



REPORT

of the

OPERATIONAL SAFETY REVIEW TEAM MISSION

to

TORNESS

NUCLEAR POWER STATION
United Kingdom

22 January – 8 February 2018

and

FOLLOW UP MISSION
2 – 6 September 2019

DIVISION OF NUCLEAR INSTALLATION SAFETY

OPERATIONAL SAFETY REVIEW MISSION

NSNI/OSART/199F/2018

PREAMBLE

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

This report also includes the results of the IAEA's OSART follow-up visit which took place 21 months later. The purpose of the follow-up visit was to determine the status of all proposals for improvement, to comment on the appropriateness of the actions taken and to make judgements on the degree of progress achieved.

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

FOREWORD

Director General

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

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

Essential features of the work of the OSART team members and their plant counterparts are the comparison of a plant's operational practices with best international practices and the joint search for ways in which operational safety can be enhanced. The IAEA Safety Series documents, including the Safety Standards and the Basic Safety Standards for Radiation Protection, and the expertise of the OSART team members form the bases for the evaluation. The OSART methods involve not only the examination of documents and the interviewing of staff but also reviewing the quality of performance. It is recognised that different approaches are available to an operating organisation 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 organisation and considers additional comments made by plant counterparts. Implementation of any recommendations or suggestions, after consideration by the operating organisation 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 Torness Nuclear Power Station (NPS) in the UK from 22 January to 8 February 2018.

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 twelve 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; Human, Technology & Organisational Interaction; and Long Term Operation.

The mission was coordinated by an IAEA Team Leader and Deputy Team Leader and the team was composed of experts from Belgium, Bulgaria, Canada, Finland, France, Hungary, The Netherlands, Russian Federation, Sweden, The United States of America, an observer from the Russian Federation and the IAEA staff members. The collective nuclear power experience of the team was 362 years.

The team identified 19 issues, resulting in 4 recommendations and 15 suggestions. 8 good practices were also identified.

Several areas of good performance were noted:

- The station adopted an Advanced Gas-cooled Reactor fuel floor mock-up in support of improved Fuel Route Training.
- The station developed a Marine Ingress Weather Alert System.
- The station developed Corrosion Cards to support the corrosion programme.

The most significant issues identified were:

- The station should improve its action plans, self-assessment programme, performance targets and measures in a more challenging and aggressive manner.
- The station should improve the quality and practice of using of operating procedures to fully ensure safe station operation.
- The station should enhance its screening and categorisation process to ensure that events are assigned the appropriate priority and investigated in accordance with their actual or potential significance.

The management of Torness NPS expressed their commitment to address the issues identified and invited a follow up visit in about eighteen months to review the progress.

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INTRODUCTION AND MAIN CONCLUSIONS

INTRODUCTION

At the request of the government of the UK, an IAEA Operational Safety Review Team (OSART) of international experts visited Torness Nuclear Power Station (NPS) from 22 January to 8 February 2018. 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; Human, Technology & Organisational Interaction; and Long Term Operation. In addition, an exchange of technical experience and knowledge took place between the experts and their station counterparts on how the common goal of excellence in operational safety could be further pursued.

The Torness OSART mission was the 199th in the programme, which began in 1982. The team was composed of experts from Belgium, Bulgaria, Canada, Finland, France, Hungary, the Netherlands, Russian Federation, Sweden, The United States of America, an observer from the Russian Federation and the IAEA staff members. The collective nuclear power experience of the team was 362 years

Torness is owned and operated by EDF Energy, a subsidiary of EDF S.A. in France. The station is situated on the east coast of Scotland near the town of Dunbar, approximately 50km east of Edinburgh. The station consists of two Advanced Gas-cooled Reactors each with an associated turbine generator. Unit 1 commenced commercial operation in 1988 and Unit 2 in 1989. Each unit has a nominal net electrical output of approximately 615 MW and each is connected to the national 400kV power grid. Cooling water is drawn from the North Sea in a once-through cooling cycle. The reactors are normally refuelled on load at reduced reactor power. As a result, maintenance and inspection outages are conducted on a three-year cycle.

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

Throughout the review, the exchange of information between the OSART experts and station 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 station's performance compared with the IAEA Safety Standards.

The following report is produced to summarise 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 Torness NPS are committed to improving the operational safety and reliability of their station. The team found good areas of performance, including the following:

- The station adopted an advanced Gas Cooled Reactor Fuel Floor Mock-Up in support of improved Fuel Route Training.
- The station developed a Marine Ingress Weather Alert System.
- The station developed Corrosion Cards to support the corrosion programme.

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

- The station should improve its action plans, self-assessment programme, performance targets and measures in a more challenging and aggressive manner.
- The station should improve the quality and practice of using of operating procedures to fully ensure safe station operation.
- The station should enhance its screening and categorisation process to ensure that events are assigned the appropriate priority and investigated in accordance with their actual or potential significance.

Torness NPS 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.

TORNESS STATION SELF ASSESSMENT FOR THE FOLLOW-UP MISSION

In January 2018 Torness Power Station was reviewed by the International Atomic Energy Agency (IAEA). This represented the first OSART for the power plant. The OSART mission represented an opportunity to compare our organisation to the IAEA safety standards.

Torness Management paid close attention to the results from the OSART mission both in terms of the overall assessment about the effectiveness of our efforts to ensure safe and reliable operation and in terms of the detailed proposals for improvement in operational safety offered by the team.

Immediately after the end of the OSART mission each recommendation and suggestion was carefully reviewed and analysed by the subject matter experts. The apparent cause of each finding was identified, and improvement plans produced to rectify both the individual observations and the apparent cause. Each finding was also reviewed to determine the support and governance required to secure effective, efficient and systemic resolution of the issue.

The station utilised the findings of the review as an initiator and catalyst to develop a culture of continuous performance improvement within the station that would drive the plant to industry best performance. The developed action panels were then integrated into the stations business plans which had the mission statement of 1,10,100,1000. (No 1 in KPI's, 10TWh in non-outage year, 100% is our target and 1000-day continuous safe generation).

The effectiveness of the actions at resolving the initial proposals for improvement were reviewed through the existing station delivery teams:

- Operational Performance Delivery Team (OPDT)
- Plant Health Committee (PHC)
- Safety Oversight Delivery Team (SODT)
- People Delivery team (PDT)

Challenge panel meetings between the Plant Manager and individual recommendation / suggestion owners and sponsoring managers were also carried out to ensure consistency of approach.

Improvement activities include:

- Developing and driving challenging action plans, through effective benchmarking and self-assessment.
- Improvements to procedures and procedural use.
- Improvements to operator rounds.
- Improvements to FME practices.
- Improvements to the handling of combustible materials and the firefighting capabilities.
- Addressing material condition on the plant
- Resilient approach to spares management
- Improvements to seismic procedures and practices.
- Enhancements to the equipment reliability programmes on the Diesel generators and Fuelling Machine.
- Addressing the temporary modification gaps to excellence.

- Enhancements to event screening and categorisation.
- A focus on effective corrective action implementation and avoidance of repeat events.
- Improvements in the reliability of plant involved in the control of chemistry.
- Improvements in the routine monitoring of chemistry parameters.
- Improvements in the activities and practices related to the emergency facilities and performance within emergency exercises.
- Enhancements to the awareness and training related to Severe Accident management.
- Procedural and implementation improvements with respect to knowledge management (KM) on the station.
- Improvements to the procedures defining how nuclear safety culture (NSC) assessments are carried out and to the tools utilised to carry out these assessments.
- Improvements to the arrangements relating to the lifetime management of station components and structures.

The ambition of the station is to sustain and develop the performance improvement framework and culture that has been secured from addressing the OSART findings and henceforth to self-identify gaps in performance before they become significant issues. This will be achieved by using the Corrective Action Programme as the Performance Improvement driver and attaining the attributes of a true learning organisation.

TORNESS NPS OSART FOLLOW-UP TEAM MAIN CONCLUSIONS

An IAEA Operational Safety Review Follow-up Team visited the Torness NPS from 2 to 6 September 2019. There is clear evidence that the station management has gained significant benefit from the OSART process. The IAEA Safety Standards and benchmarking activities with other NPPs were used during the preparation and implementation of the corrective action plan. The station thoroughly analysed the OSART recommendations and suggestions and developed appropriate corrective actions. These corrective actions, in some cases, cover a broader scope than envisaged to address the OSART recommendations and suggestions. The willingness and motivation of station management to use benchmarking, consider new ideas and implement a comprehensive safety improvement programme was evident and is a clear indicator of the potential for further improvement of the operational safety of the Torness NPS.

The station fully resolved issues regarding the quality and use of operating procedures, application of the foreign materials exclusion programme for Fuel Route activities, availability of spare parts for safety related equipment and systems, temporary modifications, events screening and categorisation, corrective action programme, equipment supporting the control of the station chemistry conditions, equipment ensuring chemistry parameters stay within their specified target range, knowledge management process, safety culture assessment process, process for scoping and screening of equipment for the long term operation.

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

Regarding the issue on the station's action plans, self-assessment programme, performance targets the station developed several ambitious plans and programmes, new procedures and introduced new practices focusing on the problematic areas identified by the OSART team and in so doing achieved noticeable results in many areas such as Fuel Route performance, Diesel Generator availability, Control Room alarms and defects, Human Performance, Industrial safety, Self-assessment and Nuclear Safety Culture. Improvement is also visible in the defect backlog. However, the performance of the fuelling machine is still adversely affected by some legacy issues and latent deficiencies and more time is required to fully demonstrate the effectiveness of actions taken to improve fuelling machine performance. The 'Oil leak improvement plan' implementation shows tangible improvements; however, the station is still challenged by numerous oil leaks. Some oil leaks were observed in the field by the OSART team members during the plant tours and were not identified and reported by the station staff as expected by management. The team also observed several oil puddles underneath the DX and DY diesel generators and several deviations in the station's practice for control of combustible materials. The station management expressed a will to continue implementation of its action plans towards operational excellence whilst improving performance.

In the area of identification and reporting of minor deficiencies in the field, a lack of rigor in fulfilling management expectations and standards, by field operators, and insufficient coaching provided by leaders were identified as root causes. A transfer of knowledge and experience between leaders to improve coaching quality was organised. Awareness of the importance of reporting minor deviations was reinforced. Staff accountability data on condition reports, work requests and observations are now used to identify performance gaps in field operator conduct. However, during the plant tour the team noted multiple cases when defects such as oil leaks were not still identified, reported and tagged.

