporary updates date back to 2010, and at the time of the mission there were 133 outstanding updates that require amendment of the electronic operating procedures. Management of the temporary amendment process does not include trending or grading the safety significance or quantity of these amendments. The increased operator burden of having to use a combination of electronic and paper based procedure increases the risk of important procedural steps being missed and many of the human error prevention tools that are designed to prevent such an occurrence become more complex to use. It also affects the lead operator’s ease of maintaining situational awareness. Having to use these two procedural systems in parallel negates all the benefits of only using the single electronic interactive procedure which was the original design intent. The team made a recommendation in this area.

DETAILED TECHNICAL SUPPORT FINDINGS

5.4. AGEING MANAGEMENT

5.4 (1) Issue: Plant ageing management does not provide a systematic approach for the identification of all systems, structures and components (SSCs), and the degradation mechanisms necessary to ensure compliance of all SSCs with their required safety function throughout the life of the plant.

During the review, the team noted the following:

- There is no plant specific document with the defined scope for ageing management, but the plant uses the 'Corporate Strategy Guide' related to ageing management. The identification of the components included in the scope is not systematic.
- The plant does not have a formal ageing management programme. Tasks associated with ageing management are carried out according to different plant programmes, such as Basic Preventive Maintenance Programme, Observation of I&C Ageing, Surveillance Test, Reliability Management, Complementary Investigations Programme (PIC), Level Compliance Review (ECOT), Multiyear Legacy Programme and Conclusion Report for the Re-examination of Reactor Safety. However, some of these programmes are only conducted on a 10-yearly basis.
- The 'Corporate Guide' presents a matrix which defines degradation mechanisms. However, the document has never been applied at the plant. Application of this document is expected as part of the preparation for the next 10 year outage (VD3)
- No reference is made to Time Limited Ageing Analysis in the plant programmes associated with ageing. This can only be found in the 'Corporate Guide', which is not expected to be applied until preparatory work for the next 10 year outage.
- Corrective actions associated with degradation mechanisms are defined by the corporate organization and the plant participates in this process. However, the definition of these actions can take at least 6 months and may result in component replacement, an increase in the frequency of maintenance interventions or changes of maintenance practices.

Without a systematic approach for the identification of all structures, systems and components, and degradation mechanisms, plant system might not fulfil their safety functions throughout the life of the plant.

Suggestion: The plant should consider enhancing the process for managing ageing effects to provide a systematic approach for identification of SSCs and degradation mechanisms to guarantee that required safety functions are fulfilled during the life of the plant.

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.

4.50 The ageing management programme shall determine the consequences of ageing and the activities necessary to maintain the operability and reliability of structures, systems and components. The ageing management programme shall be coordinated with, and be consistent with, other relevant programmes, including the programme for periodic safety review. A systematic approach shall be taken to provide for the development, implementation and continuous improvement of ageing management programmes.

SSG-48

2.6 Effective ageing management throughout the lifetime of SSCs requires the use of a systematic approach to managing the effects of ageing that provides a framework for coordinating all activities relating to the understanding, prevention, detection, monitoring and mitigation of ageing effects on the plant's structures and components.

2.8 To maintain plant safety, the effects of ageing on SSCs (i.e. net changes in characteristics) should be detected in a timely manner, so as to be able to take appropriate actions to ensure that the required safety functions of SSCs are fulfilled over the entire lifetime of the nuclear power plant.

3.20 A systematic approach (see Fig. 1) should be applied to managing the ageing and obsolescence of SSCs to ensure that required intended functions are maintained at all times during the operation stage of the nuclear power plant.

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.

5.25 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:

(1) Time limited ageing analyses associated with these structures or components should be evaluated to determine the continued validity of the analyses for the intended period of operation. Results of the evaluation of the time limited ageing analyses should be taken into account in the ageing management review.

(2) All relevant ageing effects and degradation mechanisms should be identified.

(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.

(5) If the ageing of structures or components is not managed by any existing programme, a new programme should be established or existing programmes should be modified or improved (e.g. by extending the scope of an ageing management programme) or a specific action (e.g. a new time limited ageing analysis, replacement of the structure or component, or further analysis) should be taken.

(6) If the qualified lifetime of equipment important to safety expires, such equipment should be requalified or replaced at the expiration of its present qualification.

5.27 All relevant ageing effects and degradation mechanisms for each in-scope structure or component should be identified on the basis of the understanding of ageing set out in paras 5.28 and 5.29.

5.28 A comprehensive understanding of structures or components and their ageing effects and degradation mechanisms and how these can affect the capability of an SSC to perform its function(s) should be a prerequisite for the systematic ageing management process shown in Fig. 1. This understanding should be based on:

(a) The design, including the SSC's intended function(s) and applicable regulatory requirements, codes and standards, the design basis and design documents, including safety analyses;

(b) The fabrication of the SSC, including material properties, manufacturing conditions that may affect ageing and service conditions;

(c) The operation and maintenance history of the SSC, including commissioning, operational transients and events, power uprating, modifications and replacements;

(d) Stressors on the structure or component (including loads on the structure or component and the environmental conditions inside and outside the structure or component);

(e) Results of in-service inspections and surveillance;

(f) Operating experience, results of research and development, and any post-service examinations;

(g) Results from walkdowns, inspections and condition assessments, if available;

(h) Results of the evaluation of time limited ageing analyses.

5.29. The identification process should take into account knowledge of the characteristics of the ageing effect (e.g. necessary conditions under which the effect occurs and rates of degradation), the related degradation mechanisms and their impact on the structure or component's intended function(s).

Plant Response/Action:

OSART 2019	**5.4 (1) Issue:** Plant ageing management does not provide a systematic approach for the identification of all systems, structures and components (SSCs), and the degradation mechanisms necessary to ensure compliance of all SSCs with their required safety function throughout the life of the plant.	
TS area		
MP 8	**Strategic Coordinator**	**Operational Coordinator**

Action / Deliverable	Owner	Deadline
Update corporate document D3059015018774 "management of ageing of PWR units - Methodological Guide"	Corporate (DPN)	Completed 07/2020
Application of corporate note D3059015018774 by the Civaux NPP	NPP	Completed 07/2020

Root cause analysis: the DPN reference standard for stations before VD3 (third ten-yearly outage) must be analysed in relation to the OSART reference standard to confirm they are aligned.

Progress of the action plan: corporate report D3059015018774 "management of ageing at PWR units - Methodological Guide" was updated to version B on 07/07/2020. A specific section has been added, §4 "Application of the general methodology", which explains ageing management before VD3 and its adherence to the IAEA reference standards.

Related performance measurement since 2019: no changes to our practices, they are aligned with the new version of the report.

Evidence to be provided:

Report D3059015018774 rev. B

IAEA Comments

The main cause leading to this suggestion lies in the difference between EDF’s ageing management policy and the IAEA Safety Standards. In particular, EDF’s policy differs from IAEA Safety Standards in its approach to the ageing management programme up to the 30th year of operation. EDF Corporate organization, which leads in ageing management, initiated several sequential actions to improve the consistency with IAEA Safety Standards on a fleet-wide basis after the OSART mission in Bugey NPP in 2017. Many actions with a clear objective to comply with the International Generic Ageing Lessons Learned (IGALL) document (Safety Series No. 82 Rev.1) referring to ageing management database had already been initiated at the corporate level at the time of the OSART mission to Civaux in 2019. However, due to the fact that the application of those actions to Civaux NPP was still in progress at the time of the OSART mission, plant personnel were not able to provide the required information to show compliance with the requirements in the IAEA Safety Standards. Furthermore, plant personnel were not familiar with the IAEA Safety Standards related to ageing management.

Following the 2019 mission, the plant decided to refer to the corporate organisation for alignment with IAEA safety standards and to confirm the necessary actions. As a result, the corporate organisation explained that a set of documents, including harmonisation with nine attributes and IGALL, already existed and that the corporate ageing management policy was sufficiently systematic and aligned with the IAEA safety standards. A general guide had also been developed to further clarify compliance of the ageing management programme up to the 30th year of operation. Furthermore, the plant understood that their response was generally consistent with the IAEA standards. However, the plant also identified future actions to be taken, such as the preparation of plant-specific analysis sheets for degradation mechanisms. The objective of these actions was to make the plant specific procedures consistent with corporate policy.

The team found that as of May 2022, the ageing management programme was being undertaken by the plant, in conjunction with the corporate organisation. The team also confirmed through a series of presentations made by plant staff that the process, which included the necessary elements of configuration management, maintenance database, and plant-specific operating experience, had resulted in ageing management provisions for mechanical, electrical and instrumentation equipment. Furthermore, there were plans to develop plant-specific degradation mechanisms consistent with the IAEA Safety Standards in future.

The plant plans to develop plant specific analysis sheets for degradation mechanisms, including reference to Time Limit Ageing Analysis, and reference standards that can be applied to N4 series plants, including Civaux NPP. The plant is awaiting their completion, which will be applied within the next few years.

Conclusion: Satisfactory progress to date

5.7. PLANT MODIFICATION SYSTEM

5.7 (1) Issue: The plant process and practices to manage modifications do not ensure that temporary modifications are limited in time and in number to minimize cumulative safety significance and to ensure main control room electronic operating procedures are updated in a timely manner.

During the review, the team noted the following:

- The plant modification procedure does not explicitly limit temporary modifications (TM) in terms of time and number. The lifetime of temporary modifications can be extended on that basis.
- The TMs are reviewed once a year and, if the need to maintain them continues, the time is extended for one more year (e.g. TM on vibration alarm on the primary system pump has lasted since 2012).
- New risk assessments are not being done when extending temporary modifications, but the plant verifies the validity of the original assessment. Cumulative effects of existing temporary modifications on plant safety has not been analysed. The plant analyses the risk for each function identified within the Engineering Department (FSI).
- Temporary Modifications of the Installation (MTI) (without risk or with acceptable risk in any mode of operation) amount to 265 installed modifications at the plant and 110 of them are safety related.
- The plant does not have a process, or qualified resource, that facilitates changes to the Main Control Room operating procedure software. The station relies on EDF Corporate to manage and resource station software changes. As a result, alternate temporary paper modification procedures, known as CT-305 amendments, must be temporarily implemented in order to address this deficiency.
- On Unit 1 there are currently 67 open temporary CT-305 operating instruction amendments. Of these 36 are associated with alarm operating procedures.
- On Unit 2 there are currently 66 open temporary CT-305 operating instruction amendments. Of these 33 are associated with alarm operating procedures.
- It was observed that the age of these amendments varied with some being relatively recent and others dating back as far as 2010 and 2014.
- During interviews with Lead Operators and other members of the Operations Department stated that the need to use both the original permanent electronic operator procedure in parallel with some temporary, paper modified, operating procedures increases operator burden.

Without systematic processes and practices that minimize the number and limit the duration of temporary modifications and an effective process for timely updating of the operating procedures, plant safety could be compromised.

Recommendation: The plant should enhance the processes and practices to manage modifications, with temporary modifications limited in time and in number and improving the process for timely updates to permanent electronic operating instructions to minimize the cumulative safety significance.

IAEA Bases:

SSR-2/2 (Rev.1)

Requirement 11. Management of modifications

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

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

Requirement 26: Operating procedures

Operating procedures shall be developed that apply comprehensively (for the reactor and its associated facilities) for normal operation, anticipated operational occurrences and accident conditions, in accordance with the policy of the operating organization and the requirements of the regulatory body.

7.4. Operating procedures and supporting documentation shall be issued under controlled conditions, and shall be subject to approval and periodically reviewed and revised as necessary to ensure their adequacy and effectiveness. Procedures shall be updated in a timely manner in the light of operating experience and the actual plant configuration.

NS-G-2.3

6.1 Modifications which are implemented for a limited period of time may be treated as temporary modifications…

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

6.4. The procedure for obtaining approval to implement a temporary modification should be the same as that for a permanent modification. In the procedure for authorization of proposed temporary modifications, it should be ensured that they do not involve or cause a change in the approved operational limits and conditions unless this is separately justified, and do not result in an unreviewed safety issue. In the review of proposed temporary modifications and planned permanent modifications, any existing temporary modifications and the effects of the proposed change should also be considered.

NS-G-2.2

4.3. The management should ensure that distractions to the shift personnel are minimized to enable the crew to remain alert to any changes in plant conditions. Examples of distractions that should be minimized are excessive administrative burdens and excessive numbers of people allowed entry to the main control room. In particular, the need to minimize such burdens should be taken into account in shift arrangements for accidents and emergencies. This will facilitate maintaining the situational awareness of operators.

8.1. All safety related activities shall be performed in conformity with documents issued in accordance with approved administrative procedures. The availability and correct use of written OPs, including surveillance procedures, is an important contribution to the safe operation of a nuclear power plant. The IAEA Safety Requirements [1] state that 'operating procedures shall be developed which apply comprehensively for normal, abnormal and emergency conditions' (Ref. [1], para. 5.11).

8.6. Operating procedures should be verified and validated to ensure that they are administratively and technically correct, are easy for the operator to use and will function as intended. Special attention should be paid to ensuring that OPs are compatible with the environment in which they are intended to be used. The OPs should be validated in the form in which they will be used in the field.

8.7. The OPs should be periodically reviewed to ensure that they remain fit for their purpose and if necessary the procedures should be modified, verified, validated and approved, as required.

NS-G-2.14

4.22 Procedures, drawings and any other documentation used by the operations staff in the main control room or anywhere else in the plant should be approved and authorised in accordance with the specified procedures. Such documentation should be controlled, regularly reviewed and updated promptly if updating is necessary, and it should be kept in good condition. Emergency operating procedures should be clearly distinguished from other operating procedures.

4.24 A controlled copy of all operations procedures should be available in the main control room for reference by operators. Controlled copies of selected procedures should be located at other working places where they are used or will be used in appropriate situations (for example in the emergency control room). Administrative controls should be put in place to ensure that only valid operating procedures are in use and outdated procedures are not used by mistake. The plant procedures should be kept in such a way as to ensure their rapid retrieval. Operators should take special care when new procedures are introduced and used for the first time.

Plant Response/Action:

OSART 2019	**5.7 (1) Issue:** The plant process and practices to manage modifications do not ensure that temporary modifications are limited in time and in number to minimize cumulative safety significance and to ensure main control room electronic operating procedures are updated in a timely manner.	
TS area		
MP 8	**Strategic Coordinator**	**Operational Coordinator**
Action / Deliverable	Owner	Deadline
Define the prioritization strategy for actions to reduce number of temporary mods	Temporary modification representatives	completed
Resume work on reducing number of temporary mods according to the defined strategy		31/12/2022
Compile the safety analysis of the accumulation of temporary mods		30/03/2022
Strengthen the management of CT305 using a single database and issue all necessary document update requests to SPN4.		completed

Root cause analysis:

Some temporary mods are old and the processes to address them over the long-term is long

Some temporary mods may not be relevant.

The annual review lacks traceability and does not include an overall safety analysis.

Progress of the action plan:

Actions taken with corporate entities to process temporary mods and the related modification files to be produced.

The number of temporary mods on safety related equipment, 130 at the time of the OSART, after an increase in 2020 (140), has been steadily decreasing since, with 96 (-30%) in January 2022.

Reviews were organized per function (electrical sources, effluent treatment, modifications), other old temporary mods were re-examined. The outlook is for 22 temporary mods to be removed by the end of VD2, 16 temporary mods to be removed after outage VP20. The work continues now line by line.

It should be noted that a review will be organized in April to provide recorded overall analysis and to draw conclusions on whether the situation is harmful or not.

Outlook for May 2021:

The Operations management document is up to date.

40% of temporary procedures will be removed following VD2

12% of CT305 will be removed by lifting the countermeasures related to the carbon segregation issue.

Related performance measurements completed since 2019:

Decrease in the number of temporary mods.

Management of CT305 transferred to SharePoint and visible, link made with IM4 through raised and prioritised document update requests.

Evidence to be provided:

Temporary mod review report

Database CT305, tracking file of document update requests

Presentation June 2021

IAEA Comments

The plant identified the root causes of the issue to be the lack of traceability of the temporary modifications and the insufficient overall safety analysis on the temporary modification and its resolution. In addition to these causes, the time-consuming corporate engineering process for the N4 series plants, which comprises only four units including Civaux, also affected the plant efforts to reduce the number of temporary modifications.

The plant and the corporate engineering organization have taken the following actions to address the issue:

- Improved the database and interface systems to document temporary modifications which require a temporary procedure (i.e., CT305), and provide information on their classification, together with a link with other databases on risk assessment, and the frequency of follow-up. This approach and newly created database categorises the modifications and eliminates any duplication and improved the traceability between the electronic operating procedures and the temporary modifications. The database allowed individual records of CT305s to be linked to maintenance information, work requests, so that corrective actions could be systematically tracked, medium- and long-term corrections could be monitored and effective analysis and discussion could take place together with the corporate engineering team. To prevent an increase in CT305, monthly meetings between Corporate organization, Chooz and Civaux nuclear power plants are used to review an updated list of work requests and an analysis of operating experience on temporary modifications.