In the area of control of combustible materials, a lack of enforcement on the Fire Safety process was identified as a cause of the issue. Significant efforts were made to emphasise

management expectations to all team leaders and field operators. Operators have been coached to control contents of laydown areas. This led to a significant increase in associated condition report numbers. The quality of risk assessments performed prior to laydown area authorisation was also improved. However, an inspection of several randomly chosen laydown areas showed that the station still needs to improve control of combustible materials in the field.

As for the issue on material condition the station has made great effort in improving the overall condition of systems, components and structures. The maintenance department introduced new maintenance standards and procedures. The 'Lighting Improvement' project is ongoing and a gap in maintenance work practice regarding cabling is fixed. The station is also refurbishing and restoring, equipment coating, thermal insulation and flooring. However, during a field visit, the OSART follow-up team found several situations where material degradation had not been reported or was not repaired in a timely manner. Also, although the total number of leaks and amount of corrosion has decreased it is still high.

As for the issue on movable items in seismic controlled areas, the station has made great effort in raising the awareness of the seismic safety standard and requirement among station and contractor staff. This includes revision and communication of the Toolbox Talks on seismic safety standards, the use of a seismic safety standard promotion week in 2019, the provision of comprehensive station training to support personnel in the Engineering and Nuclear Safety departments on seismic safety standards and seismic qualification methods for plant modifications, and routine walk-downs by station staff to identify and correct seismic related issues. However, during a field visit, the follow-up team observed that a trolley was not secured with the station approved straps or the wheels braked in an electrical room designated as a seismic controlled area, and two other trollies were observed not secured in the pile cap areas of reactor 1 and 2, also designated as seismic controlled areas.

Regarding the issue on equipment reliability, the station had elevated the issue, established cross-function teams, and used their 'TOP 10' mechanism to accelerate improvement. A detailed action plan was developed with clear owners, due dates, status tracking, and close out criteria. As a result, the performance of diesel generators has notably improved. There is also sign of improvement in the fuel handling machine reliability though more time is required to fully demonstrate the effectiveness of actions taken at the station.

The station conducted benchmarking on the habitability of emergency facilities in June to September 2018. Following the results, standards for equipment and facilities important to emergency response were revised and a table of habitability level was developed for the emergency handbook. Regarding the evacuation exercise, a Torness Evacuation Workshop was held on 25 April 2019. After that, the first full site Evacuation Exercise (Exercise Apollo) was delivered on 4 July 2019 assuming a fire within the waste compound. Evacuation of non-essential staff was successfully demonstrated, and the exercise report was issued August 2019. For now, the formal updating of the emergency handbook is planned to coincide with revisions to the national Radiation Emergency Preparedness and Public Information Regulations. The gap analysis against the station level document series and good practices arising from the benchmarking exercise will be completed by the end of 2019.

The station initiated refresher training for the Deployable Back Up Equipment (DBUE) operation in 2018 and Severe Accident Guidelines (SAG) in 2019. Feedback from the SAG training is already utilised to improve the Central Emergency Support Centre (CESC) functionality and the updating of the Fuel Route Severe Accident Guidelines (FRSAG). The first SAG training for emergency response personnel on site is planned for November 2019 and feedback and effectiveness assessment will be performed after that. In addition, an on-

site exercise, which includes deployment of DBUE at Torness NPS, is scheduled for March 2020.

The original OSART team in February 2018 developed 4 recommendations and 15 suggestions to further improve operational safety of the station. At the time of the follow-up mission, some 20 months after the OSART mission, 58% of issues were fully resolved and 42% were progressing satisfactorily. There were no issues considered as having made insufficient progress.

In addition, the station systematically addressed all encouragements made by the OSART. This is an excellent indication of the station's effort to use all opportunities for further improvement. The team received full cooperation from the Torness NPS management and staff and were impressed with the actions taken to analyse and resolve the findings of the original mission. The team could verify all information that was 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 vital contribution to the success of the review and the quality of the report.

1. LEADERSHIP AND MANAGEMENT FOR SAFETY

1.2 INTEGRATED MANAGEMENT SYSTEM

The Independent Nuclear Assurance (INA) activities at the station are proving very efficient due to the structure of the organisation, recruitment processes, the in-role training provided, highly developed processes supporting INA activities, and the deployment of tools to support the utility's model of Internal Regulation. This has ensured that the INA function remains independent from line management. The team recognised this as a good performance.

The team observed that station action plans, self-assessment programme, performance targets and measures are not always sufficiently challenging or aggressively pursued to improve safety performance. Action plan gaps were identified in the fuel route performance and the number of oil leaks, reactor trips, maintenance and control rod backlog, and Central Control Room alarms related to faulty equipment and some specific Industrial Safety issues such as transportation. Self-assessment gaps were identified in the Operating Experience and Aging Management programmes. In addition, the station has experienced an elevated number of repeat significant events. Moreover, challenging targets or measures were not found in the following areas: Tier 1 KPI, Fire index, OE and Industrial Safety. The team made a recommendation in this area.

DETAILED LEADERSHIP AND MANAGEMENT FOR SAFETY FINDINGS

1.2 INTEGRATED MANAGEMENT SYSTEM

1.2(1) Issue: The station's action plans, self-assessment programme, performance targets and measures are not always sufficiently challenging or aggressively pursued to improve safety performance.

Lack of challenging action plans to improve performance has been identified in the following areas:

- The fuel route performance is recognised by the station Senior Management as one of the main challenges facing the station. It has become a primary focus area of the Business Plan; however, the station is facing difficulties to improve in the following areas:
 - The action plan to improve the Fuel Route operations is more qualitative than result oriented and does not include performance indicators and action plan status.
 - The aggregated Fuel Route performance indicator shows a declining trend over the last 5 years.
 - One of the most significant equipment failures during 2017 second semester concerned the fuelling machine hoist brake no longer complying with the safety case requirements resulting in an elevated potential for damaged fuel. This was self-identified by the station; however, Independent Nuclear Assurance (INA) considered it necessary to bring this event to the awareness of the station senior management because the issue was not being addressed in a timely manner.
 - An INA corporate audit identified weaknesses in the tolerance to degraded standards and the lack of cross-functional engineering walk downs of the station.
 - Unresolved problems with Fuel Route seismic clamps have challenged the station's daily operations since 2012.
- The Oil Leak Improvement plan established in May 2016 has not been effective in addressing the performance issue. At the time of the mission the number of oil leaks was at 56 against a target of 30, however the indicator is green in the Operational Focus Index.
- In 2017, the station identified a lack of challenging action plans leading to extended diesel generator unavailability. There has been a significant delay in the implementation of the diesel generator action plan.
- The two last manual reactor trips were directly linked to maintenance activities and were due to loose connections on Single Point Vulnerability (SPV) equipment (repeat event). The last automatic trip, currently under investigation, was related to procedural, design knowledge and faulty equipment issues. The cumulative trip average at the station for the past 2 years is over 0.5, this being the average result in the nuclear industry.
- The non-outage defect backlog was 692 in December 2017, resulting in the Tier 2 KPI being red. The control rod backlog KPI Tier 2 was also red at the end of 2017 with a backlog of 8 rods against a target of 2.
- Central Control Room Alarm Improvement plans have not been successful in addressing the following performance issues:
 - Although the OFI (Operational Focus Index) KPI on Central Control Room (CCR) alarms is showing green, there are 32 alarms related to faulty equipment in the Central Control Room. Common alarms are present on the same equipment on both units.

- Out of a total of 32 alarms, 18 could be fixed online.
- Analysis of the 2016 and 2017 accident record list shows that injuries to heads, hands and legs including ankles are predominant. The plans developed to address related training issues are not specific enough to support improvement in these persistent industrial safety related challenges.
- Transportation at the station is a long-standing challenge. There have been 9 events of vehicle collision or near misses in the car park since 2013 and 12 collisions or near misses at the A1 junction at the entry road to the site since 2013. Although plans are in place the issue remains a challenge for the station.

Lack of Self-assessment has been identified in the following areas:

- Over the past 3 years, the station experienced an elevated proportion of repeat significant events, recurring issues or events for which a significant amount of past OE could have helped to prevent or minimise the event. In some cases, the OE process has not been effective in preventing repeat events, but in the last 3 years, there has not been a Self-Assessment of the effectiveness of the OE programme.
- Over the last 3 years, the station has not performed any self-assessment exercise of the aging management programme.
- There is no overall systematic self-assessment plan. There is only a draft plan covering 2018.

Challenging Targets or measures were not found in the following areas:

- Although fire is a significant nuclear safety hazard at any nuclear power plant, the Fire Index (a composite KPI) is the only Tier 2 KPI on fire safety. The following metrics were not used in 2017 in the Fire Index KPI: FEC03 (minor fire events); FEC06 (Smouldering fire, or evidence of fire having occurred); F45 (passive fire protection reliability)
- More than one third of the KPIs are regularly met even though their target is zero.
- OE targets and measures:
 - There is also no KPI covering the screening process for events.
 - The station target to complete root cause analyses is 50 days, however the KPI shows green if the root cause analysis is completed in 54 days.

Lack of challenging Industrial Safety measures have been identified in the following areas:

- The Industrial Safety key risk tool used by the station does not focus attention on the most common risks encountered at the station such as Critical risks, Time Out for Personal Safety key risks and high probability risks (handling, rigging and lifting, slipping/tripping/falling hazards, lack of PPE...). The tool directs attention towards compliance with regulation issues rather than minimising field industrial safety hazards.
- Over the past 4 years the number of Industrial Safety Category 3 events, even though less significant, has been unexpectedly lower than the number of Category 2 events. Category 3 events are not adequately identified and reported at the station to identify adverse trends.

Lack of aggressive action plans, a rigorous self-assessment programme and suitable performance targets and measures could lead to some known safety related challenges not being resolved in a timely manner.

Recommendation: The station should ensure that its action plans, self-assessment programme, performance targets and measures are sufficiently challenging and aggressively pursued to improve safety.

IAEA Bases:

GSR Part 2

4.4. Senior management shall ensure that measurable safety goals that are in line with these strategies, plans and objectives are established at various levels in the organisation.

4.5. Senior management shall ensure that goals, strategies and plans are periodically reviewed against the safety objectives, and that actions are taken where necessary to address any deviations.

6.1. The effectiveness of the management system shall be monitored and measured to confirm the ability of the organisation to achieve the results intended and to identify opportunities for improvement of the management system.

6.3. The causes of non-conformances of processes and the causes of safety related events that could give rise to radiation risks shall be evaluated and any consequences shall be managed and shall be mitigated. The corrective actions necessary for eliminating the causes of non-conformances, and for preventing the occurrence of, or mitigating the consequences of, similar safety related events, shall be determined, and corrective actions shall be taken in a timely manner shall be monitored and shall be reported to the management at an appropriate level in the organisation.

6.7. The management system shall include evaluation and timely use of the following:

- Lessons from experience gained and from events that have occurred, both within the organisation and outside the organisation, and lessons from identifying the causes of events.

SSR-2/2 (Rev.1)

3.2. The management system, as an integrated set of interrelated or interacting components for establishing policies and objectives and enabling the objectives to be achieved in an efficient and effective manner, shall include the following activities:

- (e) Review activities, which include monitoring and assessing the performance of the operating functions and supporting functions on a regular basis. The purpose of monitoring is to verify compliance with the objectives for safe operation of the plant; to reveal deviations, deficiencies and equipment failures; and to provide information for taking timely corrective actions and making improvements. Reviewing functions shall also include review of the overall safety performance of the organisation to assess the effectiveness of management for safety and to identify opportunities for improvement.

5.33. The operating experience programme shall be periodically evaluated to determine its effectiveness and to identify any necessary improvements.

NS-G-2.11

8.2. The operating organisation or licensee should periodically review the effectiveness of the process for the feedback of experience. The purpose of such a review is to evaluate the effectiveness of the overall process and to recommend remedial measures to resolve any weaknesses identified. Indicators of the effectiveness of the process should be developed.

8.3. The following should also be done as part of the self-assessment review:

- It should be verified that corrective actions arising from the process for the feedback of operational experience are being implemented in a timely manner;
- The effectiveness of the solution of the original problems and the prevention of their recurrence should be evaluated;
- Recurring events should be reviewed to identify whether improvements can be made in the process for the feedback of operational experience.

Plant Response/Action:

A – Apparent Cause of Recommendation

Although performing well in many areas the station portrayed a lack of ambition, drive and focus to strive for excellence in industry best practice. The station appeared to be comfortable with their level of performance with all-time records for output and in general being top of the EDF-Energy fleet KPIs.

Contributing factor was the station often accepted the norms, along with in some cases a lack of actions underpinning plans, key milestones or measures to drive and focus on excellence whilst improving performance.

Causal Code

MS4a/b – Corrective action not implemented.

MS3b Lack of depth in audits or evaluation or trending.

B – Summary of action plan

- Post OSART every Recommendation & Suggestion was assigned an owner with overall accountability to plan and drive improvements
- Causal analysis was conducted on every recommendation and suggestion in the form of a self-assessment taken through SARB (Self-Assessment Review Board).
- Executive Team had a strategy away day to assess all causal analysis and identify main issues to enable high level focus areas to be established and delivery teams to be put in place
- After looking at all the key facts and analysis of the causes and contributors 4 key breakthrough areas had been chosen. Corrective action programme, Fuel Route, Excellence Through People and Operational Excellence
- A new station business plan was developed with the vision ‘To be the best performing nuclear plant in the world’ (1, 10, 100, 1000) Number 1 in all KPI’s, Generate >10TWHrs, 100% is our only target, 1000 days continuous generating.
- All department business plans and KPI target setting developed in support of Torness Target One
- Delivery teams enhanced along with the SPRM to ensure accountability from department managers, plant manager, station director and ultimately the Chief Nuclear Officer.
- Impactful leadership training for all leaders on site

- Increased focus on understanding industry best practice and ensuring the station is a learning organisation
- Challenge panels chaired by the Plant Manager or Station Director with sponsoring manager and performance improvement challenging and supporting all recommendation and suggestion owners action plans and progress
- Installing a culture of continuous performance improvement utilising Corrective Action Programme as the main driver
- Management strategy away day focusing on the INPO Plant Performance Cycle
- Evidence packs produced by all recommendation and suggestion owners
- Station TOP 10 now produced with a clear problem statement, milestone plans, measures and close out criteria with governance and oversight through the OPDT and PHC

C - Action plan effectiveness review

- The Station welcomed this recommendation from the OSART team delivered in Feb 2018. The main theme was the reflection that the station had been satisfied with good performance but had not recognised that Torness needs to be striving for excellence in all aspects of our business and has the potential to deliver world-class performance.
- It was also recognised that this could only be achieved by producing plans with underpinned actions with key measures, ensuring that plans, actions, milestones, measures along with governance and oversight is in place.
- The action plan has been successful in addressing all key facts and the fundamental overall problem of the station lacking ambition to drive for excellence.

IAEA comments:

This issue appeared to be symptomatic of several problematic areas identified by the OSART team during the mission and resulted in an early warning indicator to the station management. The station conducted causal analysis on every recommendation and suggestion in the form of a self-assessment presented to a Self-Assessment Review Board and identified the cause a lack of ambition, drive and focus to strive for excellence in industry best practice. In addition, a contributing factor was identified that the station often accepted the norms, along with in some cases a lack of actions underpinning plans, key milestones or measures to drive and focus on excellence whilst improving performance. The station appeared to be comfortable with their level of performance with all-time records for output and in general being top of the EDF-Energy fleet KPIs.

After looking at all the key facts and analysis of the causes and contributors four key breakthrough areas were chosen: Corrective action programme, fuel route, people and operational excellence.

A new station business plan was developed with the vision 'To be the best performing nuclear station in the world' (1, 10, 100, 1000):

- Number 1 in all KPI's,
- Generate >10TWHrs,
- 100% is our only target,
- 1000 days continuous generation.

The station developed several ambitious plans and programmes, new procedures and introduced new practices focusing on the problematic areas identified by the OSART team and in so doing achieved noticeable results in many areas such as Fuel Route performance, Diesel Generator availability, Control Room alarms defects, Human Performance, Industrial safety, Self-assessment and Nuclear Safety Culture.

Improvement is also visible in the defect backlog.

However, the fuelling machine is still adversely affected by some legacy issues and latent deficiencies and more time is required to fully demonstrate the effectiveness of actions taken at the station to improve fuelling machine performance. The 'Oil leak improvement plan' implementation shows tangible improvements; however, the station still experiences a number of oil leaks. The OSART team members observed some oil leaks in the field during the plant tours that were not identified and reported by the station staff in the way expected by management. The team also observed several oil puddles underneath the DX and DY diesel generators and several deviations in the station's practice for control of combustible materials.

The station management expressed a will to continue efforts with implementation of its action plans towards operational excellence whilst improving performance.

Conclusion: Satisfactory progress to date

2. TRAINING AND QUALIFICATIONS

2.1. ORGANISATION AND FUNCTIONS

The station's improvement plans for training Top Issues are clearly identified and in-progress. The team noted, however, that due dates had not been established to assist in the timely resolution of these issues. For example: The station's Training Committee Performance Issues document identifies the top issues in each training area yet there are no target dates by which to eliminate the issue. Additionally, some improvement activities do not have due dates for key milestones. For example: Maintenance Continuing Training has been scheduled for the next 5 years, however there are no due dates established to design and develop the Continuing Training courses needed to meet the schedule. The team encouraged the station to establish due dates for overall training performance gaps and some key strategic training initiatives to drive timely resolution.

2.2. QUALIFICATION AND TRAINING OF PERSONNEL

The station has developed a highly visible emphasis on developing and reinforcing strong fundamentals (Monitoring, Control, Conservatism, Teamwork and Knowledge). Their specific relevance to the training is discussed at the start of every training class and reinforced throughout the training. A simple form of the fundamentals has been developed against which personnel can be evaluated in each fundamental area. This form is used for evaluation of performance during formal assessments in the simulator and to capture trainee feedback in various other training areas. The team considered this a good performance.

Following an in-depth analysis of incidents and events involving Lifting and Rigging, the station established an accredited training centre for Lifting and Rigging, Fork Lift Truck Operation and the use of Mobile Elevating Work Platforms to address an identified performance gap in these areas. This resulted in the station receiving a Globally Recognised Accreditation in Lifting & Rigging in 2015 and annual re-accreditation since then. As well as the improvement in the quality of the training, the station now has the flexibility to conduct all such training in-house. The team considered this a good performance.

The station has created a mock-up of the fuel floor of the reactor. The mock up allows training to be carried out in a controlled, low contamination and radiation environment that does not compromise safety. Trainees can learn without consequences in the event of an error or misunderstanding. The facility has been used in the training of Fuel Route Operations Engineers, Fuel Route Technicians and Health Physics Monitors. The team considered this a good practice.

DETAILED TRAINING AND QUALIFICATION FINDINGS

2.2. QUALIFICATION AND TRAINING OF PERSONNEL

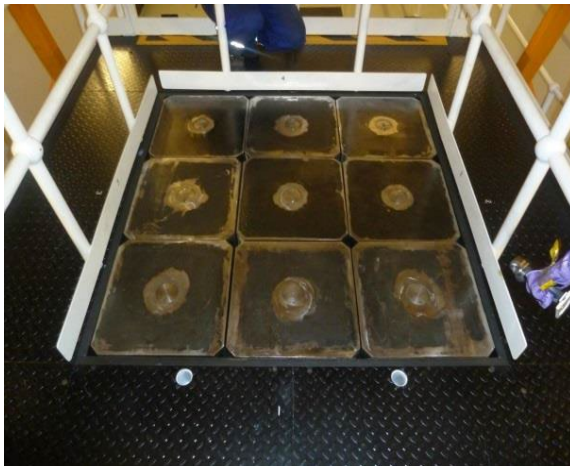
2.2(a) Good Practice: Advanced Gas-cooled Reactor Fuel Floor Mock-Up in support of improved Fuel Route Training.