- The plant introduced an annual re-assessment process of the safety impact for the categorised temporary modifications, to assess the cumulative safety analysis and to approve actions to resolve the issues. For example, the latest cumulative analysis in May 2022 suggested that the plant should specifically address the multiple modifications related to power sources, to avoid a high number of temporary modifications in future. The plant also had a clear strategy to reduce the number of temporary modifications on power sources; Civaux found that these temporary modifications were made only on documentation and planned to update the documents locally, clear the temporary modifications once the conditions were met, and report this to corporate engineering to share with other N4 series plants. Another issue identified in the same analysis was the temporary modifications on the reactor coolant pump. The plant will re-evaluate the necessity of the temporary modification under the monitoring programme for leakage and temperature. The plant was about to establish an action plan to address these issues. In addition, the annual Function Health Report is used to review the prioritisation strategy for temporary modifications. In Unit 1, with the ongoing second 10-year outage (VD2), the number of temporary procedures (CT305), which was 67 in 2019, had been reduced to 39. Also, in Unit 2, the number of CT305, which was 66 in 2019, was expected to be reduced to around 40 by the end of the current outage. During an interview in the main control room of Unit 2, the shift manager in charge of both units said that once the plant is back in operation, the operators will see their workload reduced. He also said that the shift teams were satisfied that the temporary modifications were being appropriately managed by the engineering staff, that he did not feel burdened by the temporary procedures because they were clearly marked with a red box in the original procedures. He also stated that the temporary modifications were properly reviewed and prioritized by the senior management during the daily operational focus meetings.

261 temporary modifications (130 on SSCs important to safety) were in place in 2019. This number was steadily reduced. Currently, the total number of temporary modifications was 236, of which 59 (30 on SSCs important to safety) were planned to be removed following VD2 (until the end of 2022), and 40 (9 on SSCs important to safety) after the next maintenance outages (2024, 2025).

The improvements on safety assessments and traceability described above have gradually begun to reduce the number of temporary modifications, however, it is necessary to continue to assess whether the improvements are effective and sustainable in reducing both the number and duration of the temporary modifications.

In addition, although properly prioritized, the large number of temporary modifications to be resolved would have to wait until the end of 2022 before they are removed.

For example, because river water, whose temperature fluctuates seasonally, was used to control the ambient temperature of the I&C components for the secondary system, the turbine hall cooling water (SRI) was being supplied to a non-safety grade chiller unit with two temporary polymer hoses, to prevent the temperature from rising in the summer season. The team found that this temporary modification was introduced in 2017 and would remain until 2025.

In Unit 2, shortly after the first 10 yearly outage (VD1) in 2011, a design fault on the programmed comparator of the digital turbine controller has been appropriately corrected. This modification can be permanent; however, it will remain as a temporary modification until 2025.

Conclusion: Satisfactory progress to date

6. OPERATING EXPERIENCE FEEDBACK

6.3. IDENTIFICATION AND REPORTING

The importance of identification and reporting of operating experience is frequently reinforced via various methods such as safety messages, daily meetings or pre-job briefings. Specific attention is given to the topic in the new leadership programme (Evolean).

There are two systems at the plant for reporting operating experience and non-equipment related deficiencies - eBrid and Cameleon. The systems enable centralized collection, analysis, tracking of actions and subsequent use of operating experience.

However, the reporting systems have been introduced recently and have not been fully utilized by plant personnel and contractors. Reporting practices are not aligned across the plant departments and observed deficiencies in the field are not always recorded in the systems. The loop from deficiency identification to its resolution is not complete in the eBrid system. Furthermore, the systems do not allow for a report to be raised anonymously.

The team suggested that the plant should consider improving the reporting of minor deficiencies, reinforcing high expectations for reporting and ensuring that all personnel utilize the new processes.

6.7. CORRECTIVE ACTIONS

The plant is progressively improving action tracking in the Cameleon system. The structure and verification process in the system allows for the complete and timely implementation of the actions.

However, the team noted that important corrective actions are not always implemented in an effective and timely manner to prevent event recurrence. The plant is not meeting its goals for limiting the number of overdue corrective actions and no improvement is visible over the last year despite the status being presented in management review meetings. The team also noted that several significant events recurred because of ineffective use of past operating experience.

The team recommended that the plant should enhance effectiveness and timeliness of corrective actions implementation and operating experience use

6.8. COMMUNICATION: USE, DISSEMINATION AND EXCHANGE OF INFORMATION

The plant has developed a comprehensive communication system for reactivity management related operating experience. This has allowed development of action plans for continuous improvement and increased attention to the effective use of lessons learned by personnel. The team recognized the system as a good performance.

Regular performance reviews are conducted on subjects with a high safety impact (automatic reactor scrams, configuration control events, violations of technical specifications, fire events). They include not only operating experience but also best practices from the fleet in order to proactively identify and manage technical, human and organisational risks associated with work carried out at the plant. The team recognised this initiative as a good performance.

DETAILED OPERATING EXPERIENCE FINDINGS

6.3. IDENTIFICATION AND REPORTING

6.3(1) Issue: Established processes for reporting minor deficiencies in the field have not been fully implemented and utilized by the plant staff and contractors to ensure valuable lessons are captured in the operating experience programme to support prevention of more significant events.

During the review the team noted:

- There are two systems for reporting operating experience at the plant – eBrid and Cameleon. The systems were introduced recently, and their functionalities are still being optimized. As expectations for using the systems are changing, practices in reporting on the plant are not fully aligned, e.g. in some departments procedure deficiencies are reported to eBrid, in others to Cameleon.
- The formal procedure for reporting to Cameleon (D5057MQPIL22) requires all personnel to raise a report on observed minor deficiencies. The procedure does not provide a definition or examples for the meaning of 'minor deficiency'.
- The most common reporting practice is to report observed deficiencies to line management or area/equipment owners. The decision to raise an observation report is mostly made by the line management or the problem owner. If the deficiency can be promptly addressed, usually no reporting to Cameleon is done.
- During the mission, the team observed several deficiencies in the field that had not been previously identified and reported by personnel (e.g. fire loads in storage areas, blocked escape routes or procedures not updated).
- The systems for reporting observed deficiencies do not allow for a report to be raised in an anonymous way.
- The eBrid system is considered by Operations as the main reporting system for operating experience. The loop from deficiency identification to its closure by implementing actions is not complete in the system. It is not possible to set deadlines for resolution of reported deficiencies in the eBrid system. Typical examples of OE reported through eBrid are proposals for procedure updates, tagging risks or OE from specific activities. Overall performance in eBrid is not monitored.
- A local control room operator at the demineralized water station stated that he had not been trained on the use of Cameleon or eBrid systems and never used these systems to report a deficiency. When a deficiency is observed, it is verbally reported to his line management.

Without consistently following the processes available for all personnel to report minor deficiencies, opportunities for improvement and prevention of more significant events can be missed.

Suggestion: The plant should consider improving the reporting of minor deficiencies, reinforcing high expectations and ensuring that all personnel utilize the new processes.

IAEA Bases:

SSG-50

2.23. Operating organizations should identify and feed into their operating experience programme all issues such as (a) events, including low level events and near misses; (b) potential problems relating to equipment and human performance; (c) safety related concerns; (d) situations that are likely to give rise to errors and need to be addressed to prevent undesired effects; (e) procedural deficiencies; and (f) inconsistencies in documentation. Opportunities for improvement and good practices that are relevant to safety should also be identified and fed into the programme.

2.26. Issues should be identified and reported promptly to facilitate timely screening and the implementation of any immediate actions necessary for safety and follow-up.

2.27. The identification and reporting of low level events and near misses should be encouraged and included in the operating experience programme, since such events can provide valuable lessons to help avoid more significant events.

2.28. Everyone in the operating organization should be able to report any issues that they encounter. The operating experience reporting system should be easily accessible to all personnel within the operating organization; the system should be user friendly, and computerized whenever possible. Contractor personnel should have access to the operating experience reporting system when relevant for them. Even if accountability is encouraged by recording who reports an event, anonymous reporting should also be possible.

2.29. Individuals who report issues should receive feedback, due acknowledgement, and recognition from management to encourage future reporting.

Plant Response/Action:

OSART 2019	**6.3(1) Issue:** Established processes for reporting minor deficiencies in the field have not been fully implemented and utilized by the plant staff and contractors to ensure valuable lessons are captured in the operating experience programme to support prevention of more significant events.	
OE area		
MP 1	**Strategic Coordinator**	**Operational Coordinator**
Action / Deliverable	Owner	Deadline
A00000097424 - OSART - OE - Suggestion Procedure for reporting minor deviations	Operational Coordinator	Completed 31/03/2021

Root Cause Analysis:

Recent tool change (from TERRAIN to Caméléon): support for the ongoing change.

Progress of the action plan:

- 06/19 - Caméléon management workshop
- 11/19 - OPEX presentation in GAM engineers
- 12/19 - Kibana Civaux summary available
- 12/19 - Availability of Kibana switchboards on site
- 12/19 - Availability of Caméléon Advanced Research Guide
- 09/20 - Development and distribution of a method for finding experience feedback
- 12/20 - Training in the method of searching for OPEX, PCD3 contingency controller
- 2019/2021 - Presentation of Caméléon petals (ED Civaux)
- 2019/2021 - Presentation of trend analysis findings and Management Field Visits (ED Civaux)

- Transfer of the Ebrid application to Caméléon Debriefing: change management in progress.

Associated performance measurement since 2019:

Volumes of findings and Management Field Visit compliant with the levels before the tool change.

Forms of evidence to be provided:

'Kibana' dashboard and trend analyses.

IAEA Comments

After the OSART mission, the plant conducted a self-assessment to identify causes of the issue and develop actions for improvement.

The major contributor to the issue was the absence of an integrated reporting system which resulted in inconsistent reporting practices across the plant, loss of information concerning observed issues and personnel were reluctant to report minor deviations as reported minor deviations often remained unresolved.

During the OSART mission itself, the plant was already implementing a new system for reporting, called 'Cameleon'. Since the mission, the system has been fully deployed and other reporting systems and practices closed down. As observed during the OSART follow up mission, the new system had significantly contributed to improving the reporting of issues, both in number and quality, the trending of issues, the tracking of actions and the overall management of Corrective Actions Programme (CAP) data. New dashboards provided support for managers in their oversight role in an effective way, providing up-to-date and comprehensive information about the performance of the corrective action programme.

Examples of specific actions taken in response to the issue:

- Developing and reinforcing expectations for the use of 'Cameleon' system, e.g. a workshop was organized for all managers to introduce the new system and the expectations relating to the reporting of issues was presented. The reporting to 'Cameleon' was also included in ACADEMY training for all employees.
- A specific presentation was delivered to engineers on the use of the data search function in 'Cameleon' for the retrieval and use of operating experience
- Based on data in 'Cameleon', dashboards with various performance indicators were built to monitor CAP performance, e.g. reporting trends, status of corrective actions, and their distribution across departments.
- Implementing 'Kibana' module for searching operating experience data and developing trend analysis
- Another new module was implemented within 'Cameleon' for reporting problems identified during debriefings
- Electronic versions of guides for the use of 'Cameleon' were distributed to all plant personnel
- Regular reports with trend analysis results and the status of management field observations have been established and are reviewed by plant senior management on a monthly basis.

At the time of the follow up mission, data in 'Cameleon' showed an increasing trend in reporting: the number of reports initiated by plant personnel in 2020 was 2693 with 456 corrective actions initiated in response, in 2021 it was 2899 with 651 actions. The backlog of corrective actions has also significantly reduced. Before introducing ‘Cameleon’, about 25% of the actions were overdue in 2019; after introducing the system, the number has continuously improved, with, 68 out of 651 actions taken in 2021 being overdue (approx. 10%) at the time of the follow up mission.

Conclusion: Issue resolved

6.7. CORRECTIVE ACTIONS

6.7(1) Issue: Corrective actions and operating experience resulting from significant events are not always implemented in an effective and timely manner to avoid event recurrence.

During the review the team noted:

- On 23 August 2015, a reactor scram occurred following a circulating water pump trip due to oil loss. The event causes included deficiencies in previous pump maintenance and incorrect calibration of the oil level sensor. One of the corrective actions was to revise the calibration procedure. The action is overdue because of planned modification of the sensor.
- On 24 March 2019, an event with improper position of control rods during unit power decrease occurred. A causal factor identified was an ambiguous alarm. One compensatory action was to issue a temporary procedure so that personnel respond to the alarm correctly, before its modification in the plant control system. The action deadline was 30 September 2019. The action is overdue, and it was confirmed that no temporary procedure exists.
- The plant's goal for 2019 was to have 0 overdue regulatory actions. The dashboard of plant KPI does not contain an indicator to monitor the status of regulatory actions. Currently, 236 actions are open, of which 49 are overdue (approx. 21%). 20 of the 49 overdue actions were taken from reportable events (9 of those 20 in maintenance). Most of these actions are overdue by several months.
- No improvement is visible in the number of overdue regulatory actions over the last year (about 40 per month) despite the status being presented in monthly Nuclear Safety Committee meetings. In December 2018 and in June 2019, the number of overdue regulatory actions reached approx. 100.
- There is no goal for event recurrence and no indicator to monitor OE effectiveness based on event recurrence at the plant.
- According to statistics from the Cameleon system, 96 of 402 open actions are overdue. The deadlines for some of the overdue actions were in January 2019. The plant objective for 2019 was to have less than 15% overdue Cameleon actions, but the current percentage is about 24%.
- In January 2018 there was an event with unavailability of an auxiliary feed water pump due to foreign material in the pump's oil system. A similar event occurred at Chooz in 2014. The plant was aware of operating experience from Chooz, but no actions were taken in response. Chooz had proposed to install an oil filter and this proposal was reported to the corporate in 2015. The same proposal was reported by the plant after the event in 2018. However, there has not yet been any response from corporate to the proposals and so no online oil filters have been installed. Following the event at the plant, a compensatory measure was taken to fill the oil system through a filter.
- In November 2017, EDG unavailability occurred due to the EDG ventilation shut-down button being unintentionally pushed. The same event occurred in 2016. One of the root causes was ineffective compensatory measures in response to the previous event. Corrective actions to prevent event recurrence were implemented during outages in 2019, after the proposed modification had been evaluated by corporate.
- In October 2018 there was an event with unavailability of a chemical and volume control system pump. The direct cause was inadequate setting of the limiting switch during previous maintenance. A similar event occurred at Chooz in 2016. Operating experience from Chooz was not used in a timely manner to prevent recurrence at Civaux. One of the

corrective actions taken by the plant was to develop an OPEX sheet and update the relevant work package. The OPEX sheet was approved by corporate on 18 September 2019. The original deadline was 30 June 2019.

- The main source of external operating experience screened by the plant is found in weekly OPEX reports distributed by corporate. On average, about 40 events from the EDF fleet and one from other sources (WANO, IRS – typically INES 2 and higher events) are presented monthly.
- Current statistics from Cameleon show that 8 of the 19 corrective actions taken in response to external events are overdue.
- Annual review of external OE effectiveness (SP1EPX) showed declining performance in the number of actions related to external events: 80 in 2016, 44 in 2017 and only 28 in 2018. No action was proposed in the report in response to this trend.
- One of the corrective actions in response to the event concerning the failure to conduct the EDG ventilation test in the allowed time frequency (D5057RE21811) consisted of two parts: 'Conduct the omitted test' and 'Inform maintenance personnel about the event'. According to information in Cameleon, the test was conducted. However, there is no information to confirm that the relevant maintenance group was informed about the event. The action is overdue - the deadline was 30 June 2019.
- Results from the WANO Peer Review 2017 mission showed that 46 SOER recommendations out of the 236 total number required further actions. Information about the plant response to SOER recommendations following the WANO review is kept in various action tracking systems. Each of the systems only provides partial information and the global picture of the progress and current status is missing. Some of the observations made by the team relate to SOER recommendations evaluated by WANO as 'further actions required', e.g. SOER 2010-1.

Without timely and effective implementation of corrective actions and operating experience, opportunities for the prevention of significant and repeat events can be missed.

Recommendation: The plant should enhance the effectiveness and timeliness of corrective actions implementation and use of operating experience.

IAEA Bases:

SSR-2/2 (Rev. 1)

5.30 As a result of the investigation of events, clear recommendations shall be developed for the responsible managers, who shall take appropriate corrective actions in due time to avoid any recurrence of the events. Corrective actions shall be prioritized, scheduled and effectively implemented and shall be reviewed for their effectiveness. Operating personnel shall be briefed on events of relevance and shall take the necessary corrective actions to make their recurrence less likely.

SSG-50

2.60 Recommendations on corrective actions resulting from analysis of external operating experience should be developed to prevent similar events or reduce the likelihood of their occurrence at the installation.

2.65 Major corrective actions that have not been completed should be assessed periodically in aggregate to check whether the risk to the installation is still acceptable. Extensions to deadlines for, or the modification or cancellation of, major corrective actions should be minimized and should occur only with the approval of the senior management of the installation.