The station has created a mock-up of the fuel floor of the reactor. The mock up allows training to be carried out in a controlled, low contamination and radiation environment that does compromise safety. Trainees can learn without consequences in the event of an error or misunderstanding. The facility has been used in the training of Fuel Route Operations Engineers, Fuel Route Technicians and Health Physics Monitors in tasks such as:

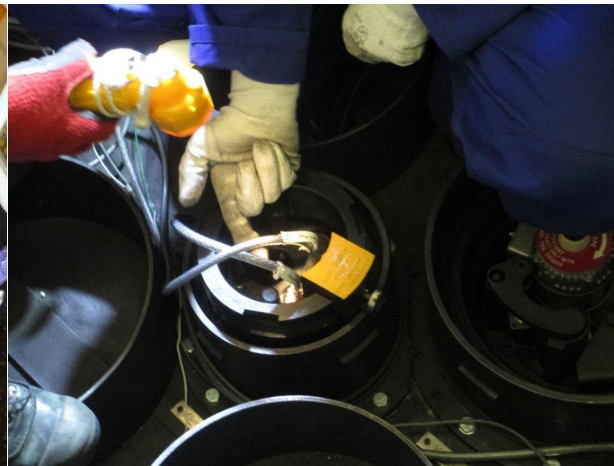
- Reactor fuel floor preparations
- Control rod actuator brake fitting and removal
- Fuel closure motor drive unit fitting and removal
- Fuel closure pressure leak tests
- Thermocouple tests
- Radioactive contamination training
- Human Performance Tools and Fundamentals

The mock up is used for initial and continuing training, On-the-Job Training, Task Performance Evaluation along with In-Service Inspection Training and Just-in-Time Training for outage rehearsals. This contributed to reducing the In-Service Inspection Programme for statutory outages by 3 days in 2017.

Station performance improvement is evident through the reduction in events related to fuel floor preparations, events during control rod floor preparation and excellent radiological safety during refuelling and reactor outages. The number of related personal contamination events reduced from 18 in 2014 to 8 in 2017.



Fuel Floor Simulator – Floor Intact



Trainees checking control rod cables – simulated contamination control area

3. OPERATIONS

3.1. ORGANISATION AND FUNCTIONS

The operations organisational structure is robust with clear responsibilities. However, known demographic issues pose a challenge to the staffing of the operational department. To mitigate the anticipated loss of experience, monitoring and forecasting has been put in place to identify areas in which recruitment and training will need to be focussed. For the operations staff this has taken the form of Staffing Resilience Spider Charts which allow the authorisations held by each shift to be visualised in an easy to understand format. They can also be used to highlight potential future staffing shortfalls and allow proper planning to maintain compliance with site licence conditions. Using these charts and other methods of analysing the Operations staff data, periods of increased recruitment can be predicted well in advance of any risk to the station. The team recognised this as a good practice.

3.2. OPERATIONS EQUIPMENT

The station recorded an elevated number of safety related configuration events between 2014 and 2016. While some were caused by operational activities, more than 50% were related to plant modification and maintenance activities, which highlights the cross-functional nature of the issue. To address this issue, the station has reinforced the local Configuration Management Working Group (CMWG). The CMWG is now an effective cross-functional forum for driving Configuration Management improvements. The team reviews a 'Heat Map' monthly, this highlight 'hot spot' in the number of different misconfiguration condition reports across all departments and allows targeted analysis. As a result, the numbers of inappropriate configuration events have recently significantly decreased. The practice was shared with fleet and is now used by all EDF Energy nuclear stations. The team recognised this as a good performance.

3.3. OPERATING RULES AND PROCEDURES

The team noted that quality and the practice of using operating procedures do not always ensure safe station operation. Gaps identified in some operating procedures could lead to human error-likely situations. In addition, some deviations in procedural use and adherence were observed. The team made a recommendation in this area.

3.4. CONDUCT OF OPERATIONS

Marine Ingress, related to seaweed and jellyfish, have caused operational issues during the life of the plant. The station has implemented a comprehensive process to prepare and respond to marine ingress events. Updates have been made to the station documentation associated with the marine ingress risk indicator. In addition, a review of the information available to the Central Control Room, to aid decision making, was also carried out. In addition, the station has introduced a set of equipment improvements. The team identified this as a good practice.

Although the station has a well-developed system of operator rounds supported by management coaching in the field, it is mainly focused on equipment in their own area of responsibility. The team noticed tolerance to minor deficiencies in the field and lack of challenging corrective actions being taken in a timely manner. The conduct and supervision of operator rounds is not always undertaken at a sufficient level to detect and report minor plant deficiencies. The team made a suggestion in this area.

The team observed that station fuel route activities do not always ensure rigorous application of the foreign materials exclusion (FME) programme to prevent the intrusion of foreign materials into station systems and components. Gaps identified include inconsistent use of logs for tools used in FME areas, ineffective barriers around FME areas allowing introduction of foreign material into equipment and use of transparent plastic in the fuel storage pond area. The team made a suggestion in this area.

3.5 WORK CONTROL

The station has adopted a high standard work management process. However, the implementation of this process can be further developed to ensure the operators in the field are kept informed of plant status, repairs and to facilitate positive feedback and ownership of plant defects. The team encouraged the station to enhance the work management process to ensure that shift personnel are aware of ongoing work (scaffold, safety documents, temporary storage, defects, etc.) on the plant and the necessary repairs are planned and executed as scheduled.

3.6. FIRE PREVENTION AND PROTECTION PROGRAMME

A computer Fire System Programme has been designed that allows a level by level view of the status of Fire Protection on all areas of site. The system can be accessed from a station overview page which can go into each location on-site and show the status of the fire protection system. The programme also allows informed decisions to be made on the cumulative effect of fire protection systems being isolated or defective. The team identified this as a good practice.

The team noted that station processes for the control of combustible materials are not being fully implemented in the field to minimise fire burden and associated fire risk. Unauthorised storage of transient combustible materials was observed in multiple station compartments. Several lay down areas were not assessed and authorised. The team made a suggestion in this area.

The station has not developed firefighting strategies for each individual area of the plant identified as important to safety. The team encouraged the station to develop firefighting strategies for all areas identified as important to safety.

DETAILED OPERATIONS FINDINGS

3.1. ORGANISATION AND FUNCTIONS

3.1(a) Good practice: Succession planning on operations using spider diagrams.

To mitigate against anticipated loss of experience, monitoring and forecasting has been put in place to identify areas in which recruitment and training will need to be focussed. For the operations staff this has taken the form of Staffing Resilience Spider Charts, which allow the authorisations held by each shift to be visualised in an easy to understand format. They can also be used to highlight potential future staffing shortfalls and allow proper planning to maintain compliance with site licence conditions.

Different shift structures can be evaluated against an assessed optimal authorisation level, this allows for a direct comparison between shifts and can identify any potential shortfalls or areas for improvement. The chart in Figure 1 below is an example of the current ‘fingerprint’ of a central control room team showing which areas are in the green optimal zone, and which areas could be improved in the amber zone. It can also highlight members of staff that are currently training to show how the graph will look upon the attainment of their authorisation.

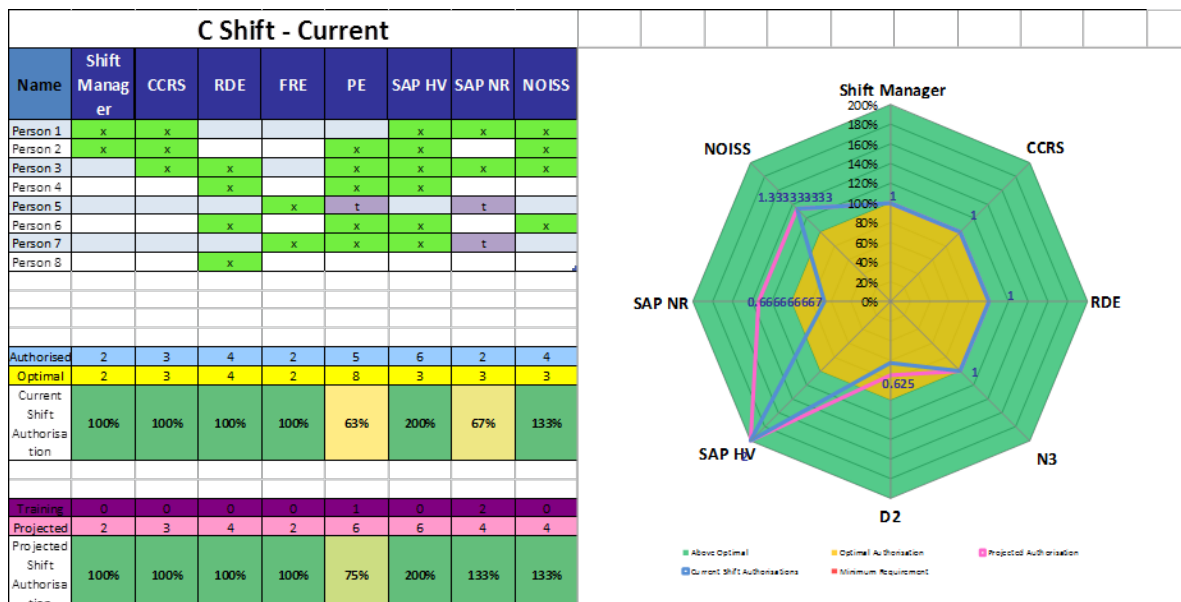


Figure 1. Current authorisation diagram for a shift

- (Acronyms: CCRS Central Control Room Supervisor,
 RDE Reactor Desk Engineer,
 FRE Fuel Route Engineer,
 PE Plant engineer,
 SAP HV Senior Authorised Person High Voltage,
 SAP NR SAP Nuclear Radiation,
 NOISS Nominated Oxygen Injection System Supervisor)

This allows the same goals all the way through the business to be visible and helps to drive operational excellence through the station. Clear and concise information and KPIs where applicable are shown to allow a common understanding of how everyone contributes to the overall business outputs and targets for improvement.

3.3. OPERATING RULES AND PROCEDURES

3.3(1) Issue: The quality of operating procedures and the consistency of their use by station personnel does not always ensure safe station operation.