Plant Response/Action:

OSART 2019 OE area	**6.7(1) Issue:** Corrective actions and operating experience resulting from significant events are not always implemented in an effective and timely manner to avoid event recurrence.	
MP 1	**Strategic Coordinator**	**Operational Coordinator**

Action / Deliverable	Owner	Deadline
Carry out managerial focus in the three reliability areas (human, technical, organisational) to reduce the number of events on the N4 series	Operational Coordinator	2018-2021
Carry out the trend analysis of the Civaux CNPE AAR over the period 2009-2019. Note D5057SUNR351 shared in AAR short loop meeting (ESS criterion 1) and in CSN on 06/07/20 with the various departments.	Operational Coordinator	2020, done
Analyse the experience feedback of significant events major fleet safety – Short loop meeting AAR – WG NC-STE in GT – Coordination Reactivity control – Fire Commission	Operational Coordinator	 Since 2019 Since 2021 Since 2019 Annual
Carry out the trend analysis of the AAR of the N4 series over the period 2009-2019. Note D5057SUNR354 shared in AAR short loop meeting (ESS criterion 1) with the various departments and at national level (AAR committee).	Operational Coordinator	2021, done
Control NC-STE risk in the context of the CNPE NC-STE WG: – Implement the safety actions from the next national working groups (low-level events and OPEX, ventilation systems, ETY and air-locks): satisfactory NC-STE indicators – Continue the analysis of the fleet experience feedback on the safety significant events and incorporate the actions of this experience feedback (including experience feedback from excursion from the operating range by P min during collapse of the bubble at the PZR in the associated TS) – Instruct the securing of the top 3 of the experience feedback of the ESS criterion 3 resulting from the ten-yearly site trend analysis: analysis carried out and checking of existing countermeasures carried out with corrective measures implemented if necessary	Operational Coordinator	2022, ongoing

Root Cause Analysis:

Insufficient awareness of recurring events, the time taken to deal with problems and their impact.

Progress of the action plan:

- 06/19 - Caméléon management workshop
- 09/19-Availability of N4 AAR file
- 09/19-Provision of ESS N4 files
- 09/19-Availability of the Chooz ESS file and follow-up of actions
- 11/19 - OPEX presentation in engineering GAM
- 12/19 - Kibana Civaux summary available
- 12/19 - Availability of Kibana switchboards on site
- 12/19 - Availability of Caméléon Advanced Research Guide
- 09/20 - Development and distribution of a method for finding experience feedback
- 12/20 - Training in the method of searching for OPEX for PCD3 contingency controller
- 10/20 - Civaux AAR trend analysis and recurrence
- 10/20-Presentation of the trend analysis and recurrence AAR Civaux (ED Civaux)
- 01/21 - Trend analysis and recurrence AAR N4
- 01/21 - Presentation of the N4 AAR trend and recurrence analysis (ED Civaux)
- 01/21 - Presentation of the N4 AAR trend and recurrence analysis (PEX AAR Fleet)
- 02/21 - Presentation of the trend analysis and recurrence AAR N4 (DPN AAR Committee)
- 03/21 - distribution of note and trend analysis and recurrence AAR N4 in shift personnel
- 2019/2021 - Presentation of Caméléon petals (ED Civaux)
- 2019/2021 - Presentation of trend analysis findings and Management Field Visits (ED Civaux)

Associated performance measurement since 2019:

- No AAR in 2020.
- No recurring NC-STE safety significant events since the NC-STE WG was set up
- Creation of a daily safety sheet that includes all the experience feedback of the Outage (IS).
- Recurrences better identified in the analyses of maintenance or operating quality deficiencies.
- 2LHQ380SP: rapid discovery of the occurrence in 2006.
- Multi-year analysis of ESS lines of defence every year
- Rate of responses to ASN questions (monthly delay of about 2% on average in 2021 and 2022)
- Improvement of SOER integration since 2019
- Reduction in the number of events on the EFWS system since 2021

Forms of evidence to be provided:

PPT presentations, trend analyses, ESS recurrence note, files made available, method of finding experience feedback, SOER 2021 self-assessment note, ASG managerial focus action plan, etc.

IAEA Comments

Based on the OSART team findings, the plant conducted a self-assessment to identify underlying causes of the issue and develop actions for improvement. The self-assessment pointed towards a lack of awareness of repeat issues and a delayed response in addressing the causes of some of the problems contributing to event recurrence.

Major efforts to address the issue were focused on improving awareness of repeat events, their causes and developing action plans to prevent their recurrence.

Extensive trend analyses were conducted on unplanned automatic reactor scrams and violations of technical specifications that had occurred at N4 series Nuclear Power Plants (NPP) (Civaux and Chooz). To improve awareness, results of the analyses were communicated to plant leadership team and personnel as well as to corporate organization and Chooz NPP.

With regard to automatic reactor scrams, the analysis conducted after the OSART mission pointed towards several human, technological and organisational issues. A more detailed action plan (22 actions, about 2/3 implemented at the time of the follow up) was developed in cooperation with corporate organization and Chooz NPP, e.g. the planning of shift staff availability was improved to ensure a better alignment of teams temporarily working together during summer vacations. A guide was also developed to support personnel in their search for applicable operating experience, e.g., when dealing with emergent issues. This resulted in improved awareness of previous operating experience, repeat events and their causes. Operating experience applicable to ongoing and planned activities was presented by safety engineers during weekly meetings across the whole plant.

There have been no reactor scrams at Civaux since the OSART mission. Before the OSART mission, the average number of unplanned automatic reactor scrams was two per year.

Another major contributor to repeat events was the unavailability of the emergency feed water system (EFWS), which in some cases also resulted in forced unit shutdown as per Technical Specification requirements. An extensive working group was created to identify causes and develop actions, again in collaboration with corporate organization and Chooz NPP. In summary, 135 actions were developed and at the time of the follow up mission, more than 90% of them were implemented. The initiative was closely monitored and, when necessary, supported by the plant leadership team. This initiative had resulted in significant improvement of EFWS reliability, e.g. in 2020 there were 19 unplanned entries into Technical Specifications due to problems on EFWS, while in 2021 there have been only 3 such cases. A number of actions were to improve preventive maintenance and the upskilling of maintenance personnel, conduct EFWS surveillance tests and improve the availability of critical spare parts.

Another initiative with a similar structure had been recently initiated to improve the reliability of the emergency diesel generators.

The timelines of corrective actions had also improved significantly, e.g. at the time of the follow up mission, 188 regulatory actions were open and only two of them were overdue (approx. 1%). As a comparison, at the time of the OSART mission the number of open regulatory actions was 236 actions, of which 49 were overdue (approx. 21%).

The overall status of all corrective actions was reviewed by plant senior management on a monthly basis and statistics showed improving trends.

Conclusion: Issue resolved

7. RADIATION PROTECTION

7.2. RADIATION PROTECTION POLICY

The plant uses several administrative barriers to prevent contamination spread out of the Radiation Controlled Area (RCA). However, in 2019 there were three instances when contamination was found outside the RCA at the plant. The team observed that the contamination control practices are not always effective in preventing unauthorized release of radioactive material outside the RCA. The team made a suggestion in this area.

A silicone resin, originally developed for medical purposes, was tested at the plant to trap contamination, to facilitate decontamination of equipment and reinforce integrity of containment airlocks. Tests performed on scaffold catwalks have shown significant contamination removal efficiency. The resin, when sprayed on the equipment surface before contamination, can facilitate decontamination by simple peeling off. Furthermore, the resin can be used to seal the containment airlock outlet piping. The team considered this a good practice

7.4. CONTROL OF OCCUPATIONAL EXPOSURE

The plant has a sophisticated information system for surveillance and control of radiologically sensitive works on site. Audio and video signals from chosen work sites together with measurement results are transmitted to a dedicated room with restricted access. The room is manned by trained personnel and enables immediate intervention when needed. Remote dose rate measurement systems have also been used for monitoring plant equipment prone to radiological condition change during an outage to optimize timing of jobs to be performed near the equipment. This was recognized by the team as good performance.

On several occasions, performance of radiological barriers did not meet the plant expectation. The use of shielding to reduce radiation dose showed flaws, and shielding was found incomplete or damaged, thus limiting its effectiveness. The team also concluded that control of the radiography process by the plant could be improved to keep radiation dose optimized. The team made a suggestion in this area.

DETAILED RADIATION PROTECTION FINDINGS

7.2 RADIATION PROTECTION POLICY

7.2(a) Good Practice: Use of a resin (RTV FA 878) to facilitate the decontamination of the equipment and reinforce the integrity of the containment airlocks

Context:

The scaffolds used in a highly contaminated environment are difficult to decontaminate. The ‘classic’ manual decontamination is difficult, long and requires important technical, human and organizational means.

Good practice:

The spraying of the resin (RTV FA 878) in order to trap the contamination enables to fix the contamination and to remove it easily. The tests performed on the nuclear power plant scaffoldings have given satisfaction. 80% of the contamination has been removed in one only go.

Description:

- Fluid silicone resin, self-levelling and acting as a fixing agent, it can be either sprayed or applied with a spatula
- It can be applied with a manual spray
- High resistance to rupture and rips
- Durability of the mechanical properties
- Injectable under water

Washable protection/decontamination on a scaffolding catwalk

Ambition and stakes: Improve decontaminations and the containment of the protective airlocks.

- Enhance the level of contamination control in the radiation controlled area rooms
- Facilitate the decontamination process (time-saving trick, therefore saving dose)

- Multi-purpose use (airlock, waste containers…)

Tests and results observed:

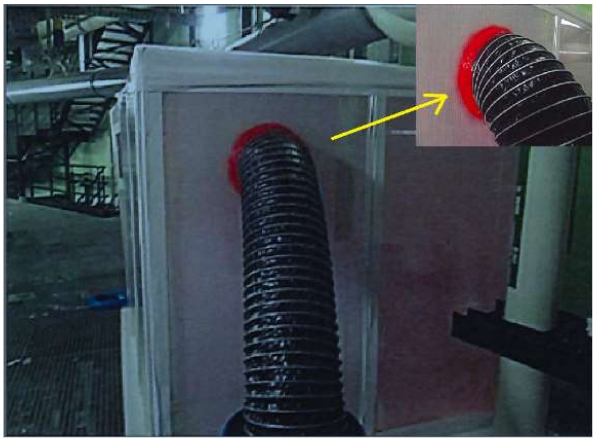
Scaffolding catwalks were tested twice, and the results are as follow:

- On a scaffold catwalk that has a non-fixed contamination of 100 Bq/cm² detected with a smear: after spraying and peeling the resin RTV FA 878, the non-fixed contamination was of 20 Bq/cm² detected with a smear. The measure of specific activity on the resin was of 200 kBq.
- On a scaffold catwalk that has no non-fixed contamination detected with a smear, but a specific activity of 4 kBq (Geiger counter): after spraying and peeling the resin RTV FA 878, the activity recorded by the Geiger counter on the scaffold catwalk was of 2 kBq and it was of 2 kBq on the peeled resin.
- Implementation during the unit 2 outage in 2019, with 3 integrity tests on ventilated airlocks.

Expected results:

The resin can be used to prevent a risk of contamination. It can also be used as a decontamination solution for equipment.

Its use should be extended to the preparation of construction sites and for their demobilization.



Improvement of the integrity of ventilated airlocks 2R16

Decontamination and protection of concrete waste containers

7.2(1) Issue: The plant's contamination control practices are not always effective in preventing unauthorized release of radioactive material from the Radiation Controlled Area (RCA).

The team noted the following:

- In 2019 there were two events of contamination outside of the RCA ('not reportable' according the regulator's expectation) at the station found during routine monitoring of the roads. The activity found was 10 and 40 kBq.
- In 2019 a contaminated (612 kBq) vacuum cleaner bag was found in municipal waste. The bag was recovered from the waste at transit area – the area is used for temporary storage of municipal waste before leaving the site and is equipped vehicle monitor. The event was reported to regulator as important event.
- Approximately 20 metal grids were seen unposted in the 'K' – conventional zone (QA0620, +3.6 m) stored. When asked, the area owner stated that the grids were from the disassembly of filters from the non 'K' zone. The grids were later checked for contamination and were found clean.
- In 2019 a tank used to transport sewage water from decontamination facility (Medical Centre outside plant's fence) was disposed of into municipal waste chain. The event was identified by Radiation Protection and the tank was classified as 'nuclear waste' and disposed of in the radioactive waste chain, although measurements taken on the tank did not show any contamination. The event was reported to the regulator.
- All RCA exits are equipped with portal monitors (beta, gamma), tacky pads and pre-monitors (friskers and hand-foot monitors). When leaving the RCA workers are supposed to use friskers as the first step as a contamination check, then they should proceed to hand-foot monitors and finally perform a whole body contamination check in the dedicated portal monitors. The results from the friskers are not recorded and trended, results from hand-foot monitors and portal monitors are recorded. Only results from portal monitors are used to assess contamination rate at the RCA border, which is the performance indicator followed on plant level.
- One performance indicator – number of reportable contaminations outside RCA –resulted in 0 for 2018 but the target has been set to 1 for 2019.

Without consistent radioactive contamination control practices, unauthorized release of radioactive material outside the RCA could occur.

Suggestion: The plant should consider improving its radioactive contamination control practices to ensure effective protection against unauthorized release of radioactive material from the RCA.

IAEA Bases:

GSR Part 3

3.90. Registrants and licensees:

…

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

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

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

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

GSG-7

9.27. When the use of physical design features (including specific engineered controls) to restrict individual exposures is impractical or not sufficiently effective, administrative controls should be implemented.

NS-G 2.4

6.64. … Low level events and near misses should be reported and reviewed thoroughly as potential precursors to degraded safety performance. Abnormal events important to safety should be investigated in depth to establish their direct and root causes. Methods of human performance analysis should be used to investigate human performance related events. The investigation should result in clear recommendations to plant management, which should take appropriate corrective action without undue delay to prevent recurrence.

NS-G 2.7

3.13. Before items are removed from any contamination zone, and in any case before they are removed from controlled areas, they are required to be monitored as appropriate and suitable measures should be taken to avoid undue radiation hazards.

Plant Response/Action:

OSART 2019	**7.2(1) Issue:** The plant's contamination control practices are not always effective in preventing unauthorized release of radioactive material from the Radiation Controlled Area (RCA).
RP area	

MP 4	**Strategic Coordinator**	**Operational Coordinator**

Action / Deliverable	Owner	Deadline
Raise the awareness of workers carrying out maintenance at risk of contamination transfer (PGAC, valves and fittings, etc.) upstream of the outage	Operational Coordinator	completed
Identify worksites at risk of contamination on the outage, systematically link C2 via the IZs to the sites concerned for analysis and reactive inspection by the RZs.	Operational Coordinator	completed
Make the medicine tank a dedicated piece of equipment and formalize in an operating procedure the methods for processing biological waste.	Operational Coordinator	completed
Establish a reference catalogue showing the worksite barriers and exits of the reactor building.	Operational Coordinator	completed
Monitor equipment contributing to the containment of worksites and contamination barriers.	Operational Coordinator	completed
Carry out a daily mapping of the filter floor in the outage.	Operational Coordinator	completed

Carry out a review upstream of the exit of the reactor building of the large equipment (false lid and multistud tensioning machine).	Operational Coordinator	completed
Describe the process for managing dedicated equipment before it is sent to the public field.	Operational Coordinator	completed
Strengthen the frequency of inspection of DI 82 areas.	Operational Coordinator	completed
Sanctuarise DI82 areas	Operational Coordinator	In progress
Strengthen checks of equipment used for handling equipment.	Operational Coordinator	completed
Recapture the rooms in order to have an operational zoning closest to the reference zoning.	Operational Coordinator	In progress
Improve the monitoring of the PGAC on activities related to contamination control.	Operational Coordinator	In progress
Implement the new frame of reference on contamination control.	Operational Coordinator	2022 (index 2 for September)
Analyse contamination that has led to traces of internal contamination.	Operational Coordinator	Completed
Make managers aware of Power operation fundamentals, including contamination control.	Operational Coordinator	Completed
Communicate and inform on the radiation protection management recovery plan.	Operational Coordinator	Completed

<u>Root Cause Analysis:</u>

- Lack of robustness of worksite contamination barriers / storage conditions on filter floor
- Management of non-dedicated equipment to be strengthened, special cases of the medicine tank and the management of biological waste,
- Fragility on the output of large equipment
- Lack of expertise of some workers to work on an Everest site
- Monitoring of weak signals to be improved
- Potential transfer of contamination during handling via DI82 areas or handling equipment:

Progress of the action plan:

Completed except for the sanctuary of DI82 areas and the implementation of the new radiological cleanliness frame of reference (index 2)

Associated performance measurement since 2019:

- Improvement of C2 rate on VPs
- Number of roadway contamination points, C3, etc.
- Reconstitution of radiological classification of rooms

Forms of evidence

- Operating procedures SPR COF8, SPR COF60, LNE COF155, catalogue of contamination and BR exit barriers
- Outage radiation protection risk assessment, C2 analyses
- Photos of the medical tank, biological waste management worksheet
- BSTC new PGAC with air-lock inspection worksheet, worksite channels and barriers, Serlog sheets
- Number of people made aware of contamination control
- Large equipment output review
- Handling equipment inspection register
- PCI, monitoring programme

IAEA Comments

The plant reviewed the issue, investigated all the circumstances associated with the plant's contamination control practices and came up with the following primary causes of the deficiency.

- Lack of the plant personnel awareness of a risk of contamination transfer when carrying out maintenance on the plant systems and components and insufficient identification of the worksites at risk of contamination
- Lack of supporting tools and data demonstrating to the plant personnel the worksite barriers and exits from the reactor building.
- Insufficient frequency of inspections associated with contamination control process and practices

The plant had developed and implemented an action plan comprising organizational and technical arrangements focused on the enhancement of the contamination control process and practices at the plant during normal operation and when on outage. All the principal provisions and measures had been planned and implemented in a timely manner including:

- development and implementation of new operating procedures and guides on contamination control for contractors and plant personnel
- introduction of a 'safety message' dedicated to contamination control process and practices delivered to the plant staff twice a year, having weeklong actions evaluating contamination control performance and indicators and practical actions. In addition, management observations were focused on radiation protection fundamentals and behaviors and on reinforcing plant management expectations.

- developed and delivered training courses on contamination control for contractors and the plant personnel and management. In 2020, 300 contractors had been trained and in 2021, 450 contractor representatives were trained within an awareness campaign focusing on radiation protection fundamentals and behavior in the radiation controlled area. The targeted group of contractors involved personnel dealing with logistic, housekeeping, industrial cleaning and teams of contractors performing high risk activities, such as welders and radiographers.
- introduction of practical arrangements for the identification and visibility of worksites at risk of contamination.
- increase in the monitoring and inspection activities associated with contamination control.

These plant efforts were supported by associated performance measures within the Integrated Management System, corporate evaluations and baselines and operational and management records.

The reporting data showed that the enhancements associated with the plant's contamination control process and practices had improved the contamination control practices. For example:

- C2 (exit from the radiation controlled area) monitors actuation rate in 2021 was 0.33 %. For the first two quarters of 2022, the C2 rate was 0.25 %.
- C3 (exit from the plant) monitors actuation rate in 2021 was 0.
- No roadway contamination points and contamination points at other locations at the Civaux site were identified in 2022 or in 2021.

Low level events were analyzed each year via the global review of the sub-process 'Radiological Cleanliness':

- In 2021, 6 internal audits had been made. Those visits concluded that the action plan was progressing well and the audit did not find any deviations from the plant management expectations,
- In 2020, 3 external audits have been made (French regulator and WANO). Those visits showed an improvement of the quality of the radiological barriers for the control of contamination,
- In 2021, the findings from low-level reports on contamination control practices have been included into the action plan.

During the plant tour in the radiation-controlled area the IAEA experts observed the plant personnel performance and held discussions with plant personnel on the enhanced contamination control process and practices and did not find any deviations from the plant management expectations in the areas visited.

Conclusion: Issue resolved

7.4. CONTROL OF OCCUPATIONAL EXPOSURE

7.4(1) Issue: Radiological barriers put in place by the plant do not always ensure dose optimization.

The team noted the following:

- Dose constraints are not set at the plant. The corporate is assessing the new legislation which requests the use of dose constraints and will provide guidance to the plant in the future.
- For each entry to Radiation Controlled Area (RCA) an Electronic Personal Dosimeter (EPD) is required. For all visits to RCA the dose rate alarm of 1.6 mSv/h or higher is set. Minimal dose alarm is 200 microSv. The alarm settings are higher than the expected maximum dose rates indicated on radiation work permits and in the field.
- A radiography shot was planned in the RCA in room NB0525 in BAN building. The room is adjacent to an area outside the RCA. Erecting of barriers and shielding was requested during the planning phase to assure the value 7.5 microSv/h was not exceeded at the barrier. During the shot the maximum measured (measurement requested by the reviewer) value at the barrier was 24 microSv/h. The provisions were found ineffective.
- Two types of areas exist at the plant: supervised areas (dose rates from 0.5 microSv/h to 7.5 microSv/h) and controlled areas (>= 7.5 microSv/h). Borders of individual areas are marked. A lorry container with radioactive material was observed temporarily stored behind the BCU building. The area is used to perform measurement before sending radioactive material out of the station. The obligatory measurements (contact dose rate, dose rate at 1m distance and surface contamination) were being performed. The maximum value in contact was 10 microSv/h. The area was not posted and freely accessible to plant personnel.
- A shielding of 'orange material' storage area is installed in 2NB1014 room, level 22,85 m. The purpose of the shielding is to reduce exposure of the scaffolders working in adjacent area. The shielding had a gap which was not recognized by the plant.
- On 5 July 2017 an RP technician found out that barrier used at the radiography site was not placed according to the radiography plan. The Barrier was further from the site (in other words a wider area was barriered off) and not placed on the cage ladder as expected by the plan. This event was considered reportable to the regulator.
- In 2018 an 'orange area' was not barriered off for several days at the beginning of an outage. This was reported to the regulator.
- The permanent shielding observed in the room NB0525 of BAN building was torn and defective and thus less effective than had this not been the case. The room is used for radioactive waste handling. The situation was noted by the management team performing walkdown in parallel with the observation.

Without effective use of radiological barriers personnel radiation doses might not be optimized.

Suggestion: The plant should consider enhancing the effectiveness of radiological barriers used to ensure that personnel radiation dose is optimized.

IAEA Bases:

SSR- 2/2(Rev. 1)

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

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. … The programme shall make arrangements to maintain these doses as low as reasonably achievable.

GSG-7

6.46. Where the management of the facility has no direct in-house expertise in the work to be carried out by the contractor, it should restrict its involvement essentially to non-technical information gathering. The management of the facility should place the primary responsibility on the contractor for cooperation on the more technical aspects of the work, but should nevertheless be able to satisfy itself that the contractor has made adequate provision for achieving safe working conditions.

9.6. When the use of physical design features, including specific engineered controls to limit individual exposures, is impractical or inadequate, administrative controls should be considered to ensure that protection and safety is optimized….

9.8. The effectiveness of the shielding should be actively monitored by means of installed workplace monitoring instruments and/or by regular area surveys performed by suitably qualified personnel. Additional local shielding should be provided to reduce the radiation field as needed.

NS-G 2.4

3.20. The plant management should develop goals and objectives that support and complement established corporate goals. The plant goals and objectives should be commensurate with the expectations of the management of the operating organization and should include key performance areas of the plant and areas recognized as needing improvement. …

Plant Response/Action:

OSART 2019	**7.4(1) Issue:** Radiological barriers put in place by the plant do not always ensure dose optimization.	
RP area		
MP 4	**Strategic Coordinator**	**Operational Coordinator**
Action / Deliverable	Owner	Deadline
Implement the concept of dose constraint required by French regulations.	Operational Coordinator	Completed
Provide specific equipment to mark out orange areas.	Operational Coordinator	Completed
Create self-check and verification worksheets on the quality of orange area markings	Operational Coordinator	Completed
Address the case of rooms NB0525 and NB1014 (improved installation of biological protection)	Operational Coordinator	Completed
Have specific equipment to ensure the marking of containers at the BCU.	Operational Coordinator	Completed
Have specific equipment to ensure the marking of gamma radiographic inspections.	Operational Coordinator	Completed

Ensure 100% lifting of the hold points of the new or reinforced worker companies as part of the performance of radiography inspections.	Operational Coordinator	Completed
Write a note on biological shield management.	Operational Coordinator	Completed
Define a biological shield programme and ensure dosimetry experience feedback before the Unit 2 VP.	Operational Coordinator	Completed
Improve hot spot monitoring by ensuring the creation of a new inventory.	Operational Coordinator	Completed

Root Cause Analysis:

- Lack of robustness of radiological markings (orange areas, restricted areas, gamma radiography shots) due to lack of equipment and monitoring
- Lack of robustness of radiological markings due to container transfer (BCU)
- Provision of equipment for the entire French Nuclear Fleet and application of French regulations
- Insufficient knowledge of our hot spots, their identification, marking and biological shields installed

Progress of the action plan: 100%

Associated performance measurement since 2019:

No orange area / restricted area over the period

Forms of evidence to be provided:

- WANO and IN (Independent Nuclear Oversight) report on radiological markings
- Photos of new equipment implemented (safety bow markings, BCU, orange area markings, etc.)
- Self-check and monitoring worksheets
- Photos of NB0525 and NB1014
- VP Unit 2 biological shield installation programme and biological shield management worksheet
- Site hot spot mapping

IAEA comments:

The plant reviewed the issue, investigated all the circumstances associated with the provision of radiological barriers and came up with the following primary causes of the deficiency:

- Insufficient robustness of radiological barriers and markings (orange areas, restricted areas, gamma radiography areas) due to lack of necessary demarcation equipment, management attention and monitoring
- Insufficient awareness of plant staff regarding hot spots in radiological controlled areas, and lack of identification, marking and biological shielding

The plant had developed and implemented an action plan which included organizational and technical provisions. These were focused on enhancing radiation protection arrangements and practices to ensure the provision of radiological demarcation for ‘hot spots’ in radiological controlled areas and activities related to radiography activities. All main arrangements and measures were planned and implemented in a timely manner, including:

- development and implementation of new operating procedures and guides regarding the management of biological protections during outages for contractors and plant personnel
- introduction of regular ‘safety messages’ for contractor and plant staff dedicated to the process and practices of managing ‘orange zones’ and radiography activities
- introduction of an enhanced practice for identifying, marking and shielding ‘hot spots’ when necessary, taking into account dose during installation, dose reduction due to shielding and dose during removal
- introduction of the practice for the classification of existing hot spots and their monitoring via a mapping process
- updated list of all hot spots with indication of the overall dose rates and information on the radiation conditions on entrance doors to the rooms
- introduction of ‘orange zone’ signage and demarcation of the working areas with suitable ‘fenced off area’ marking and signage and regular monitoring of radiation conditions according to the guide on the handling of ‘hot spots’

The plant applied identical arrangements to radiography activities, supported by newly introduced organizational changes such as:

- attendance of a department representative, fully competent and knowledgeable in the area of risk prevention, prior to starting radiography activities. Their role was to assist workers during the pre-job brief and to share just in time operating experience
- introduction of ‘hold points’ when activities are performed by newly hired workers or first-time performers and the introduction of independent verification of activities by the second representative from the risk prevention department.

These plant efforts were supported by relevant performance measurements within the plant’s Integrated Management System, Corporate evaluations and baselines and operational and management records.

The efficiency of the implemented corrective actions was assessed in line with new baseline limits identified by the corporate and specific reviews of the ‘orange zones’ and radiography activities conducted by the dedicated plant staff.

Since 2019, the plant had not experienced any reportable event caused by a lack of quality of non-robust markings (relatives to orange zones and radiography process) due to completion of the internal action plan.

In 2021, 3 internal audits had been carried out on orange areas. They concluded that the action plan had been completed and did not find any deviation from the plant expectations.

In 2021, 8 internal audits have been carried out on radiography activities. They concluded that the action plan had been completed and highlighted the professionalism of contractors in terms of risk management.

At the end of 2020, an internal audit carried out by EDF corporate inspection department entitled ‘Global Evaluation of Excellence’ stated that orange zone and radiography activity markings and demarcation were a strength of the Civaux NPP organization.

Every year, low level events were analyzed via a global review of the ‘Orange areas’ and ‘Radiography’ sub-processes. Conclusions from low level event reports were included in the action plan.

During the plant tour in the radiological controlled areas, the IAEA experts observed plant personnel performance, held discussions with plant personnel on the enhanced processes and practices to manage hot spots and radiography areas and did not find any deviations from the plant management expectations in the areas visited.

Conclusion: Issue resolved

8. CHEMISTRY

8.1. ORGANIZATION AND FUNCTIONS

The Nuclear Logistics, Environment, Chemistry (LNE) department management has an integral role in the chemistry training programme, including determining the training programme content, periodic review of the needs and assessing final competencies. The chemistry training coordinator from the Training Department and LNE department management analyse the staff training performance and the skills periodically to improve staff performance (such as improvement of skills for activities that are infrequently performed, especially in outages). For example, the chemistry department implemented training for aligning a boron meter on a virtual reality mock-up. The team considered this a good performance.

8.2. CHEMISTRY PROGRAMME

The units' stator cooling water system cools the stator bars using demineralized water with a neutral pH in hollow copper conductors. Because the copper hollow-core conductors are susceptible to clogging, a curative process was implemented to dissolve the deposits of copper oxide. A new way of conditioning has been developed by corporate engineering and 'piloted' at Civaux. This process involves conditioning the stator cooling water system at basic pH using an anion exchange resin. A layer of copper oxide forms on the surface and passivates the system, inhibiting the dissolution of copper and its reaction with oxygen which would form solid oxides that would block the hollow conductors. The team considered this as a good performance.

The plant has implemented ultraviolet (UV) treatment of cooling tower drain water with the purpose of limiting releases of amoeba. The UV stations enable the amoeba population to be killed off, particularly 'Naegleria fowleri', an amoeba that is pathogenic in humans. The UV stations also allow the plant to comply with health protection thresholds. The team considered this as a good practice.

8.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

The management and handling of chemicals at the plant is not performed in a way that ensures equipment and personnel safety. The team observed examples where chemicals were not properly labelled and stored. The team made a suggestion in this area.

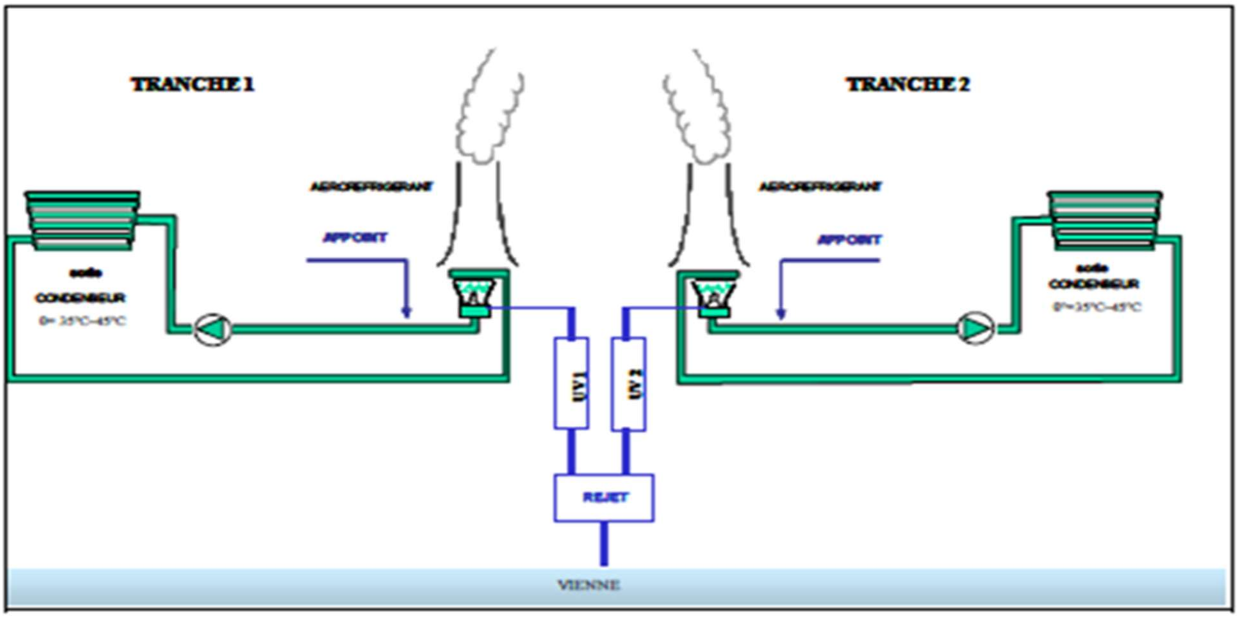
DETAILED CHEMISTRY FINDINGS

8.2. CHEMISTRY PROGRAMME

8.2 (a) Good practice: UV treatment of cooling tower drain water

The plant has implemented physical (ultraviolet) treatment of cooling tower drain water with the purpose of limiting releases of amoeba.

The treatment uses mercury-vapour lamps which emit quasi-monochromatic UV-C light at 254 nm, in the optimum band for the germicidal effect. The treatment is physical and has no impact in terms of releases of chemicals into the environment.



The UV stations enable the amoeba population to be killed off, particularly *Naegleria fowleri*, an amoeba that is pathogenic in humans. The UV stations also allow the plant to comply with health protection thresholds.

8.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

8.6(1) Issue: The plant process and practices for managing chemicals do not always ensure effective control and use of chemical substances within some plant departments and groups.

Although the plant has developed a chemicals control programme, the team found the following:

- There is no procedure issued for managing and handling chemicals on site;
- There is no generic and refresher training for staff who handle and manage substances in their work (for example: in the chemistry department, only initial training was provided);
- There is no common practice for field observation of chemical handling practices on the site.

During field observations the team noted:

- Smaller containers with chemicals transferred from an original container are not properly labelled (e.g.: in the oil and solvent store, the labels put on transfer containers have only the name of chemical products and information regarding hazards and do not always have pictograms);
- In the Turbine Hall Unit1 (SIT) sampling room:
  - An original plastic bottle containing Potassium chloride 3 mol/l (3 N) was found expired, with a ‘validity date’ of 10.09.2019;
- In the Turbine Hall Unit 2 (SIT) sampling room:
  - An empty plastic container (about 5 l), used for water storage was found labelled with ‘validity date’ of 07.05.2013;
- In the Nuclear Auxiliary Building Laboratory, Unit 1:
  - In the storage cabinet, a plastic bottle with Vaseline was found expired, with a ‘validity date’ of 28.08.2018
- In the Safeguard Auxiliary Building (BAS-6.48) Unit 2:
  - A bottle with unknown liquid was found with an informal (handwritten) label;
- In the Maintenance workshop:
  - In the first storage cabinet, a glass bottle with liquid (about 1 l) was found with no ‘manufacture date’, and no ‘validity date’ or pictograms. The Maintenance Manager did not know who brought it, or what it was used for;
  - An empty spray bottle (about 1 l) was found with an illegible label, with no pictogram and with an expired ‘validity date’;
- In the storage zone for gas cylinders:
  - Two mixed gas cylinders were found with an expired ‘validity date’ (1.09.2019), stored in the area for full gas cylinders;
  - All gas cylinders (except for mixed gas cylinders) were found to be without a ‘validity date’;
  - In the storage zone for gas cylinders from Unit 1 and the chemistry laboratory, all bottles were found to be without a ‘validity date’;
- In the I&C workshop:

  - Two bottles with Ethanol (about 100 ml each) were found with illegible labels, without a ‘transfer date’ or ‘validity date’;
- In the Mini Waste Collection Area in the Turbine Hall, Unit 2:
  - Three water bottles containing an unknown liquid (about 1.5 l each) were found without any information; the liquid waste is stored in inappropriate bottles and without any label.