The team noted the following:

- Work instruction SUT24 (G) to test the Trip Control Valves requires three persons to perform the test. However, only two engineers were observed performing this test.
- The procedure for secondary shutdown system nitrogen injection valves test requires checking the nitrogen pressure, which actuates the trip control valves, on three gauges. According to the procedure, the pressure should be 7.5 bars. However, the pressure in supply nitrogen tank is 7.2 bars and procedure does not require checking this pressure before the test. The personnel performing the test did not challenge the procedure quality.
- During performance of the procedure for secondary shutdown system nitrogen injection valves test, the pressure gauges indicated between 5.5 and 6.0 bars. However, two separate procedural steps to check for a pressure gauge indication of 7.5 bar were ticked as ‘OK’ by a Reactor Desk Engineer. The second individual who provided a peer check did not challenge this behaviour.
- 2CX Inverter return to service was performed in accordance with Work instruction ‘Changeover to Maintenance Bypass condition and Return to Service of Inverter’. This procedure is not specific to each inverter and some decisions needed to be made promptly in field.
- During execution of the plant item operating instruction ‘Verification of PTSE’ (PTSE - post trip sequence equipment) the Reactor Desk Engineer in the CCR did not complete the fields ‘time of trip’ and ‘signature on verification of PTSE operation’. Several steps were not completed (not marked). The completion of the procedure was not confirmed and authorised by the CCR supervisor by signature.
- The plant item operating instruction ‘Operate technicians Actions Following a Unit Trip – Reactor plant operators’ and ‘Operate technicians Actions Following a Unit / Turbine Trip – WTP, Turbine & Outside plant operators’ should be used by field operators to check and confirm status of the parameters and equipment after reactor trip. However, after a reactor trip on 29/01/2018 there was no evidence in the station log or CCR documentation that these procedures had been used.
- During execution of the working procedure ‘On load testing of LP Exhaust trip temperatures’ one of steps was missed resulting in unexpected indications.
- One of the steps of the procedure ‘On load testing of LP Exhaust trip temperatures’ requires turning of a switch on the ‘LP Exhaust on Load Test’ panel to ‘Section 1 Position 1’. However, the positions labelled from top down are ‘NR012’, ‘NR013’, ‘NR014’ etc. This caused difficulties for the engineer performing the test in selecting the correct position of the switch.
- Reactor seawater pump 1BY motor control buttons inside ‘RSW Pump BY Rack’ 1/679 in the circulating water pump house have been labelled by hand: green button – ‘OFF’, red button – ‘ON’. In the related surveillance test operating procedure, these buttons are described as ‘STOP’ and ‘START’.
- The station procedures do not require incorporating long-term temporary instructions into related operating procedures. One of these supplemental procedures has been used in the

Condensate Polishing Plant control room since 2010 without being integrated into the main procedure and involves safety related manipulations.

- The station had an event in April 2017 ‘New Fuel Assembly L35 build order incorrect’ caused by incorrect use of a step-by-step procedure by Fuel Route staff.

Without high quality operating procedures and their rigorous and consistent use, safe and reliable operation could be compromised.

Recommendation: The station should improve the quality and consistency of use of operating procedures to ensure safe and reliable station operation.

IAEA Basis:

SSR-2/2 (Rev.1)

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 organisation and the requirements of the regulatory body.

7.1. The level of detail for a particular procedure shall be appropriate for the purpose of that procedure. The guidance provided in the procedures shall be clear and concise and, to the extent possible, it shall be verified and validated. The procedures and reference material shall be clearly identified and shall be readily accessible in the control room and in other operating locations if necessary. They shall be made available to the regulatory body, as required. Strict adherence to written operating procedures shall be an essential element of safety policy at the station.

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.

Plant Response/Action:

A - Apparent cause of suggestion

The Torness Operations organisational structure is robust with clear responsibilities.

However, it is recognised that a range of experience and demographic issues posed a challenge to personnel in identifying and correcting procedures.

The identified OSART recommendation to quality and consistency of use of procedures was recognised as linked to Operational standards.

The processes and accountability of Operations leadership in the field has been reviewed. New arrangements have been implemented; previous processes were refreshed and refocused as a response to the suggestion.

External reviews and operating experience at Torness since the OSART mission have identified that the quality of Operational instructions required improvement and that operator fundamentals needed rigorous application.

With specific respect to procedures or Procedural Use and Adherence, the shortfall in document quality is exposing less experienced operators to ‘error likely situations’ an intervention though ‘Torness Top 20’ was mobilised and aligns with OSART recommendation 3.3. The actions delivered by ‘T20’ also link to the delivery of 3.4.1.

B - Summary of Action Plan

The action plan centred on the following:

- Initial identification of which Plant areas that had the highest risk if documentation errors existed within the procedures. This identified 20 plant areas, which subsequently identified 150 procedures across those areas that needed reviewing.
- The process of reviewing the T20 procedures included a leadership observation in the field, a review of the Pre-Job Brief and plant visit to identify any shortfall in plant labelling.
- Nomination of a single point of contact for procedure review within the day operations services group.
- To fully optimise the procedure review, support was sought from Human performance group at Barnwood. This identified a need for a procedures writers training course to be implemented, to ensure that procedures were user friendly and unambiguous.
- Leaders committing to and being accountable for increased ‘Time in the field’ with Operators.
- Leaders being directly involved in the oversight of critical tasks. Ensuring quality of plant procedures and Operator conduct in support of the T20 action plan.
- Allowing better access and availability of label production within Day Operations. Improved label quality to better align with plant need and operational procedures.
- Upon completion of the document changes for the Top 20 campaign, a Team Leader led initiative of T5 was developed in order to sustain continuous improvement in Procedure Use and Adherence.
- A Human performance plan was also implemented that supports good operator fundamentals in PU&A.

C- Action Plan Effectiveness review

- A number of data points have been used to assess success of the Torness action plan for recommendation 3.3. The Station welcomed the recommendation and used the action plan with the following effectiveness review.
- Procedures working group implemented to track document changes across Torness.
- One Stop Shop, to enable efficient document changes, set up.
- Plant labelling through put with higher quality labels and easier request/acquisition of replacement
- All 150 procedures identified under the banner T20 have been reviewed and when requiring amendment they have been updated,
- Mobilisation and ongoing ‘T20’ programme of improving the delivery of critical tasks. This has supported and kick started a massive change in approach with respect to Operations document changes being delivered. This is a surrogate indicator, but it

supports evidence of a 'change in culture' and setting of higher standards within the department. Other EDF plants within the UK fleet have now adopted our 'T20' model to mitigate against HU events and support/underpin trip-hardening activities.

- Feedback from team leaders confirm that many procedure changes are being processed through Day operations services. This is supported by the increased trend supplied through the One Stop Shop operational; procedure changes are being sustained at a higher level of document change than previously seen prior to OSART visit.
- External assessment of plant condition, operational activities and feedback. External Bench marking and WANO technical support missions by Cruas France, Doel Belgium and UAE Nawah Energy' Bakarah 1 (looking for Torness P.S. to support the Field Operator training programme prior to their power raise at plant). These external reviews have been instigated on WANO recommendations to other utilities on our Operations management and field

IAEA comments:

The station performed a self-assessment to identify causes of the issue. Discussions with operational staff showed a lack of knowledge of the procedure correction process: some operators thought that it takes a month to change a procedure although in reality it could take as little as one day for minor changes. The assessment also showed that operator fundamentals are not rigorously applied.

- A comprehensive action plan was developed and implemented.
- A specific person was assigned with responsibility for review of procedures. ‘
- A 'One stop shop' responsible for the document change process was reinforced:
- The number of people involved was increased;
- additional training in advanced procedure writing was provided;
- An additional procedure working group led by the station's Human Performance (HU) Lead to support the 'one stop shop' was established.

Based on best practices the format and requirements for content of the operational procedures were improved. A new format of procedures includes easily visible warnings, cautions, critical steps, hold points and operating experience. That makes procedures more user friendly and helps to avoid error-likely situations.

The content of pre job briefings was revised and improved.

20 station areas with highest risk were identified which identified the need to revise 148 procedures. This work is complete and furthermore the station has revised more than 1000 procedures over the last 18 months. Long running temporary instructions were formalised in plant item operating instructions. All revised procedures are now subject to independent verification and are validated in the field and/or at the full scope simulator. A specific warning is attached to ensure shift staff are aware that they are going to use a revised procedure.

All operational staff were trained in use of HU tools with focus on procedure use and adherence, pre job briefings and the Stop Think Act Review (STAR) principle. A dedicated experienced HU coach was hired. He observes activities in the field and raise specific actions to improve human performance. Several observations in coaching for procedure use and

adherence increased from 68 in Q3 2018 to 128 in Q2 2019. Weekly leadership coaching review meetings are used to discuss, analyse and correct identified issues.

New equipment is now in use to produce aluminium labels to fix labelling issues. More than 1200 labels were changed in the 12 months prior to the follow-up mission.

During observation of a 2BX Post Trip Sequencing Equipment test, rigorous use of procedure adherence and self-checking were evident.

Conclusion: Issue resolved

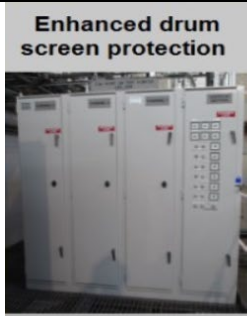
3.4. CONDUCT OF OPERATIONS

3.4(a) Good practice: Marine Ingress Weather Alert System

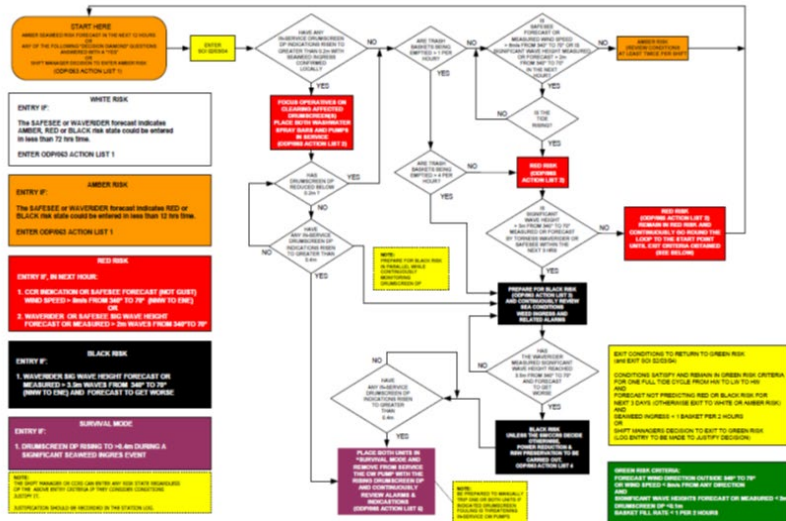
Marine Ingress into cooling water intakes, primarily related to seaweed and jellyfish, has caused operational issues during the life of the plant. Episodes of significant seaweed ingress have challenged nuclear safety and have led to reactor trips. The station has implemented a comprehensive process to prepare for and respond to marine ingress events. Updates have been made to the plant documentation associated with the marine ingress risk indicator. This indicator is based on meteorological forecasts of wind direction, wave height and wave direction. In addition, a review of the information available to the Central Control Room, to aid decision making, was also carried out.

Improvements implemented include:

- A new comprehensive procedure and flow chart place which defines the process to assess marine debris risk to aid operations personnel to take appropriate mitigating actions to minimise the potential impact on the station cooling water systems.
- Improved drum screen and circulating water pump instrumentation to give accurate and reliable indications to the Central Control Room to support operator decision making.
- Enhanced drum screen protection system improvement - prevents drum screen failures, loss of reactor sea water system flow and automatic trips from condenser circulating water pass loss of prime, by preventing excessive drum screen differential pressure.
- Drum screen wash water augmentation uses the reactor sea water system to augment wash water supply, which has addressed the lack of redundancy on existing system and greatly improves wash water availability.
- Installation of a raking system to reduce the likelihood of high drum screen differential pressure developing by removing larger weed upstream of the drum screens.



SEAWEED RISK INDICATOR FLOWCHART



3.4(1) Issue: The conduct and supervision of field operations is not always effective in ensuring that minor plant deficiencies are identified and reported.

The station has a well-developed system of operator rounds supported by management coaching in the field. However, the team noted the following deficiencies that were not identified and reported or challenged by station personnel:

General housekeeping:

- Steel beam left on the floor in the turbine hall + 37 m level not far from the hatchway to 0 m.
- During an observation of the turbine hall outside area, concrete debris was visible on the stairs to the Relief Valve and the ceiling is crumbling.
- During an observation of the operator manipulation on TG1 lubricating oil system, heavy parts (valve, shaft coupling) had been dismantled and left on top of the main oil tank.
- In the turbine hall basement an FME bag had been left in a drainage tray.
- During an observation several previously identified, reported, long standing deficiencies were discovered in the electrical cabinets and cable corridors. The defect tags were dated between 2012 and 2016.
- A lock and chain were observed inside an FME area in the Charge Hall during a plant tour. This deviation was not identified and fixed by field operators during the following week.

Equipment status:

- The Central Control Room zone I central processing unit (CPU) battery charger current measurement failed (oscillated between ends) but there was no Defect tag in place.
- The turbine hall 0 m level area: A Padlock was missing from LP Heater Steam Isolating Valve Pneumatic Control Panel and 2 large screws were found inside the Control Panel.

Leakages:

- Turbine hall 0 m level area: Oil puddles were visible at two locations on the turbine jacking oil pumps.
- In the turbine hall on the -4.5 m cable hall (TH1B1-10) fire system water leakage was found and the water was dripping onto cables.
- On the TG1 lubricating oil system, several small oil leakages were observed on various equipment, most of them were collected using absorbent matting.
- All the three oil pumps for the AX Diesel (AX, DGAX-OLD-A3, DG-AX1, DG-AX2) have leakage from the seals, but station personnel reported none of the leaks.

Storage areas:

- At the turbine hall, 0m level a heavy item storage space is in the central area close to the hatch to the underground level. Items could fall over the barriers.
- An unauthorised storage place is located storing extension cords and flexible pipes in a corner of the Turbine Hall at the -4.5 m level.

Labelling of safety related equipment:

- In turbine hall + 37 m, the ID label R1-AV-0107C (at Reserve Feedwater Tank) was not fixed on the equipment.
- Multiple cases of broken, painted, handwritten not fixed or missing equipment labelling.
- According to the database of Torness NPS 2017 Site excellence internal evaluation the poorest performance, values are at areas of cleanliness, fire prevention, firefighting and electrics.

Without consistent and timely identification and reporting of minor deficiencies in the field, the condition of Structures Systems and Components could gradually deteriorate.

Suggestion: The station should consider improving the conduct and supervision of field operations to ensure that minor plant deficiencies in the field are identified and reported.

IAEA Basis:

SSR-2/2 (Rev.1)

5.3. The plant management should ensure that all valves, switches, breakers and components are labelled using the same labelling nomenclature as that prescribed in current design documents. Furthermore, operations procedures and documents should also reflect the same nomenclature. When discrepancies are found, they should be reported and corrected in accordance with the established procedure. To assist in the management of the labelling programme, the number of discrepancies awaiting correction should be tracked and monitored.

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

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.

Requirement 28: Material conditions and housekeeping

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

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

7.12. The operating organisation shall be responsible for ensuring that the identification and labelling of safety equipment and safety related equipment, rooms, piping and instruments are accurate, legible and well maintained, and that they do not introduce any degradation.

Plant Response/Action:

A - Apparent cause of suggestion

The Torness Operations organisational structure is robust with clear responsibilities.

However, identified demographic issues posed a challenge to the correct levels of supervision and setting of standards in the field.

Within the identified OSART suggestion, the link or common thread of supervisors correctly setting and maintaining operational standards was recognised.

The processes and accountability of Operations leadership in the field has been reviewed. New arrangements have been implemented; previous processes were refreshed and refocused as a response to the suggestion.

Subsequent external reviews and operating experience at Torness since the OSART mission have identified that the quality of Operational instructions also requires improvement and that operator fundamentals need rigorous application.

With specific respect to procedures or PU&A, the shortfall in document quality is exposing less experienced operators to 'error likely situations'. An intervention through 'Torness T20' was mobilised and aligns with OSART recommendation 3.3. The actions delivered by 'T20' also link to the delivery of 3.4.1.

B - Summary of Action Plan

The action plan centred on the following:

- Leaders committing to and being accountable for increased 'Time in the field' with Operators. Leaders committing to and being accountable for increased 'Time in the field' with Operators.
- As part of the leadership time in the field setting standards a plan was developed to carry out a full review of Operational high risk plant tasks
- Leaders being directly involved in the oversight of critical tasks. Ensuring quality of plant procedures and Operator conduct in support of the T20 action plan.
- Establishing a more robust Leadership coaching review framework coupled with a strategic quarterly trend analysis to apply cognitive input to field operator and CCR operations.
- Increased external oversight from other departmental managers on operations activity and subsequent feedback ('LIFE' programme)
- Provision and refreshment of data to establish a cross check on challenge output from Operations staff (Number of CR's and WR's raised) as an indicator of staff engagement.
- Allowing better access and availability of label production within Day Operations. Quality of labels produced has been improved to better align with plant needs.
- Cross-functional support to FME part of Maintenance business plan

C- Action plan Effectiveness review

A number of data points have been used to assess success of the Torness action plan for 3.4.1. The Station welcomed the suggestion and used the action plan with the following effectiveness review.

- Review of the organisation coaching database and acting on feedback to direct coaching areas by leaders. The coaching has created discussion and action within the Operations leadership. Sharing of knowledge within the Ops lead team, highlighting gaps and promoting good practices.
- Review and accountability of Leaders and Field operators in the field using data indicators
- Causal analysis self-assessment completed post OSART visit
- Defect raising and attrition rate monitored to drive defect reduction.
- Plant labelling through put with higher quality labels and easier request/acquisition of replacement
- The trend analysis quarterly meeting, providing strategic overview. This is similar to the first but using trend data to identify a more strategic plan for improvement within the department on its approach to leaders in the field and setting of standards
- Mobilisation and ongoing 'T20' programme of improving the delivery of critical tasks. This has supported and kick started a massive change in approach with respect to Operations document changes being delivered. This is a surrogate indicator, but it supports evidence of a 'change in culture' and setting of higher standards within the department. Other EDF plants within the UK fleet have now adopted our 'T20' model to mitigate against HU events and trip hardening activities.
- External assessment of plant condition, operational activities and feedback. External Bench marking and WANO technical support missions by Cruas France, Doel Belgium and UAE Nawah Energy' Bakarah 1 (looking for Torness P.S. to support the Field Operator training programme prior to their power raise at plant). Theses external reviews have been instigated on WANO recommendations to other utilities on our Operations management and field operator conduct.
- Plant Defect raising and attrition rates analysis
- Engagement within Operations teams on establishing a cross-functional FME programme.

IAEA comments:

The station performed a self-assessment and identified the causes of the issue as insufficient rigor in fulfilling management expectations and standards by field operators and insufficient coaching provided by leaders.

The station developed and implemented an action plan to improve the situation and eliminate identified causes.

The station operations organisation has been benchmarked by 3 external utilities (Cruas, Doel and Barakah NPPs) to gain knowledge and experience in this area.

A newly introduced HU Coach helps the station to identify and correct human performance deficiencies. The station organised a transfer of knowledge and experience between leaders to improve coaching quality. This has become a mandatory part of all operations lead team meetings. Awareness of the importance of reporting minor deviations was reinforced. Operations managers encourage area champions to carry out housekeeping tours. Operations have recently re-taken ownership of site excellence and housekeeping.

Relabelling plant process has been improved delivering over 1200 replacement labels over the period.

The defect backlog was reduced from 1000 to 571 in the 12 months prior to the follow-up mission.

Staff accountability data on condition reports, work requests and observations are used to identify performance gaps in field operator conduct. Observations submitted by Operations leaders improved from 10 per month in July 2018 to 50 per month in July 2019. When in the field, leaders now pay more attention to defect identification and reporting. The number of condition reports related to housekeeping grew from 6 in Q1 2018 to 20 in Q2 2019.

The number of work requests grew from 22 in January 2019 to 50 in August 2019.

During the plant tour, some oil leaks were found without defect tags and absorbing pads in turbine hall. Examples:

- Lubricating oil leak from the Main Boiler Feed Pump 2 bearing;
- Oil leak and puddle below in-board seal of starting/standby boiler feed pump 2B;
- Oil leak and oil level below normal on condenser air extraction pump bearing 2C.

Conclusion: Satisfactory progress to date

3.4(2) Issue: Fuel route activities do not always ensure rigorous application of the foreign materials exclusion programme to prevent the intrusion of foreign materials into station systems and components.

The station has implemented a ‘Company specification on Foreign Materials Exclusion’ (FME) providing necessary requirements and instructions to prevent the introduction of foreign materials into station mechanical, electrical and control & instrumentation systems and components.