Shortfalls in the process and in the practices for control of chemicals may lead to inappropriate chemical usage and adverse effects on equipment and personnel safety.

Suggestion: The plant should consider improving its process and practices for managing chemical substances to ensure equipment and personnel safety.

IAEA Basis:

SSR – 2/2 (Rev. 1)

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

SSG – 13

9.3 The use of chemicals and other materials at the plant, including those brought to the plant by contractors, should be controlled in accordance with clearly established procedures. The intrusion of non-conforming chemicals or other substances into plant systems can result in deviations in the chemistry regime, leading to component and system damage or increase of dose rates. The use of uncontrolled materials on the surfaces of the components may also induce damage.

9.7. Procedures for the procurement, storage, replacement and ordering of chemicals and other substances, including hazardous chemicals, should be made available.

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

9.10. When a chemical is transferred from a stock container to a smaller9.10. When a chemical is transferred from a stock container to a smaller container, the latter should be labelled with the name of the chemical, the date of transfer and pictograms to indicate the risk and application area. The contents of the smaller container should not be transferred back into the stock container. Residues of chemicals and substances should be disposed of in accordance with plant procedures. The quality of chemicals in open stock containers should be checked periodically.

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

9.13. Management should periodically carry out walkdowns of the plant to9.13. Management should periodically carry out walkdowns of the plant to evaluate the effectiveness of the chemistry programme and to check for uncontrolled storage of chemicals.

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

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

Plant Response/Action:

<table>
<tr><td>OSART 2019</td><td colspan="4" rowspan="2">8.6(1) Issue: The plant process and practices for managing chemicals do not always ensure effective control and use of chemical substances within some plant departments and groups.</td></tr>
<tr><td>CH area</td></tr>
<tr><td>MP 2</td><td colspan="2">Strategic Coordinator</td><td colspan="2">Operational Coordinator</td></tr>
<tr><td colspan="3">Action / Deliverable</td><td>Owner</td><td>Deadline</td></tr>
<tr><td colspan="3">Check the compliance of hazardous product labels - SMT maintenance workshop (A0000224408)</td><td>Maintenance [SMT]</td><td>Action closed on 30/04/2021</td></tr>
<tr><td colspan="3">Perform a check of the compliance of hazardous product labels - IAE maintenance workshop (A0000224413)</td><td>Operational Coordinator</td><td>Action closed on 17/06/2021</td></tr>
<tr><td colspan="3">The station should consider improving its chemical management process and practices to ensure equipment and personnel safety (A0000102730)</td><td>Risk Prevention Department (SPR)</td><td>Action closed on 25/11/2020</td></tr>
</table>

The Civaux CNPE has an integrated management system approach (IMS) with a basic process "Chemical and asbestos risk" is managed in SP 4. PMR by the safety engineer with annual review. During the Review of this basic process on the Dangerous Chemical Agent (ACD) part, the management of hazardous products on the Civaux CNPE was identified as a weakness to be addressed.

The internal organisation must be structured so as not to be based solely on the SPR department, otherwise the organisation can never be viable on the management of hazardous products. Vigilance must be paid to this topic, even if the number of events remains low.

The action plan on hazardous chemical agents was presented to the MP4 committee in May 2021. The aim is to meet the requirements for registering hazardous chemical agents and to take into account the OSART and PEER-REVIEW recommendations to improve the subject.

Root Cause Analysis:

The lack of knowledge of the requirements for chemicals has led to errors in their labelling and storage.

Progress of the action plan:

To improve in the field of "ACD" we have set up a more comprehensive action plan. The network of HU champions is formed with a first meeting held in December 2021. The aim is now to maintain this network by scheduling network appointments for 2022 (due every two months as a first step). ACD champions must have ‘Training in prevention rules for the handling of chemical products’ to help them in their role and function. As a result, an exchange with their managers is planned to request their registration for 2022 or to register them for 2023. The aim is to answer a large part of their questions on the subject through this training.

An organisational note is used to define and decide on how to operate, this is to be finalised (D5057ENVNT153), it is in progress (planned to complete at the end of May).

A key requirements sheet has been produced containing the elements important for controlling chemical risk so that it can be presented at the managers' workshop on 28 February (safety message ACD put on this week).

An inventory and progress of actions on the management of hazardous products at the Civaux CNPE will be presented to the Committee on 23 May. Support for ACD champions in the field is the priority of the SPR department over the 1st half of 2022.

Action	Deliverable:	Owner	Deadline	Status
A0000176536	**Train ACD group contacts within the SPR department** **Justification:** Seirich Training (EvRC) Conducted in December 2020 chemical department personnel Chinon training on 'Prevention rules for the handling of chemical products' planned for 3 SPR employees: June 2021 To be expected for 2022: site training for department referent FDSe training March 2021	Operational Coordinator	31/02/2021	completed 30/03/2021
A0000176571	**Update the Register of Hazardous Products and the EvRC (SEIRICH)** **Justification:** The register of hazardous products of the Civaux CNPE is being updated by SPR. The template of the register has been revised to be based on the Pre-Commissioning Plan. An inspection of the various storage locations identified is being carried out by the apprentice Engineer in the SPR department, the apprentice DUT HSE and technicians in the SPR department. The industrial safety Work Coordinator trained on 10 December in the Seirich tool to update the EvRC. Updating the registry is used to update the Seirich tool. Following the ASN inspection (Lubrizol experience feedback), the question of the CNPE's existing register was questioned, particularly on the point of self-reliance. As a result, after studying the condition and the findings made, it is proposed to produce a document allowing each department to carry out inventories check every quarter. The registry template has been optimised based on the Establishment Plan Listed by identifying storage locations on the CNPE. Tabs by storage area	Operational Coordinator	10/12/2021	completed 13/12/2021

	containing the product description (trade name) with a hyperlink to the FLU under OLIMP (national tool for managing hazardous products), the hazard statements and associated pictograms, the physical state, the maximum quantity usually stored. Technical assistance for the updating of the chemical risk assessment on the Civaux CNPE took place from 15 July 2021 with a first step being an inventory check with the impacted services in order to make the data contained in the register reliable. This service took place over 3 months. The NEODYME service was suddenly decreed (resignation of the person in charge of the file), the services to be finalised are PLS warehouse / LNE LN / SCP / SMT and SPR. *Finalised items are incorporated into the registry available in SharePoint and accessible to all. The service with an obligation to produce results must finalise the missing services.*			
A00002247 63	**Improve risk management in the field in relation to hazardous products** **Justification:** 1. The frame of reference is being reformed and rewritten on the SSQ side (alternating) 2. A meeting with the ACD champions is scheduled for 7 December with a preparation meeting on 6/12 3. On the issue of fireproof cabinets with several exchanges with HALECO, we must provide a status during the next inspection of cabinets with photos and follow to decide on the status of our current cabinets and identified those that can be repaired and those that cannot to downgrade them to storage cabinet hazardous products but not flammable 4. Training completed for 3 SPR staff and request made for 2022 for 3 others A post-EGE action plan is carried out and monitored as part of the ACD review.	Operational Coordinator	31/10/2021	completed 02/12/2021
	Update the organisation document on chemicals (D5057ENVNT153) **Justification:** An organisational note is used to define and decide on how to operate, this is to be finalised (D5057ENVNT153), it is in progress (planned to complete at the end of May).	Operational Coordinator	31/12/2021	completed 30/05/2022
A00001765 80	Report on the condition on the circuit for the control of hazardous products on the site **Justification:** Exchanges were made with the purchases and the warehouse to understand the	Operational Coordinator	31/07/2021	completed 24/08/2021

	organisation, the circuit and the internal operation when ordering hazardous products. A check is carried out by the purchases during the orders under Dauphin to check the presence of the hazardous product under OLIMP but without verification of the validation on the Civaux CNPE At the warehouse, a list of hazardous products is checked at the storage sites and the quantities (16 CMR products only).			
	Monitor the performance of VLEP checks **Justification:** Bureau Véritas service is in charge of carrying out VLEP measurements at the Civaux CNPE. The measurement strategy is carried out through our chemical risk assessment under SEIRICH (assessment in relation to the single document of the Civaux CNPE). The ordering party for this service is the SPR department. However, the correct implementation of the measurements requires a strong involvement of the functional groups concerned. The 2022 strategy has been defined in the light of our chemical risk assessment but also taking into account the associated regulatory changes to ensure compliance with the exposure regulations for our workers. This service is also monitored at national DPN level. As a matter of principle, one day per month of work is defined to carry out measurements and then additional days in relation to the activities carried out on the site.	Operational Coordinator	31/12/2022	Ongoing in 2022
	Create a network of ACD (hazardous chemical agents) champions with a referent for each department at the Civaux CNPE **Justification:** The network of HU champions is formed with a first meeting held in December 2021. The aim is now to maintain this network by scheduling network appointments for 2022 (due every two months as a first step). ACD champions must have ‘Training in prevention rules for the handling of chemical products’ to help them in their role and function. As a result, an exchange with their managers is planned to request their registration for 2022 or to register them for 2023. The aim is to answer a large part of their questions on the subject through this training.	Operational Coordinator	30/12/2021	completed 12/12/2021
	Set up regular meetings between HU champions and SPRs Justification: The network of HU champions is formed with a first meeting held in December 2021. The aim is now to maintain this network by scheduling network appointments for 2022 (due every two months as a first step). ACD champions	Operational Coordinator	31/12/2022	First meeting on 7 December 2021

	must have 'Training in prevention rules for the handling of chemical products' to help them in their role and function. As a result, an exchange with their managers is planned to request their registration for 2022 or to register them for 2023. The aim is to answer a large part of their questions on the subject through this training.			
	Carry out a manager's workshop to indicate the expectations to managers and carry out a "focus" Justification: During the week of the safety message on hazardous chemical agents, a manager workshop was carried out in the form of a focus on the organisation and management of cabinets of hazardous products (hazardous products including flammable products) in parallel with a reminder on the expectations and the associated regulations. This workshop was carried out in collaboration with the fire protection officer and the chemistry department at the CNPE.	Operational Coordinator	31/03/2022	completed 28/02/2022
	Carry out a workshop for contractors (GIE) on the theme of hazardous chemical agents. Justification: On the same principle as the manager workshop to carry out for managers during the safety message week on hazardous chemical agents, the same session will be organized for contractors affiliated to the GIE.	Operational Coordinator	31/12/2022	Date to be defined in 2022
	Carry out an inventory of the fire-resistant cabinets Justification: The PCIs require and track the integrity of the fire-resistant cabinet (owner department) once a year. In addition, our PGAC carries out an inspection every 6 months of the fire-resistant cabinets at the CNPE and brings it up.	Operational Coordinator	31/12/2021	completed 31/12/2021
	Purchase of fire-resistant cabinets Justification: In view of the state of repair of the fire-resistant cabinets at the CNPE, it is requested that 10 new fireproof cabinets be purchased to replace those that are too deteriorated. Cabinets that can still be used will be downgraded as simple safety cabinets for non-flammable products. The aim is to replace our fleet of fire-resistant cabinets on the site as we go on. For specialists wishing to make their own purchase of cabinets, a single type of cabinet is required to be respected. The aim is to be able to set up overall maintenance on the site of all our fire-resistant cabinets in the long term.	Operational Coordinator	31/12/2022	In progress
	Create a key requirement sheet on hazardous chemical agents	Operational Coordinator	28/02/2022	completed 18/02/2022

	Justification: This key requirement sheet on chemical risk management was presented during the manager workshop on the safety message of hazardous chemical agents. This sheet is then transcribed in the VMT framework under Caméléon by MP1 Process Steering			
A0000176577	Update current notes to clarify management of hazardous products Justification: Update on FLU management at the Civaux CNPE with the installation of a dedicated SHAREPOINT area: - OLIMP direct access - FLU request online form - Request tracking - ECM link note "Request for FLU" The note has been updated by CA Sécurité and a communication medium has been prepared for distribution to the site heads of departments. (D5057SPRCOF31)	Operational Coordinator	31/12/2021	completed 07/12/2021
A0000213668	Create FLU requests on products used at LNE CE Justification: All FLU requests were made to the SPR department. They are awaiting validation by the SPR department or the medical service. Upon receipt of the approved FLUs, they will be incorporated into the new AGELIOS software, each chemical will be connected to its compliant FLU. Compliant FLUs are classified in a network file under 11-Laboratory-Chemicals-FLU. The action concerning the updating of 100% of the FLUs of the chemicals used by the laboratory is completed.	Operational Coordinator	31/12/2021	completed 20/12/2021
A0000104985	Purchase of chemical management software from LNE CE (stock status, management of product expiry dates, and management of FLU due dates)	Operational Coordinator	31/12/2021	completed 14/12/2021

IAEA Comments

The plant reviewed the issue, investigated all the circumstances associated with the processes and practices used in departments and working groups for the handling of chemicals and identified the following primary causes of the deficiency:

- Lack of plant personnel’s knowledge of requirements and management expectations for the handling of chemical products, leading to errors in labelling and storage of respective consumables.
- Insufficient attention within the plant management system to the communication and verification of chemical risks associated with chemical agents on the plant.
- Lack of efficient software tools to ensure a prompt and easy way of creating comprehensive specifications, highlighting specific characteristics, selecting and tracing chemical products and consumables for routine, daily use.

The plant had developed and implemented an action plan, including organizational and technical measures aimed at improving its management system in terms of processes and practices for the handling of chemical products.

As part of the action plan, the plant had created documents to develop awareness through ‘safety messages’ to be delivered to the plant staff twice a year. This communication takes place over a week, with a focus on different daily topics, covering requirements related to the use of chemicals. On the Monday of these two weeks, chemical risks as well as handling and storage of chemicals were addressed.

The plant significantly updated AGELIOS software for the tracking and checking of chemical products using the expertise of experienced personnel. The AGELIOS software, implemented for laboratory technicians, improved the traceability, stock management and labelling of chemicals.

The plant had created a network for chemical hazards ‘champions’ identified within the plant’s departments and groups, to ensure their familiarization with the new systems and requirements and extended their knowledge of chemical risks. These eleven ‘champions’ have been duly appointed in each department involved in the storage or handling of chemicals products.

A set of training sessions was planned for the chemical hazard ‘champions’ in May – June 2022 involving the corporate, as well as plant specific training courses dedicated to safe practices for handling chemical products. A refresher course on knowledge and requirements was planned during these two training sessions, based on various documents (register, safety messages, observation techniques, internal control point).

The plant had significantly improved the chemical product register, listing 342 chemical products used during daily operations, verified, and validated by the medical department and responsible representatives of the plant management.

Chemicals used by contractors were clearly identified in the ‘prevention plan’ department.

The plant key performance indicators associated with handling of chemical products were as follows:

	Year	2019	2020	2021	May 2022
OLIMP software	Number of products registered	/	290	275	342
	Number of products awaiting renewal	/	106	1	11
	Number of products in draft	/	81	1	20
Caméléon software	Number of actions	1	4	12	4
	Number of field checks	13	22	26	11

During a walkdown in the industrial areas, the team observed the plant personnel performance and practices for labelling and storage of chemical products and did not note any significant deviations.

However, the plant still needed some time to embed the new approaches to handling chemical products and to verify the understanding and work of plant personnel in this area in order to ensure the safe and sustainable control of the use of chemical substances.

Conclusion: Satisfactory progress to date

9. EMERGENCY PREPAREDNESS AND RESPONSE

9.1. ORGANIZATION AND FUNCTIONS

The corporate organisation arranges benchmarking of the Emergency Preparedness area twice per year, where the EdF plants exchange experience. However, the plant Emergency Preparedness workers have not participated in any international benchmarking since 2015. The team encouraged the plant to participate in international benchmarking.

The emergency organisation fills key positions from management. There is a special process which assigns the skills and experiences for head of Emergency Response Organisation (PCD1). The PCD1 declares that they have these skills then the plant manager and the corporate organization approves the PCD1 licence. The team considered this as a good performance.

9.2. EMERGENCY RESPONSE

The plant has comprehensive planning, documentation and equipment for effective emergency response. However, the team observed that the emergency response arrangements do not cover all the expected emergency response aspects. For example, emergency classification system and notification time limits do not correspond with IAEA standards, lack of earthquake fax communication equipment in Emergency Control Centre and problems using emergency documentation. The team made a suggestion in this area.