However, the team noted the following:

- Several foreign items (plastic pipe, tape, cover) found on the floor inside the Unit 2 pile cap FME area in the Charge Hall.
- The plastic bin with radioactive waste was not secured inside the Unit 2 pile cap FME area in the Charge Hall. This can lead to dissemination of small waste in the case of a seismic event.
- Open equipment in the irradiated fuel buffer store in the Unit 2 Charge Hall (FME area) was observed not covered while no work was being performed.
- The refuelling machine is not subject to the FME programme during normal operation, however it moves frequently or can be positioned above FME areas and open equipment in the Charge Hall. No precaution has been taken to prevent items falling from the machine into open equipment.
- Workers involved in maintenance work in the Charge Hall on the refuelling machine believe that it is not needed to maintain an FME tool log if the work is not on the machine pressure vessel.
- A Purge Air Filter for Vessel Entry was being prepared for installation in the Charge Hall with no visible barriers or signs related to FME protection zone, as required by the station procedure ‘Company specification on Foreign Materials Exclusion’. The working area was partially fenced with an ordinary tape barrier. Unnecessary tools and items were present and a tool was lying on the floor inside the fenced area.
- There are no expectations for operations personnel to control FME programme implementation by maintenance staff during routine field rounds, only as a part of observations and coaching programme.
- The last entry on 08/01/2018 in the FME control log for the ‘High risk FME area’ in the New Fuel Build Cell showed that a working party logged tools into the area, but there was no corresponding entry for their removal.
- Unnecessary items and foreign materials were observed inside a ‘High risk FME area’ in the New Fuel Build Cell, such as locker keys (with tags) and a bolt.
- Personnel were observed working in the Fuel Storage Pond area without maintaining the appropriate FME control log.
- Transparent plastic is widely used in Fuel Storage Pond area.
- The barrier around the Fuel Storage Pond is not solid and does not protect the pond from debris.
- Debris was observed in various places around the Fuel Storage Pond

- Chairs on the crane above the Fuel Storage Pond are not secured to prevent them falling into the pond.

Without rigorous application of an effective foreign material exclusion programme to fuel route activities, the potential for FME intrusion could be significantly increased.

Suggestion: The station should consider ensuring rigorous application of the foreign materials exclusion programme to the fuel route activities to prevent the intrusion of foreign materials into station systems and components.

IAEA Bases:

SSR-2/2 (Rev.1)

Requirement 28: Material conditions and housekeeping

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

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

NS-G-2.5

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

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

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

NS-G-2.14

4.36. Factors that should typically be noted by shift personnel include:

- Deterioration in material conditions of any kind, corrosion, leakage from components, accumulation of boric acid, excessive vibration, unfamiliar noise, inadequate labelling, foreign bodies and deficiencies necessitating maintenance or other action;

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

other degradations in the plant that may affect the long-term reliability of plant equipment or structures) should be evaluated as part of the plant housekeeping programme.

Plant Response/Action:

A thorough specification exists within EDF Energy that governs the control and implementation of an FME within EDF Energy [BEG/SPEC/MNT/003]. This specification provides clear guidance as to the standards and expectations expected whilst working on all areas of plant. Two further local documents [TSP/PLANT/048 & TSP/PLANT/046] provide further details in how the specification is to be enacted at a Site level particularly detailing the control measures required whilst working in FME sensitive areas. These specifications were in force during the period of the Safety review.

Due to the findings, a number of investigations and self-assessments have been carried out to ensure Torness understands the root causes of the issues identified during the OSART mission with suitable actions plans in place to ensure similar shortfalls in FME practices are prevented in the future.

A/R 1090571/06- Causal Analysis assignment

Causal codes identified from analysis:

- NIQC2c- Foreign material exclusion during work
- MS2c- SPAC Enforcement

A/R 1125598 Maintenance quarterly trend report:

6 areas identified as contributing to less than adequate FME control

A/R 1140963- Foreign Material Exclusion self-assessment

2 of recommendations identified with the above self-assessment.

Summary of action plan:

A number of station recognised improvement vehicles have been utilised to ensure that the causes identified within the above investigations, all captured within the respective department's plans, are rectified to ensure the stations FME programme is fully effective.

- A station wide clarity of standards campaign was developed to ensure all station staff have a clear understanding of the foreign material exclusion programme on site. The campaign was delivered during May 2019-July 2019 and consisted of site wide safety messages, delivery of read and sign brief targeting all plant touchers (Toolbox Talk/0015), dissemination of relevant operations experience (OPEX) to prompt discussions, targeted FME observations from leaders, reinforcement of the FME 'What excellence looks like' (WELL) sheet and further targeted communications via weekly/monthly briefs.
- Targeted approach of field observations for FME related activities began in January 2019 and has continued to date via the Executive Leadership Coaching review (LCR), Maintenance LCR & Operations LCR.
- The Foreign Material working group has been reinvigorated to ensure a cross-functional approach to the stations FME programme. To ensure that the FME programme is fully embedded into daily working practices attendees include Maintenance, Operations, Technical & Safety, Contract partners (Doosan, Work Place Solutions, Balfour Kilpatrick, Cavendish Nuclear) and Performance improvement. The FME working group meeting is held on a monthly basis where key station improvements are being tracked.

The meeting also shares OPEX (both site specific and via the Organisation learning portal) and shares good practices.

- The site has been supporting fleet maintenance in the current revision of the corporate Foreign Material Exclusion specification ensuring key learnings are included in the forthcoming revision. One area of particular focus is ensuring that appropriate work order cards contain sufficient instructions to ensure FME controls are specified. This will ensure PJBs highlight the required mitigations to control the identified FME risk.
- Due to identified gaps, it was determined that, in order to support the site FME co-ordinator in driving FME standards a ‘Foreign Material Champions’ would be nominated for all teams. FME champions have been identified within the following areas: Maintenance, Operations, Doosan, Work place solutions, Balfour Kilpatrick and Cavendish Nuclear. The purpose of the FME champion is:
 - Foreign Material Exclusion support within their team.
 - Attendance to the FME working group.
 - Understand FME standards (via the appropriate specifications and the FME WELL sheet) and share knowledge/best practice.
 - Support the team in understanding the locations of Torness’ high-risk FME areas and what control measures should be implemented.
 - Share learning between FME Champions.
 - Share FME OPEX within team/s.
 - Seek assistance from the FME Co-ordinator to further enhance FME standards.
 - Carry out FME observations to assist in driving standards within the station.
- In response to identified gaps, a site-specific FME training course has been developed which will re-inforce our standards and expectations for the FME programme on site. This material is being rolled out to all plant touchers; a training plan has been produced and is being delivered as per the agreed plan.
- The FME programme has been added as a ‘Top issue’ at the Station Performance Committee and Maintenance Training advisory committee. The aforementioned will ensure adequate oversight is provided, both in delivery of the required FME training and ensure all gaps have been closed prior to completion of the issue.
- An FME benchmarking exercise was carried out to Doosan Mission Critical Services onshore facility. A number of good practices were observed during the visit, which are to be replicated in class 1 maintenance facilities improvements.
- Funding of £150k has been obtained to support the stations ambitions for FME improvements within identified high-risk FME areas throughout the station. 2018/19 has seen on-going investment in high-risk FME control on site via use of appropriate storage of tools and equipment.
- The development of ‘What excellence look like’ sheets has been rolled out throughout the entire station by including in the respective monthly brief and discussions at FME working group and relevant LCRs. The purpose of the ‘WELL sheets’ is to ensure all staff understand the minimum standards expected while carrying out activities on plant and provides observers the ability to confirm that tasks are being carried out in

compliance with the relevant FME Policy enabling shortfalls to be identified and actioned.



Foreign Material Exclusion (FME)



Determine specific FME requirements using plant walkdowns and apply the correct controls maintaining equipment and component cleanliness.



Standard Level FME Control (inspection and retrieval of materials is achievable)

- Level of FME control is discussed during the pre-job brief.
- Loose parts will be stored in suitable containers away from the system opening.
- Work areas should be clean and clear of debris before plant is opened up.
- Openings into systems will be covered with an approved FME cover.
- FME covers and boxes must be clean, free from debris.
- A "clean as you go" approach should be adopted.
- Dirty FME covers must be placed in the used FME bins for washing. Clean used FME can be returned to storage areas.
- Debris is controlled to prevent the creation of foreign material.
- Supervisors/Team Leaders to inspect work sites to ensure good general housekeeping/FME controls.
- PPE is maintained and worn in a way to prevent the introduction of foreign material.
- Clear plastic or plastic bags should be kept away from open plant systems.



References:
 BEG/SPEC/MNT/003
 BEG/SPEC/ENG/TGN/126
 BEG/SPEC/ENG/TGN/077
 BEG/SPEC/ENG/TGN/078

High Level FME Control (where it is difficult to identify or retrieve foreign material)

The High Level FME controls should be as specified within documentation and/or discussed and agreed with the Leadership during the PJB. Additional High Level FME Controls include:

- High Level FME control area signage and access barriers.
- When working over open systems tools and equipment will be secured with lanyards/straps.
- Logging of equipment in and out of the controlled area.
- FME Guardian
- Restrict personal items.
- Back out inspections which clearly identify what, when and by who is to be inspected.

NOT PROTECTIVELY MARKED

BEG/FORM/MNT/011/04 Rev 001

Parent Document: BEG/SPEC/MNT/011



Foreign Material Exclusion (FME)



Determine specific FME requirements using plant walkdowns and apply the correct controls maintaining equipment and component cleanliness.



Score	Observation Criteria
5	<ul style="list-style-type: none"> • The Work Area was cleaned prior to commencing the task. • The level of FME Control required for the task was discussed in the task PJB • Correct FME devices are in place on all system openings. • FME storage boxes are in active use. • Any additional High Level FME Controls are in place and in active use. • A clean as you go approach is obvious. • PPE is maintained and worn in a way to prevent the introduction of foreign material. • Back out inspection of open systems are carried out or planned. • Lanyards being used on equipment.
4	<ul style="list-style-type: none"> • The level of FME Control required for the task was discussed in the task PJB • Correct FME devices are in place on all system openings. • FME storage boxes are in active use. • The Work Area was cleaned prior to commencing the task. • A clean as you go approach is obvious. • PPE is maintained and worn in a way to prevent the introduction of foreign material.
3	<ul style="list-style-type: none"> • The level of FME Control required for the task was discussed in the PJB. • No Work Area cleaning completed prior to commencing the task. • Correct FME devices are in place on all system openings. • Work area cleanliness evident in places.
2	<ul style="list-style-type: none"> • FME in place on most system opening. • Work areas are clean, tidy and storage boxes in place and being used.
1	<ul style="list-style-type: none"> • No / little understanding of Foreign Material Control. • No / little FME protection in place on system openings.