9.3. EMERGENCY PREPAREDNESS

The plant provides special decision-making training for head of emergency organization (PCD1). The PEPPS (Preparation of Expert and decision-makers by Storytelling and Serious Game) this is a tool to prepare decision makers for the reality of emergency management of an actual event. The team considered this as a good performance.

The plant has prepared for an unexpected situation where there is limited access to plant areas by placing 7 secured cabinets in strategic rooms in the plant. The cabinets contain all emergency management documentation. As an additional measure, each head of emergency organization (PCD1) has a secure USB memory stick which contain all emergency documentation in electronic format. The team recognised this as a good performance.

DETAILED EMERGENCY PREPAREDNESS AND RESPONSE FINDINGS

9.2 (1) Issue: The plant emergency classification, documentation, notification times and notification equipment do not always guarantee the effectiveness of the emergency response.

During the review the team noted:

- In the plant nuclear emergency classification systems:
  - The plant uses the corporate level base classification system, which does not provide information about the seriousness or the progression of the event.
  - The classification system uses different physical plant parameters, but it does not relate them to the emergency classification.
- The documentation available in the Emergency Control Centre (BDS) to be used for real events and for exercises is not the same.
- The plant Emergency Plan (PUI) does not contain deadlines for the information to be provided to the local and national authorities.
- There is no V-SAT (earthquake-resistant system) satellite FAX in the Emergency Control Centre (BDS).

Without clear emergency classification, documentation, notification times and notification equipment, the effectiveness of emergency response cannot be assured.

Suggestion: The plant should consider enhancing the process for emergency classification, documentation, notification times and notification equipment.

IAEA Bases:

GSR Part 7

5.14. 'The operating organization of a facility or activity in category I, II, III or IV shall make arrangements for promptly classifying, on the basis of the hazard assessment, a nuclear or radiological emergency warranting protective actions and other response actions to protect workers, emergency workers, members of the public and, as relevant, patients and helpers in an emergency, in accordance with the protection strategy (see Requirement 5). This shall include a system for classifying all types of nuclear or radiological emergency as follows:

(a) *General emergency* at facilities …

(b) *Site area emergency* at facilities …

(c) *Facility emergency* at facilities…

(d) *Alert* at facilities…

(e) *Other nuclear or radiological emergency* for an emergency…'

5.16. 'The emergency classification system … It shall be ensured that any process for rating an event on the International Nuclear and Radiological Event Scale (INES) does not delay the emergency classification or emergency response actions.'

5.17. 'For facilities and activities in categories …. These arrangements shall include suitable, reliable and diverse means of warning persons on the site, of notifying the notification point (see paras 5.41–5.43, 6.22 and 6.34) and of communication between response organizations.'

6.17. 'Each response organization shall prepare an emergency plan …… The emergency plans shall be coordinated with other plans and procedures that may be implemented in a nuclear or radiological emergency, to ensure that the simultaneous implementation of the plans would not reduce their effectiveness or cause conflicts.’

GS-G-2.1

Appendix VI. RESPONSE TIME OBJECTIVES

Identifying, notifying and activating (the objective is timed from the time at which conditions indicating that emergency conditions exist are detected)							
Classify the emergency (declaration of emergency)	<15 min			<15 min			<15 min
Notify local authorities (PAZ and UPZ) after classification[a]	<15 min			<15 min			<1 h
Fully activate emergency organization	<2 h	<6 h	<12 h	<2 h	<6 h		<2 h
Notify all States within the UPZ	<1 h		<1 h			<1 h	
Notify the IAEA			<2 h			<2 h	

Plant Response/Action:

OSART 2019 EPR area	**9.2 (1) Issue:** The plant emergency classification, documentation, notification times and notification equipment do not always guarantee the effectiveness of the emergency response.	
MP 3	**Strategic Coordinator**	**Operational Coordinator**
Action / Deliverable	Owner	Deadline
Classification Address the issue of classification according to the IAEA frame of reference in relation with the Corporate Emergency Response Organisation (BONC) branch of the DPN	Operational Coordinator	Processed by UNIE GPEX See: Note D455031111053 para 6 of 16-12-2021
Documentation - Provide documentation for emergency exercises that is identical to that applicable in real-life conditions - Deploy the DSR PUI index E incorporating the IAEA classification - Support the deployment of the DSR PUI index E to the crisis team members - Support the deployment of the "GUEPARD" DA for the launch of alarms (PCD1 & PCL1)	Operational Coordinator	Completed 31/12/2020 Completed 30/06/2021 Completed 30/06/2021
Communication deadlines - Support the DSR PUI Ind E and DA "GUEPARD" **Means of communication** - Support the DSR PUI Ind E + DA "GUEPARD" (PDF presentation for the launch of alarms)	Operational Coordinator	Carried out 2 weeks max before deployment

Root Cause Analysis:

The CNPE is in compliance with the EDF frames of reference defined at DPN level.

Progress of the action plan:

BONC response at corporate DPN level:

The IAEA classification was as planned incorporated into the DSR PUI so-called E index. It was also a request from the ASN/DEU during the investigation of this file. The table in section 1.2.1 responds to this, as well as the message to the Prefect and the message followed by the accident (FA PCD 2.1).

In the alarm message, we also notify the type of Site Emergency Response Plan (PUI) (on the basis of pre-established criteria and thresholds) and if it is a radiological emergency situation by application of Article R 1333-85 of the Public Health Code "The person responsible for the nuclear activity causing a radiological emergency condition shall carry out an initial assessment of the circumstances and consequences of the condition and implement the necessary measures, including, where appropriate, those provided for in the internal emergency plan. It shall inform the competent authorities without delay of the occurrence of the radiological emergency situation."

Note: the alarm times are not included in the classification question, but specifications 39 and 40 deal with the staffing deadline. We can also argue about the adaptation and the increase in power of the organisations according to the condition, with the criteria of the LOIC which allow in the event of unfavourable developments to anticipate the triggering, and the PAM GAT/PUI sequence.

Associated performance measurement since 2019:

Deployment of DSR PUI which incorporates the classification of categories with regard to national note D455031111053 (5) "Thresholds associated with national criteria for the implementation of actions to combat climate and similar hazards"

The "reference" values are of two kinds:

- Classification criteria by category of climate hazards the procedure (D455031111053) para 6 page 20/41 (for the Civaux NPP)
- “Time” criterion (information periods)
  - Prefecture: See: FA PUI PCD1 (Ref.: D5057SURNT16)
  - ASN: Letter "Information and alerting procedure for the ASN on-call team" Ref.: CODEP-DEU-2021-000888 (Notify as soon as possible and no later than 1 hour after the events concerned have been identified)

With regard to the PUI exercises carried out since 2020, the public authorities information criteria are met in accordance with the requirement (FA PUI PCD1 & SI-Collaborative).

IAEA Comments

The plant identified the root cause as Civaux NPP being in compliance with the EDF frames of reference which were not fully aligned to the IAEA guidance.

The actions taken address the issue. The plant has enhanced the process for emergency classification, documentation, notification times and notification equipment.

The classification scheme has been updated to closely align with IAEA guidance although some minor refinements exist.

While the plant Emergency Plan still does not contain deadlines for the information to be provided to the local and national authorities, in practice the plant met the IAEA notification times. This was demonstrated in drill reports from 2020. The documents for Emergency Preparedness exercises and emergency use were both controlled and identical.

A means of communication in the event of an extreme external hazard such as a beyond design basis earthquake had been ensured.

The Emergency Preparedness drills since 2020 have proved the effectiveness of the plant's response to emergencies.

Conclusion: Issue resolved

10. ACCIDENT MANAGEMENT

10.1. ORGANIZATION AND FUNCTIONS

The scope of the Severe Accident Management practical training, exercises and drills are not sufficient to maintain an adequate level of proficiency of the personnel involved in the implementation of the severe accident management guidelines at the plant. The team made a suggestion in this area.

The plant has revised the severe accident management training material to include table top exercises and will start implementing this training during the second half of 2020. The team also noted that the drill programme for 2020 includes a multi-unit accident with fuel damage. The team encouraged the plant to continue with these improvements planned for 2020.

The team at the plant responsible for deploying the FARN equipment have a comprehensive practical training programme followed by regular drills where the equipment is deployed in all weather conditions and in disrupted environments which could necessitate the wearing of radiological protection suits. The team recognized this as a good practice.

10.2. OVERVIEW OF THE SEVERE ACCIDENT MANAGEMENT PROGRAMME

Although the plant has recently implemented the Extreme Situation Team which would facilitate the management of a multi-unit accident; there has been no training or drills for multi-unit severe accidents. Further, the severe accident management programme does not address severe accidents involving fuel in the spent fuel pools. The team made a suggestion in this area.

10.5. PLANT EMERGENCY ARRANGEMENTS WITH RESPECT TO SAM

As part of the Fukushima Accident response, the plant has installed a 3.3 MW diesel generator for each unit designed to criteria that exceed the original design basis of the plant. With the installation of these diesels, the plant is more able to cope with extreme external hazards. The team recognized this as a good performance.

DETAILED ACCIDENT MANAGEMENT FINDINGS

10.1. ORGANIZATION AND FUNCTIONS

10.1(a) Good Practice: Training on the deployment of FARN equipment

The 70-person team at Civaux NPP responsible for deploying the FARN equipment have initial practical training provided by National experts from outside of EDF that includes:

- Stress management techniques
- Route clearance and rigging
- 4-wheel drive vehicle training
- Helicopter hoist operations
- Transport of dangerous substances
- Fitness maintenance programme

They then go on a 5-week cycle where one of the 5 weeks is devoted to realistic drills where the equipment is deployed in all weather conditions, in disrupted environments which could necessitate the wearing of radiological protection suits.

Benefits:

- Greater confidence in the successful and timely deployment of the emergency equipment.
- Experience and proficiency in using radiological protection suits outside of an RCA in an unstructured environment.
- Regular practice and proficiency in all aspects of the deployment of the emergency equipment.


10.1 (1) Issue: The scope of the Severe Accident Management practical training, exercises and drills are not sufficient to maintain an adequate level of proficiency of the personnel involved in the implementation of the severe accident management guidelines at the plant.

The team noted the following:

- The training on severe accident management for the local technical support team (ELC) and the emergency director (PCD-1) consists of a 3-hour lecture which does not include any table-top exercises or drills to familiarize and provide proficiency of these personnel on use of the Severe Accident Management Guidelines (GIAG).
- The drills for the emergency response personnel (local technical support team and emergency director) did not include the use of the Severe Accident Management Guidelines (GIAG).
- The training on the on-site pumps and compressors used in accident mitigation does not include practical training such as starting the equipment and so there is no documented evidence that the responders would have previously started the equipment.

Without adequate practical training, exercises and drills the severe accident management guidelines might not be applied in an efficient manner.

Suggestion: The plant should consider extending the scope of the practical training, exercises and drills to ensure an adequate level of proficiency of the personnel involved in the implementation of the severe accident management guidelines at the plant.

IAEA Bases:

SSR-2/2 (Rev1)

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

NS-G-2.15 (Superseded by SSG-54)

2.29. The overall form of the guidance and the selected amount of detail should be tested in drills and exercises. Based on the outcome of such drills, it should be judged whether the form is appropriate and whether additional detail or less detail should be included in the guidance.

3.104 The training should be commensurate with the tasks and responsibilities of the functions; hence, in-depth training should be provided for the key functions in the severe accident management programme, that is, the technical support centre evaluators, decision makers and implementers.

3.109 Exercises and drills should be based on appropriate scenarios that will require the application of a substantial number of procedures and guidelines. Results from exercises and drills should be fed back into the training programme and, if applicable, into the procedures and guidelines as well as into organizational aspects of accident management.

SSG-54

2.98 Personnel responsible for performing accident management measures should be trained to acquire the required knowledge, skills and proficiency to execute their tasks. A comprehensive training programme for accident management should be prepared that includes the interfaces with emergency preparedness and response. Training should include a combination of techniques, such as classroom training, drills, tabletop exercises11 and the use of simulation tools.

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

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

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

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

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

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

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

Plant Response/Action:

<table>
<tr><td colspan="2">OSART 2019</td><td colspan="3" rowspan="2">10.1 (1) Issue: The scope of the Severe Accident Management practical training, exercises and drills are not sufficient to maintain an adequate level of proficiency of the personnel involved in the implementation of the severe accident management guidelines at the plant.</td></tr>
<tr><td colspan="2">AM area</td></tr>
<tr><td>MP 6</td><td colspan="2">Strategic Coordinator</td><td colspan="2">Operational Coordinator</td></tr>
<tr><td colspan="3">Action / Deliverable</td><td>Owner</td><td>Deadline</td></tr>
<tr><td colspan="3">Expand practical training and reflex training of emergency response team members in severe accident management
Update the COCA4 training of OPs to incorporate a severe accident response guide scenario
Incorporate severe accident response guide training into the training of Deputy Shift Managers (D5057NSCDT04)
Incorporate severe accident response guide training into safety engineer training (D5057SURNT298)
Carry out NT200 refresher training of operations crews every 4 years with one day on the severe accident response guide on the simulator
Carry out NT300 refresher training of safety engineers every 4 years with one day on the severe accident response guide on the simulator
Train on-call ELC team members 1, 2, 2.1; PCL 1, 2, 2.1; PCD 1, 2, 2.1 in initial and refresher training on the severe accident response guide in CRGC</td><td>Operational Coordinator</td><td>completed

2021

2022

2022

2018-2019
2022-2023
2020-2021

After VD2s
2022-2023</td></tr>
<tr><td colspan="3">Expanding emergency response team exercises to include severe accident management
Carry out emergency exercises up to the severe accidents</td><td>Operational Coordinator</td><td>completed
2020-2021-2022</td></tr>
</table>

Root Cause Analysis:

The station only applied EDF frames of reference for training and reflex training in emergency response management until 2019. It has since incorporated the IAEA frames of reference to extend its continuous improvement in severe accident management.

Progress of the action plan as at 31/12/21:

- **Operators (OP)**
  - **Initial training:** During the initial COCA1 training (T-43852007-2020-000153), operators are trained for one day on the thermal-hydraulic and fuel phenomena linked to a severe accident and then on the use of the severe accident response guide instruction (room). The COCA4 training update (T-43851001-2020-018316 DRACOCA4) in the summer of 2021 requires the incorporation of a severe accident response guide scenario (outage engineer request email of 02/04/2021). At present, the only scenario available leads the installation to the severe accident response guide entry criterion; the simulator operating scenario in AG is not yet developed.
  - **Refresher training:** The national operating team refresher training programme (NT200) provides for one day of severe accident response guide training on the simulator every 4 years (last due date 2018/2019 and next due date 2022/2023).
- **Deputy Shift Manager (CED):**
  - **Initial training:** there was no corporate specification requiring the deputy shift managers to carry out initial training (severe accident response guide) on the severe

accident response guide (no TOTEM specific to the deputy shift manager profession), and the station-level report on the standard Deputy Shift Manager training plan (D5057NSCDT04) does not refer to severe accident response guide training either. As a result, the deputy shift managers on shift did not carry out this training when moving to ESE (January 2020). This deviation will be resolved at least by the participation of the Deputy Shift Managers in the severe accident response guide scenario planned under NT200 in 2022. Note D5057NSCDT04 is updated by the operations department to incorporate CIAG training into the standard training plan for future Deputy Shift Managers.

  - **Refresher training:** The national operating team refresher training programme (NT200) provides for one day of severe accident response guide training on the simulator every 4 years (last due date 2018/2019 and next due date 2022/2023).

- **Operations Shift Manager (CE):**
  - **Initial:** the initial severe accident response guide training is carried out by the CRGC (PCL1).
  - **Refresher training:** the severe accident response guide refresher training is carried out by the CRGC (PCL1).
- **Safety Engineer (IS)**
  - **Initial:** note D5057NSSSQ2 indicates that safety engineers must be trained in the CIAG during their initial training. It was detected that 4 of the 5 safety engineers in place did not carry it out. This deviation is completed by carrying out a severe accident response guide simulator scenario during the MCIS of the 1st half 2021. The consideration of the performance of the CIAG for future safety engineers has been taken into account by the SCF and the SSQ training contact. It was detected that document D5057SURNT298 "PUI expertise" does not include requirements for CIAG training for safety engineers and deputy shift managers. An update is made to incorporate this training for safety engineers. For Deputy Shift Managers, this is taken into account in station-level report D5057NSCDT04.
  - **Refresher training:** NT300 requested a simulator scenario in 2016-2017 and then in 2020-2021 ending in the severe accident response guide. The severe accident response guide refresher training frequency in NT300 is decided by GPSN.
- **ELC1, 2 and 2.1, PCL 2 and 2.1, PCD2 and 2.1, PCD1**
  - **Initial:** CRGC training trains the PUI people (ELC1, 2 and 2.1, PCL1, 2 and 2.1, PCD2 and 2.1, PCD1), in initial and refresher training, in the severe accident response guide (severe accident instruction). The current module of two to three hours is currently theoretical (in the classroom). During the third ten-yearly outage (VD2) at Civaux, the module will be upgraded to incorporate an exercise on documentation in the room based on highlighted APE procedures and an ongoing accident history. Note: reference of CRGC training documents. From the second half of 2022, the CRGC training will be increased from 2 to 3 days to incorporate the AG part. (Decision of 03 February 2022).
  - **Refresher training:** In 2020/2021 on Civaux, three PUI exercises were carried out from 09:00 ending at 03:00 in the severe accident response guide (09/11/2020, 03/12/2020 and 07/01/2021).

Scope of AG exercises:

- Multi-unit AG

The severe accident response guide does not take the multi-unit severe accident into account. The severe accident response guide is used to manage the AG's mitigation actions for a unit, in the same way as the CIA instructions. To manage the multi-unit aspects and to prevent the consequences of an initiating event from leading to several AGs, a multi-unit PUI called "SACA" (Climate and Environmental Safety Emergency Plan) has been in place since 15/11/2012. The staffing and resources necessary for multi-unit crisis management have been tested during emergency exercises since September 2020, and the station benefits from experience feedback from exercises of the same type, carried out on other EDF sites.

Since 13/11/2014, the evolution of the crisis frame of reference has made it possible to incorporate the implementation of the Nuclear Rapid Response Taskforce (FARN). FARN provides human and material resources on site in extreme conditions. It provides support to the local teams within 24 hours, with the start of work 12 hours after the alarm. It intervenes to recover supply of water, electricity and compressed air, thus limiting the deterioration of the condition. Several multi-unit exercises were conducted by the FARN on the fleet, including three qualification exercises for team members on the Civaux CNPE in 2013, 2014 and 2017. A corporate FARN exercise took place in Civaux at the end of June 2020.

- AG BK

The severe accident response guide does not take severe accidents into account in the Fuel Building pool. However, the AG procedures include the monitoring of the Fuel Building pool and refer to the appropriate instructions in the Chap. 6 RGE in the event of deterioration of the parameters. In exercises with loss of heat sink, a scenario can be carried out with the temperature rise of the SFP, which leads to the installation of one of the MLCs to supply cold water to the Fuel Building pool. These mitigation actions prevent fuel meltdown in the pool. The Fuel Building pool water supply systems are numerous (fire networks, SER tanks, discharge pool) with different pumps. These resources are tested regularly in exercises and during dedicated training days.

Since September 2021, Virtual Reality training has been set up to allow training on the industrial safety of fuel elements during off-site and on-site blackout conditions (condition H3). Two employees from the LNE department are trained as a Senior Trainer on this topic.

In February 2022, the FARN of the Civaux CNPE, during an annual simulator availability maintenance session, tried out the possibility of taking over in a severe accident condition in NRBC clothing.

Associated performance measurement since 2019:

Report on the training assessments of CNPE emergency response team members.

Report on CNPE crisis exercises.

Evidence:

Training and refresher training materials:

- DRACOCA4 T-43851001-2020-018316
- DRACOCA1 T-43852007-2020-000153
- DRACRGC T-43852007-2020-000030 /
- DOPCRGC T-43852007-2020-000062

Training programme:

- TOTEM for safety engineers, operations shift managers and deputy shift managers
- NT200 / NT300
- D5057NSCDT04 standard Deputy Shift Manager training plan

Emergency response team authorisation files

Report on emergency exercises

Report on tests of equipment used in AG

IAEA Comments

The plant identified that the root cause was that it had applied EDF Corporate frames of reference for the practical training, exercises and drills for emergency response management which were not fully aligned to the IAEA guidance in this area.

The plant had analyzed the suggestion and developed a significant number of actions to address the issue. The majority of these actions were complete with those remaining sufficiently developed to provide high confidence that they would be successfully completed.

The original issue was that there was good theoretical knowledge of severe accident management, but no practical training, exercises and drills as suggested in IAEA Safety Standard, SSG-54. The intent of this was to ensure the theoretical knowledge would be appropriately applied to mitigate a severe accident.

The plant response focusses both on the Initial Training and Refresher Training of those primarily involved in the mitigation of a severe accident. In both cases, the training now included practical exercises to ensure the theoretical knowledge could be applied.

From 2019, the plant had been performing drills that included the mitigation of severe accidents.

A similar situation now existed for the use of the site mobile and portable equipment. The training included practical exercises, and the equipment was used annually in Emergency Preparedness drills.

The plant response was appropriate. The practical training and exercises were now appropriate to maintain a sufficient level of proficiency of the personnel involved in the implementation of the severe accident management guidelines at the plant. This continues to be demonstrated during annual Emergency Preparedness drills.

Conclusion: Issue resolved

10.2. OVERVIEW OF THE SEVERE ACCIDENT MANAGEMENT PROGRAMME

10.2 (1) Issue: The current scope of the severe accident management programme does not address multi-unit severe accidents or severe accidents involving fuel in the spent fuel pools.

The team noted the following:

- The plant has a procedure to manage the loss of cooling to the spent fuel pools but a strategy to address severe accidents in the spent fuel pools has not been developed.
- There is no guidance in the latest version of the SAMG documentation (V4B) for the local technical support team (ELC) or the emergency director (PCD-1) on how to manage a severe accident involving fuel in a spent fuel pool.
- The latest version of the severe accident training material (CRGC for V4B dated 31/05/2017) does not include training on spent fuel pool severe accidents or multi-unit severe accidents.
- The drills have not included severe accidents on both units or the melting of fuel in a spent fuel pool.

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

Suggestion: The plant should consider broadening the scope of the severe accident management guidelines to include multi-unit severe accidents and severe accidents involving fuel in the spent fuel pools.

IAEA Bases:

SSR-2/2 (Rev 1)

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

NS-G-2.15 (Superseded by SSG-54)

2.16. The potential damage of spent fuel both in the reactor vessel and in the spent fuel pool or in storage should also be considered in the accident management guidance.

SSG-54

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

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

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

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

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

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

Plant Response/Action:

Analysis Conducted:

The cause of the issue is appeared that the plant applied EDF Corporate frames of reference for the Multi-Unit Severe Accidents and Spent Fuel Pool Severe Accidents.

Corrective Action Plan:

The plant corrective action plan consists of three main actions. These are:

- To this date, EDF has not considered management of multiple unit severe accidents on-site in its emergency plan.

In the event of a severe accident involving more than one unit, the plant would follow the corporate directives and relies on the nuclear rapid action force (FARN) to support the plant and manage severe accidents on all three reactors on site.

Simultaneously, emergency response members would manage the organization required to cope with multi-unit accidents (management of releases, prioritization between emergency entities – including FARN – resort to external support organizations…).

Nevertheless, the plant and corporate organization will start looking into any organizational and operational improvements which could be considered to enhance the severe accident management programme with consideration of concurrent multiple unit accidents on-site. The study will start in 2022.

- The EDF corporate position is to prevent a severe accident in the Spent Fuel Pool. On one hand, studies show the residual character of fuel damage, preventing its dewatering. Moreover, situations of loss cooling accident in the spent fuel pool are considered with a low kinetics and would give time to crisis teams (including national ones), to establish the more accurate means to be led by operators. On the other hand, quick emptying scenarios have been subjected to very significant improvements and have been made very unlikely: they are considered in the residual risk.

A benchmark will be led in order to identify if there are any interesting recommendations that could be considered in EDF prevention strategy.

- To perform drills and exercises at the plant in the meantime to the extent practical to support the above.

Progress to date:

Multi-unit beyond design basis accidents (including severe accidents) would be addressed in much the same way as multi-unit design basis accidents. This structure is already set out in documents such as PUI-SACA. A review of the organizational and operational improvements that could be considered to the severe accident management programme will be performed by VD4 of 1300MW fleet (2024-2025) where the approach will be documented. This could lead to minor changes to PUI-SACA, its reference documents and the associated training material to explain the approach to multi-unit severe accidents.

Procedures are already in place at the station to manage Spent Fuel Pool accidents. The company strategy is to prevent a severe accident from occurring in the Spent Fuel Pools. This is based on the probability of a severe accident within the Spent Fuel Pool not being significant.

Implemented the on-shift "Extreme Condition Team" operations organization to deal with emergency conditions on both units. This aids the plant responding the multi-unit severe accident.

The plant carried out an emergency exercise in 2020 with the FARN on the plant. FARN have sufficient equipment to manage an accident on both Units.

The plant carried out annual (2019, 2020 & 2021) multi-unit emergency exercises (PUI SACA) over a day up to severe accident on one Unit.

The staffing and resources required for multi-unit crisis management have been tested annually at the plant since 2019.

Carried out emergency exercises (in 2021 and 2022) for Spent Fuel Pool cooling failure accidents. Incident procedures where used to prevent the scenario developing into a severe accident. This mitigation involved the use of the Station's mobile equipment as a means to supply cold water to the Spent Fuel Pool.

Results/Effectiveness:

Emergency Preparedness drills for multi-unit accidents have been performed which demonstrate the plant's ability to respond to this type of accident. Emergency Preparedness drills have also been performed for Spent Fuel Pool accidents which demonstrate the ability of the plant to prevent a severe accident in the Spent Fuel Pool.

IAEA Comments:

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

EDF Corporate organization and Civaux NPP had a plan to expand the scope of the Severe Accident Management guidance to include multi-unit severe accidents and this plan is expected to be implemented by the year 2024. The plan required EDF to develop the associated guidance and training material that the plant could implement.

EDF Corporate organization did not envisage providing Severe Accident Management guidance for the Spent Fuel Pools with the justification being that the risk of fuel melt in the Spent Fuel Pools was not sufficient to warrant such formalized guidance. This was supported by the EDF spent fuel reprocessing strategy which prevents fuel pools becoming full. Consequently, the EDF policy assumes that sufficient cooling will always be available within the spent fuel area. It is also supported by the extensive focus on preventing a severe accident.

The Civaux NPP had regular Emergency Preparedness drills and exercises on multi-unit accidents and Spent Fuel Pool accidents. These have demonstrated the plant's ability to respond to multi-unit accidents and exercises have been performed for Spent Fuel Pool accidents which have demonstrated the ability of the plant to prevent a severe accident in the Spent Fuel Pool.

Further, the plant has implemented the on-shift 'Extreme Condition Team' and performed exercises with FARN, both of which add to the ability to manage complex accidents.

However, a review of the organizational and operational improvements that could be considered for the severe accident management programme will be performed by VD4 of 1300MW fleet (2024-2025) where the approach will be documented.

Civaux NPP had carried out exercises to demonstrate its ability to prevent and mitigate complex accidents. However, the EDF company organization will begin to study potential organizational and technical improvements that could be considered to improve the severe accident management programme by taking into account simultaneous multiple unit accidents on the site in 2024-2025.

Conclusion: Satisfactory progress to date

11. HUMAN-TECHNOLOGY-ORGANIZATION INTERACTION

11.1. INTERFACES AND RELATIONSHIPS

The plant is currently implementing several sitewide organizational changes, some of which are complex and affect the whole organization. No guiding document for performance of organizational changes is in place. They are not consistently prioritized and classified and not monitored and documented according to the expectations. Their concurrent implementation is not assessed, which may adversely affect plant safety performance. The team made a suggestion in this area.

Communication of safety and operational information is achieved through many communication channels ranging from many meetings, weekly safety messages, safety days, newspapers, etc. The team recognized this as a good performance.

11.3 HUMAN FACTORS MANAGEMENT

The plant paid special attention to personnel overload during the core unloading operations and reorganized the shift turnover in order to ensure the reliability of information exchanged about sequencing, unplanned events during the turn-over and equipment malfunctions. The decision was taken to offset the two fuelling supervisors working time by one hour to stagger the shift turn-over. This reduces the risk of information loss. The team considered this as a good performance.

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

EDF, CGN and EDF Energy have developed major accident ‘showrooms’ describing the Three Mile Island, Chernobyl and Fukushima-Daiichi accidents for the young nuclear plant staff. The Civaux NPP showroom can be visited by teams, typically guided by their manager, supported by a safety expert familiar with the details of the accidents. It helps opening the dialogue and questions from the staff to the managers. Each showroom will be available at each of the EDF NPPs for a period of time to allow a wide range of staff and contractors to visit. The team considered this a good practice.

DETAILED HUMAN-TECHNOLOGY-ORGANIZATION INTERACTION FINDINGS

11.1. INTERFACES AND RELATIONSHIPS

11.1(1) Issue: The plant process for the implementation of organizational changes has shortfalls regarding their control, communication, monitoring, tracking and recording.

The team noted the following:

- Several sitewide organizational changes are currently under simultaneous implementation. No guideline document is in place for monitoring and assessing risks of their concurrent implementation;
- There is no guiding document for performing organizational change management.
- Change classification and prioritization in accordance with the change safety significance is not done consistently;
- Some plant personnel expressed difficulties in the newly installed software applications, which may affect daily activities;
- Socio, Organisational and Human (SOH) and risk analyses are not always reviewed, and risks are not tracked. There is no Key Performance Indicator (KPI) related to the results from risk and SOH analyses;
- The data migration on some of the software applications used (CAMELEON and EOX) was not completed upon installation, leading to difficulties in tracking, trending and data extraction for reporting. Maintenance and operations Information System (SDIN) was transferred to the end users without complete data verification.

Without all the necessary attributes of an effective organizational change process plant safety may be affected.

Suggestion: The plant should consider enhancing its process for the control, communication, monitoring, tracking and recording of organizational changes.

IAEA Bases:

SSR-2/2: (Rev. 1)

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. Modifications shall be characterized on the basis of their safety significance. Modifications shall be subject to the approval of the regulatory body, in accordance with their safety significance, and in line with national arrangements.

[GS-G-3.1; 5.56-5.63, 5.65, 5.67, 5.71, 6.25]

5.56. When organizational change is necessary, no reduction in the level of safety achieved should be acceptable, even for short periods of time, without appropriate justification and approval.

5.57. The drive to improve efficiency and reduce costs can result in organizational changes that can have significant safety implications. Examples of such changes are:

- Mergers of organizations, leading to a drive for harmonized standards and procedures;

- Changes in the arrangements for providing central support services;
- Reassignment of work activities, thereby increasing the likelihood that expertise in critical areas will be lost;
- Changes in the policies for recruitment, selection, induction and training of individuals;
- Reductions in the number of management levels and in the grades of individuals carrying out activities in the organization.

5.58. When major organizational changes are planned, they should be rigorously and independently scrutinized. Senior management should remain aware that it has the ultimate responsibility for safety and should ensure that safety considerations are given a priority commensurate with their significance during any process of major change.

5.59. Individuals should be made aware of how their responsibilities will change both during and after organizational changes. Consideration should be given to the possible need for temporary additional resources and for compensatory measures to manage the impacts during any transitional phase.

5.60. For changes for which it is judged that potentially significant effects on safety could arise, assessments should be carried out to ensure that the following factors are considered:

- The final organizational structure should be fully adequate in terms of safety. In particular, it should be ensured that adequate provision has been made to maintain a sufficient number of trained, competent individuals in all areas critical to safety. It should also be ensured that any new processes introduced are documented with clear and well understood roles, responsibilities and interfaces. All retraining needs should be identified by carrying out a training needs analysis of each of the new roles. The retraining of key individuals should be planned. These issues are especially important if individuals from outside the organization are to be used for work that was previously carried out internally, or if their roles are to be otherwise substantially extended.
- The transitional arrangements should be fully adequate in terms of safety. Sufficient personnel with knowledge and expertise that are critical to safety should be maintained until training programmes are complete.

Organizational changes should be made in such a way as to maintain clarity about roles, responsibilities and interfaces. Any significant departures from preplanned transitional arrangements should be subject to further review.

5.61. Senior management should develop a specific process to manage and review organizational changes. The process should ensure that there is no degradation in the safety culture of the organization.

5.62. A safety assessment should be developed for any changes that have the potential to affect safety. For more significant changes, advice should be sought from internal and external experts.

5.63. Criteria for assessing the implications and controlling the impacts of organizational changes should include the following considerations:

- Changes should be classified against agreed criteria and in accordance with their safety significance.
- Changes may necessitate different levels of approval on the basis of their significance.
- The organization should explain how the planned changes will help in continuing to maintain acceptable levels of safety. This applies to both the final state of the organization

and the arrangements during the transitional period from the old organizational arrangement to the new one.

- A review mechanism should be agreed on to ensure that the cumulative effects of small changes do not reduce safety.
- A method of monitoring progress in the planned introduction of significant changes should be developed and any shortfalls should be rapidly identified so that remedial action can be taken.

5.65. For each change, the project leader should apply a systematic and transparent project management process, the rigour of which should be commensurate with the significance of the change. In parallel, senior management should consider the overall integration of all changes, and should oversee very significant changes that are imposed and the cumulative effects of smaller changes that may interact with each other. Effects on ongoing activities during the implementation of changes should be studied well and given careful consideration.

5.67. The interactions between different changes should be given careful consideration. Changes that on their own may have only a limited effect on safety may combine and interact to produce much more significant effects. Where possible, different initiatives for changes that are pursued at any one time and that may affect safety should be minimized. In addition, the total workload imposed on the organization to implement the changes in parallel with continued operational activities should be given careful consideration.

5.71. Adequate monitoring should be carried out to provide early warning of any effects on performance, thereby ensuring that there is sufficient time to take remedial action before acceptable safety levels are challenged. Wherever possible, such remedial action should be planned in advance. Care should be taken in choosing the measures to be monitored and in assessing their effectiveness in providing early warning of any trend towards deterioration.

Changes with the potential for major effects on safety levels should be subject to more extensive monitoring to detect adverse trends earlier. The likely effectiveness of changes should also be considered and the speed with which a situation that may be critical to safety can be rectified should be assessed.

6.25. Internal audits should also be prompted by significant changes in the management system or the associated processes, or by weaknesses in performance or in safety.

[GS-G-3.5; 3.23, 5.40]

3.23. Organizations should promulgate a policy for promoting and managing change that encompasses their vision and values. This policy for change management:

(a)Should give priority to safety;

(b)Should address all types of change;

(c)Should introduce the process for change management;

(d) Should state that only approved changes will be implemented;

(e) Should promote effective communication.

5.40. Reference [1] states in paras 5.28 and 5.29 that:

‘Organizational changes shall be evaluated and classified according to their importance to safety and each change shall be justified.

‘The implementation of such changes shall be planned, controlled, communicated, monitored, tracked and recorded to ensure that safety is not compromised.’

NS-G-2.3

5.3. Organizational changes should be carefully evaluated in order to avoid frequent modifications to the operational structure which may pose a threat to the stability of the organization. Whenever organizational restructuring is undertaken at any level, the modified structure should be such as to ensure that all the responsibilities of the operating organization, as formulated in the Safety Requirements publication on Safety of Nuclear Power Plants: Operation [1] and the Safety Guide on The Operating Organization for Nuclear Power Plants [9], continue to be discharged.

5.5. Special attention should be paid to the review and revision of plans for training personnel to ensure in advance that management and staff have a broad understanding of the new tasks and functions that will follow the organizational changes. In particular, it should be ensured that adequate provision has been made to maintain a suitable level of trained and competent staff in all areas important to safety, and that any new systems introduced have been documented with clear and well understood roles, responsibilities and interfaces. All needs for retraining should be identified by, for example, carrying out an analysis of training needs for each of the new roles and planning the retraining of key staff where this is found to be necessary.

NS-G-2.4

5.15. All the proposed plant modifications, including organizational changes, should be thoroughly planned. The operating organization should establish a procedure to ensure that the safety significance of any changes is assessed in advance, with the level of assessment based on the safety significance of the changes. This procedure should ensure that the plant limits and conditions are observed and applicable codes and standards are met. Further guidance on the management of plant modifications can be found in Ref. [3].

Plant Response/Action:

<table>
<tr><td colspan="2">OSART 2019</td><td colspan="3" rowspan="2">11.1(1) Issue: The plant process for the implementation of organizational changes has shortfalls regarding their control, communication, monitoring, tracking and recording.</td></tr>
<tr><td colspan="2">HTO area</td></tr>
<tr><td>MP</td><td colspan="2">Strategic Coordinator: Daniel SALGUES</td><td colspan="2">Operational Coordinator:</td></tr>
<tr><td colspan="3">Action / Deliverable</td><td>Owner</td><td>Deadline</td></tr>
<tr><td colspan="3">Clarify the organisation of the site to ensure the coordination, communication, monitoring and traceability of organisational changes</td><td>Operational Coordinator</td><td>Completed
06/2021</td></tr>
<tr><td colspan="3">Carry out surveys on the perception of the accumulation of organisational changes, carry out the analysis and share on the actions to be taken
- Annual My EDF survey
- Questionnaire Perception of safety culture, QPS every 2 years
- IMS Unit Risk Analysis</td><td>Operational Coordinator</td><td>Completed
Annual
2021
2021</td></tr>
</table>

Root Cause Analysis:

Lack of clear mechanism to identify and formalise the analysis of SOH impacts of organisational changes.

Progress of the action plan:

- Benchmark with various sites and the UNIE.
- Proposal of a method (and the associated organisational note).

- Mapping of the most important projects on the site (with a strong impact), with the PMPs.
- Carrying out SOH analyses on the projects identified, by supporting the coordinators concerned.
- In practice, identification of the FAMA process (Add Equipment Sheet or Activity) as support already existing on this type of analysis.
- Upcoming (as soon as the post is staffed):
  - Construction of a concatenation of the main risks at station level, and shares twice a year with the senior management team.
  - Support for SOH analysis of project managers.
  - Method and note validation.

Organisational changes are also monitored through the annual MyEDF surveys and on the safety side through the analysis of the safety culture perception questionnaire carried out every 2 years according to the WANO guideline.

<u>Associated performance measurement since 2019:</u> performance of CNPE/changes

Unit vision of the combination of the main risks.

Number of Safety Significant Events related to the new safety frames of reference

Number of deviations (ESS, NQME, etc.) related to the evolution of organisations and IS tools

<u>Evidence:</u>

- SOH analyses (example: operations teams during the health crisis in 2020).
- Results of My EDF surveys
- Multi-year programme 2018-2022 for the development of the nuclear safety culture of the Civaux CNPE, incorporating the analysis of the safety culture perception questionnaires carried out in 2019 and 2021
- Unit cumulative vision (under construction).

IAEA Comments

The plant conducted a benchmarking with several other nuclear power plants from the EDF fleet (Cruas, Tricastin and Chooz NPPs) to evaluate the issue and develop possible solutions to address the issue. Based on the results of this activity, the root cause was identified as a lack of methodology for the analysis of impacts of organisational changes.

A procedure was developed for improved impact assessment and coordination of major organisational changes. The procedures provide guidance for impact assessment of changes, covering three aspects:

- Identification of projects (changes) that need to be analysed using the methodology
- Impact assessment of the change
- Developing action plans to cope with potential negative impacts of the change

Project leaders were coached on using the new methodology and it had already been tested on a number of projects. The plant had achieved a good level of progress in addressing the issue. At the beginning of 2020, a list of ongoing and planned major projects was developed and updated in April 2021. The projects were selected based on the following criteria: regulatory changes; changes impacting safety and security; changes related to environment protection; and ‘others’.

According to the methodology, each project should be evaluated for potential impacts on the organisation, each impact assessed for significance (high, medium or low impact) and addressed by compensatory measures if needed (e.g. additional training, communication or procedure update). Examples of such projects included re-organisation of the plant logistics department, changes in plant security and replacement of plant communication system ('Connect').

The new methodology had improved the implementation of organisational changes. However, it had only been used on a limited range of organisational changes and more time was needed to better understand what organizational changes should be assessed using the new methodology to improve coordination and communication of their implementation.

Conclusion: Satisfactory progress to date

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

11.4 (a) Good practice

EDF, CGN and EDF Energy have jointly created and made available TMI, Chernobyl and Fukushima major accident showrooms for the young nuclear generation to help develop a Strong and Healthy Nuclear Culture.

The decision was to start with Dampierre NPP's ‘Major accident showrooms: practice sharing and extending’.

The showrooms give the opportunity for individuals to question their managers and for managers to share their legacy knowledge:

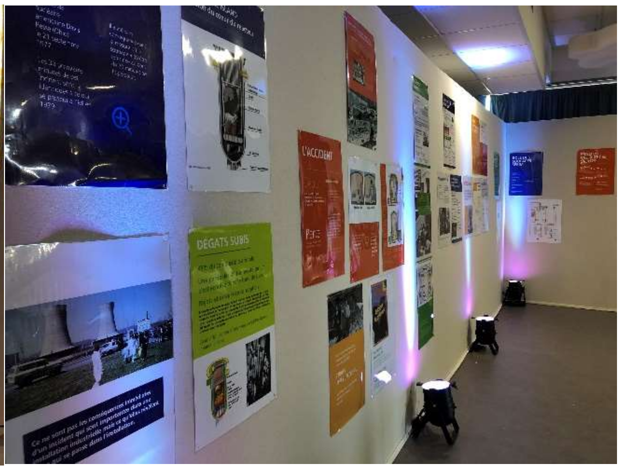
- Share the knowledge of the accidents, events, decisions
- See the link with fundamental designs of our organization and practices
- Learn how to act to prevent future accident

The TMI exposition at Civaux NPP focused on accountability, respect and humility. In this example props from the 1970s set the stage for what life was like in 1979: popular songs, movies and arcade games and a gripping reminder of the accident through pictures, posters and recorded news conferences. The guided tour included modifications and improvements made at Civaux NPP in response to the accident. The showroom methodology is an immersive real experience rather than using solely presentations and teaching.

The showroom describes the accountabilities of nuclear worker, safety as the overriding priority: the need to prevent accidents and limit effects on public. In the three events, the failure of the nuclear industry is shown in the context that thousands of people had to leave the exclusion area perhaps for decades.

The showroom is intended to be visited by groups, typically guided by a team with its manager, supported by a safety expert knowing the details. It helps in opening the dialogue and questions between staff and managers.

The spirit of the showrooms is shared between the 3 fleets (EDF, EDF Energy, CGN). The detailed goal with the related showroom content, the location and the way to use it can be further developed depending on the reaction of the visitors and further ideas from safety experts.

SUMMARY OF RECOMMENDATIONS AND SUGGESTIONS

AREA	RECOMMENDATIONS & SUGGESTIONS
LMS	1.1(1) **Suggestion:** The plant should consider improving the effectiveness of its Manager in the Field (MiF) programme.
TQ	2.2(1) **Suggestion:** The plant should consider upgrading full scope simulator modelling to provide control room operators realistic training on controlling the plant during planned reduced inventory conditions and postulated severe accident conditions.
OPS	3.3(1) **Recommendation:** The plant should establish and implement a system to ensure that operator aids used by plant personnel are authorized and controlled. 3.4(1) **Suggestion:** The plant should consider revising its policies on managing interactions with the Main Control Room to minimise distractions in the Main Control Room. 3.6(1) **Recommendation:** The plant should enhance the vigilance of all personnel to potential fire hazards to ensure compliance with existing prevention measures.
MA	4.5(1) **Suggestion:** The plant should consider improving the leak management programme to be more comprehensive and effective at reducing active leaks. 4.6(1) **Suggestion**: The plant should consider enhancing its foreign material exclusion programme to eliminate the risk of foreign objects entering plant equipment and systems
TS	5.4(1) **Suggestion:** The plant should consider enhancing the process for managing ageing effects to provide a systematic approach for identification of SSCs and degradation mechanisms to guarantee that required safety functions are fulfilled during the life of the plant. 5.7(1) **Recommendation:** The plant should enhance the processes and practices to manage modifications, with temporary modifications limited in time and in number and improving the process for timely updates to permanent electronic operating instructions to minimize the cumulative safety significance.
OE	6.3(1) **Suggestion:** The plant should consider improving the reporting of minor deficiencies, reinforcing high expectations and ensuring that all personnel utilize the new processes. 6.7(1) **Recommendation:** The plant should enhance the effectiveness and timeliness of corrective actions implementation and use of operating experience.
RP	7.2(1) **Suggestion:** The plant should consider improving its radioactive contamination control practices to ensure effective protection against unauthorized release of radioactive material from the RCA.

	7.4(1) **Suggestion:** The plant should consider enhancing the effectiveness of radiological barriers used to ensure that the radiation dose is optimized.
CH	8.6(1) **Suggestion:** The plant should consider improving its process and practices for managing chemical substances to ensure equipment and personnel safety.
EPR	9.2(1) **Suggestion:** The plant should consider enhancing the process for emergency classification, documentation, notification times and notification equipment.
AM	10.1(1) **Suggestion:** The plant should consider extending the scope of the practical training, exercises and drills to ensure an adequate level of proficiency of the personnel involved in the implementation of the severe accident management guidelines at the plant. 10.2(1) **Suggestion:** The plant should consider broadening the scope of the severe accident management guidelines to include multi-unit severe accidents and severe accidents involving fuel in the spent fuel pools.
HTO	11.1(1) **Suggestion:** The plant should consider enhancing its process for the control, communication, monitoring, tracking and recording of organizational changes.

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

	RESOLVED	SATISFACTORY PROGRESS	INSUFFICIENT PROGRESS	TOTAL
Leadership and Management for Safety				
S1.1(1)	X			
Training and Qualification				
S2.2(1)		X		
Operations				
R3.3(1)	X			
S3.4(1)	X			
R3.6(1)	X			
Maintenance				
S4.5(1)	X			
S4.6(1)		X		
Technical Support				
S5.4(1)		X		
R5.7(1)		X		
Operating Experience Feedback				
S6.3(1)	X			
R6.7(1)	X			
Radiation Protection				
S7.2(1)	X			
S7.4(1)	X			
Chemistry				
R8.6(1)		X		
Emergency Preparedness & Response				
S9.2(1)	X			
Accident Management				
S10.1(1)	X			
S10.2(1)		X		
Human, Technology and Organization Interaction				
S11.1(1)		X		
TOTAL R	3	2		5
TOTAL S	8	5		13
TOTAL	11	7	0	18
	61%	39%		100%

DEFINITIONS

DEFINITIONS – OSART MISSION

Recommendation

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

Suggestion

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

Good practice

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

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

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

DEFINITIONS – OSART FOLLOW UP MISSION

Issue resolved - Recommendation

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

Satisfactory progress to date - Recommendation

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

Insufficient progress to date - Recommendation

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

Withdrawn – Recommendation

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

Issue resolved – Suggestion

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

Satisfactory progress to date - Suggestion

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

Insufficient progress to date - Suggestion

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

Withdrawn - Suggestion

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

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

Satisfactory progress to date - Recommendation

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

Insufficient progress to date - Recommendation

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

Withdrawn - Recommendation

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

Issue resolved - Suggestion

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

Satisfactory progress to date - Suggestion

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

Insufficient progress to date - Suggestion

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

Withdrawn - Suggestion

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

REFERENCES

IAEA SAFETY STANDARDS (BASES)

SF-1 Fundamental Safety Principles (Safety Fundamentals)

GSR Part 2 Leadership and Management for Safety

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

GSR Part 7 Preparedness and Response for Nuclear or Radiological Emergencies

SSR-2/1 Safety of Nuclear Power Plants: Design (Specific Safety Requirements)

SSR-2/2 (Rev1) Safety of Nuclear Power Plants: Operation and Commissioning (Specific Safety Requirements)

SSR-5 Disposal of Radioactive Waste (Specific Safety Requirements)

GS-R-1 Governmental, Legal and Regulatory Framework for Safety (General Safety Requirements)

GS-R-4 Safety Assessment for Facilities and Activities (General Safety Requirements 2009)

GS-R-5 Predisposal Management of Radioactive Waste (General Safety Requirements)

GS-G-1 Classification of Radioactive Waste (Safety Guide 2009)

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

GS-G-2.1 Arrangement for Preparedness for a Nuclear or Radiological Emergency (Safety Guide)

GS-G-3.1 Application of the Management System for Facilities and Activities (Safety Guide)

GS-G-3.5 The Management System for Nuclear Installations (Safety Guide)

GS-G-4.1 Format and Content of the Safety Analysis report for Nuclear Power Plants (Safety Guide 2004)

SSG-2 Deterministic Safety Analysis for Nuclear Power Plants (Specific Safety Guide 2009)

SSG-3 Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants (Specific Safety Guide 2010)

SSG-4 Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants (Specific Safety Guide 2010

SSG-13 Chemistry Programme for Water Cooled Nuclear Power Plants (Specific Safety Guide)

SSG-25 Periodic Safety Review for Nuclear Power Plants (Specific Safety Guide)

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

NS-G-1.1 Software for Computer Based Systems Important to Safety in Nuclear Power Plants (Safety Guide)

NS-G-2.1 Fire Safety in the Operation of Nuclear Power Plants (Safety Guide)

NS-G-2.2 Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants (Safety Guide)

NS-G-2.3 Modifications to Nuclear Power Plants (Safety Guide)

NS-G-2.4 The Operating Organization for Nuclear Power Plants (Safety Guide)

NS-G-2.5 Core Management and Fuel Handling for Nuclear Power Plants (Safety Guide)

NS-G-2.6 Maintenance, Surveillance and In-service Inspection in Nuclear Power Plants (Safety Guide)

NS-G-2.7 Radiation Protection and Radioactive Waste Management in the Operation of Nuclear Power Plants (Safety Guide)

NS-G-2.8 Recruitment, Qualification and Training of Personnel for Nuclear Power Plants (Safety Guide)

NS-G-2.9 Commissioning for Nuclear Power Plants (Safety Guide)

NS-G-2.11 A System for the Feedback of Experience from Events in Nuclear Installations (Safety Guide)

NS-G-2.12 Ageing Management for Nuclear Power Plants (Safety Guide)

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

NS-G-2.14 Conduct of Operations at Nuclear Power Plants (Safety Guide)

NS-G-2.15 Severe Accident Management Programmes for Nuclear Power Plants Safety Guide (Safety Guide)

RS-G-1.1 Occupational Radiation Protection (Safety Guide)

RS-G-1.2 Assessment of Occupational Exposure Due to Intakes of Radionuclides (Safety Guide)

RS-G-1.3 Assessment of Occupational Exposure Due to External Sources of Radiation (Safety Guide)

RS-G-1.8 Environmental and Source Monitoring for Purpose of Radiation Protection (Safety Guide)

WS-G-2.5: Predisposal Management of Low and Intermediate Level Radioactive Waste (Safety Guide)

WS-G-6.1 Storage of Radioactive Waste (Safety Guide)

INTERNATIONAL LABOUR OFFICE PUBLICATIONS ON INDUSTRIAL SAFETY ILO-OSH 2001

Guidelines on occupational safety and health management systems (ILO guideline)

Safety and health in construction (ILO code of practice)

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

TEAM COMPOSITION OF THE OSART MISSION

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