NOT PROTECTIVELY MARKED

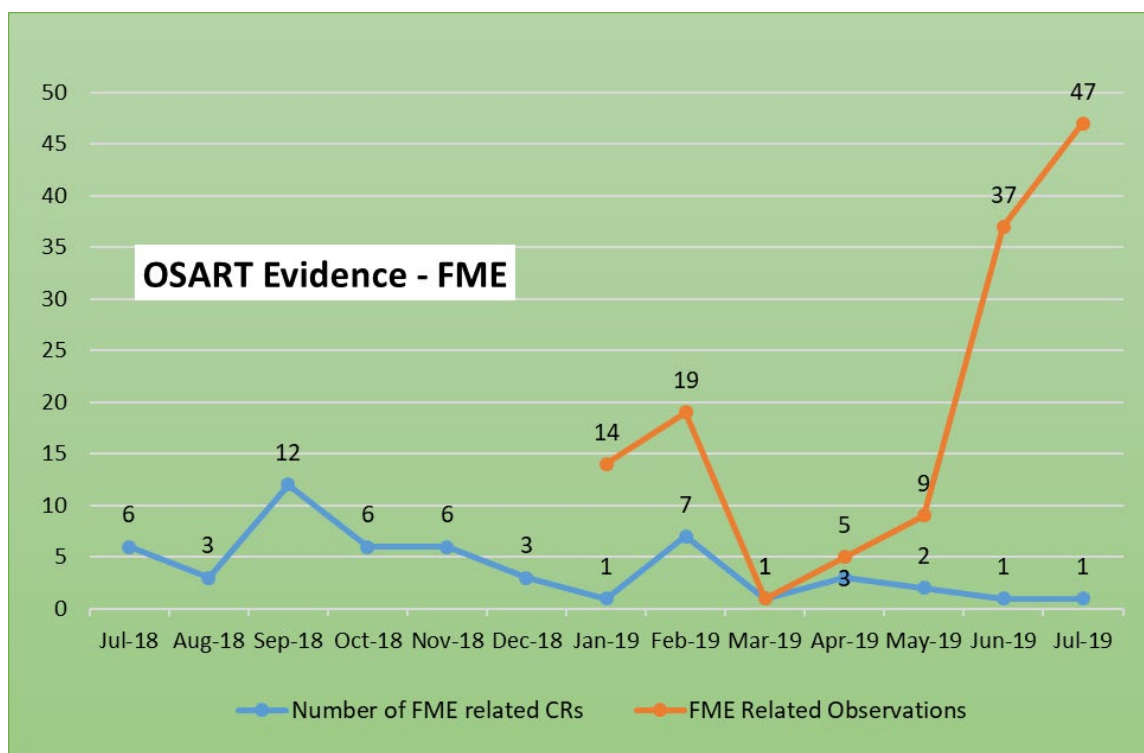
BEG/FORM/MNT/011/04 Rev 001

Parent Document: BEG/SPEC/MNT/011

Action plan effectiveness:

All site FME related events are being tracked via the FME working group, where they can be reviewed and actioned as required. Specific focus has been made on utilising previous site OPEX events to prevent re-occurrence. FME related Condition reports (CRs) are tracked via the maintenance quarterly trend report. In the event that an increase in quantity and/or impact FME CRs are identified these will be highlighted to the Maintenance leadership team via the Maintenance CAP Co-coordinator for further discussion and action.

The information contained within the graph below (January 2018-July 2019) shows that there has been a significant improvement in both the monitoring of working practices (Observations) as well as a favourable trend in FME related CRs indicating that the additional focus placed on FME is providing benefits. The average of 2 FME CRs raised/month in 2019 also shows an improving trend (average of 6/month the previous 6 months).



Over the period of January-July 2019, a total of 155 FME observations were recorded. Analysis of the observation data has revealed that the observations met 93% of the criteria set within the FME well sheet. See below for further information:

Total Observations:155

Achieved Scores

Type	Total	Monitoring	Control Procedural	Control	Conservatism	Teamwork Comms	Teamwork Leadership	Teamwork Workload	Knowledge, Skills and Attitudes
All	155	3.7	3.7	3.7	3.6	3.9	3.6	3.9	3.7

A total of 55 recorded observations were carried out from July 2018-December 2019. Comparison of the data has shown that there has been a 281% improvement in the number of

recorded observations in the first 7 months of 2019 confirming that engagement with the site FME programme has increased from all levels of the station.

Going forward it is the intention of the site to amend local procedures (TSP/PLANT/048 & TSP/PLANT/046) to ensure they complement and support site implementation of the newly revised feet specification (BEG/SPEC/MNT/003) and to continue with the identified FME investment with particular focus on improvements of tooling and equipment in high-risk FME zones.

IAEA comments:

The station conducted specific self-assessment and common cause analysis to address the issue. One of main causes identified was that operations personnel were not fully engaged in the FME programme, which is driven mostly by the Maintenance department. As a result of the self-assessment, performed 10 major actions were scheduled. Of these actions, 6 are completed and 4 were due to be completed soon after the follow-up mission.

Based on fleet operating experience the associated corporate guideline relating to the FME programme has been revised and station procedures updated accordingly. The requirements were simplified to help people make correct decisions in FME zones identification and organisation.

The station training materials were subsequently revised to adopt this new corporate guideline. Specific training for the station personnel including operations staff started in July 2019 and is scheduled to be completed on 4 December 2019.

Categorisation of FME zones have been revised and signage and fencing were improved.

Representatives from each operation shift ('FME champions') were included in the FME working group that drives FME excellence through the station.

Updated FME Safety Message, 'Clarity of standards: Leader's brief' and 'Tool box talks' are used to deliver management expectations to the staff.

The number of observations dedicated to FME standards significantly grew from 55 in 2018 to 130 from January to July in 2019.

The walkdown of the fuel route areas showed visible improvements regarding FME. No major concerns were noted.

Conclusion: Issue resolved



Figure 2: Detailed view of the Fire Station Systems Status in Maintenance Workshop Area

3.6(1) Issue: The station processes for the control of combustible materials are not fully implemented in the field to minimise fire burden and associated fire risk.

The station has established a process to evaluate, authorise and control combustible and flammable materials. ‘Company specification: Operator plant tours’ requires control of the fire loading of compartments. In addition, the station has established requirements for fire patrols. According to ‘Company specification: Site Excellence in material condition’, a review of contents and time limits of lay down areas shall be carried out during normal area tours, walkdowns, inspections, and operator tours.

However, the team noted the following:

- The Generation Team Leader does not expect field operators to observe and check lay down areas when doing the regular plant tours although it is required by the station procedure.
- Several lay down areas in Reactor 1 and 2 buildings and in the Turbine Hall were observed without a ‘Lay down area authorisation form’ as required by the station procedure. Combustible materials such as wooden pallets, wooden beams, cardboard boxes, plastic pipes, canisters, and scaffold end caps were observed inside these areas.
- An approved lay down area in the turbine hall loading bay contains unauthorised wooden pallets.
- Approved lay down area T0243 in the Outside Plant had an expired authorisation date.
- The Turbine Lubricating Oil Store, designed as a separate compartment in turbine hall, level -9.00m (laydown area T0029) is authorised for storage of 6 drums (205 litres) of oil. However, additional unauthorised combustibles such as plastic pipes, plastic canisters with chemicals and metal canisters with oil were observed inside the store.
- The station has no requirements to document the maximum permissible fire load in areas significant to safety.
- Permanent lay down area P0028 in the Fuel handling building, Unit 2 is labelled with an obsolete authorisation form and contains unassessed wood, plastic, and paper items stored close to cable trays.
- Multiple cases of plastic and paper litter and bird feathers on the floor and cable trays were observed in Unit 2 Reactor building rooms.
- Over 50 oil leaks were observed, some on safety related equipment (for example, diesel generators and gas circulator lubricating oil systems). These leaks increase fire loading.

Without consistent, rigorous implementation of station processes for the control of combustible materials, the rise of fire may increase.

Suggestion: The station should consider implementing fully, its processes for the control of combustible materials in the field to minimise fire burden and associated fire risk.

IAEA Bases:

SSR-2/2 (Rev.1)

Requirement 22: Fire safety

The operating organisation shall make arrangements for ensuring fire safety.

5.21. The arrangements for ensuring fire safety made by the operating organisation 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

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 that may be introduced in activities related to maintenance or modifications.

6.2. Written procedures should be established and enforced to minimise 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.

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.

NS-G-2.14

4.36. Factors that should typically be noted by shift personnel include:

Deviations in fire protection, such as deterioration in fire protection systems and the status of fire doors, accumulations of materials posing fire hazards such as wood, paper or refuse and oil leakages, or industrial safety problems such as leakages of fire resistant hydraulic fluid, hazardous equipment and trip hazards.

Plant Response/Action:

A – Apparent Cause of Suggestion

The apparent cause of this shortfall is a lack of enforcement of station processes pertaining to Fire Safety.

Causal Code

SPAC Enforcement NI MS2c – Standards, policies or admin control enforcement needs improvement

B – Summary of Action Plan

- Standards have been reinforced to Generation Team Leaders to ensure that laydown areas are checked as per the fleet process and station specific processes. The processes have been discussed with teams to ensure conscious knowledge of housekeeping and good practice on site.
- A station Site Excellence Champion has been appointed that is part of the Operations Team. This will provide clear oversight on housekeeping matters that relate to both Operations and Site Excellence.
- Obsolete laydown authorisations that have been highlighted have been reassessed and submitted if still deemed necessary. The Fire SQEP and other relevant stakeholders must approve all new laydown requests in plant areas significant to safety.
- To combat the risk that wooden pallets cause in relation to combustible loading, additional procurement of metal pallets has been made. This mitigates the fire risk that wooden pallets add.
- Whilst there is no requirement to implement a regular quantitative review of compartmental fire loading, this will be investigated to see if it is a process that will add sufficient benefit to the extensive processes already in place at Torness to fire risk assess areas on site.
- Oil leaks are assessed for risk and operability impact. Any leak that is reported is assessed and categorised as part of normal business. Those pertaining to fire safety have either been addressed or have planned rectification work scheduled in appropriate work windows. This ensures continued station operation without causing unnecessary fire risk.

C - Action Plan Effectiveness Review

- The reinforcement of site excellence and operator tour standards has led to a direct increase in the reporting of low-level issues that impact fire safety and laydown area compliance. The number of CRs relating to low level laydown compliance, fire loading and housekeeping (categorised as FEC 10s) have shown a significant increase by 120%. This is from 35 FEC 10s in Q1 2018 to 77 in Q2 2019.
 - Site excellence lead appointed and making improvements across site.
 - Area owners identified for all areas and held accountable for findings in their areas, including those from laydown areas and fire safety related matters.
- Through the reinforcement of operator plant tour expectations, laydown area compliance is aligned to the fleet process. This is assessed and monitored through regular plant

operator inspections to ensure all laydown areas remain valid and within maximum authorised combustible inventories.

- It has been recognised on site that wooden pallets contribute to fire loading. There has been an increased implementation of metal pallets on site to mitigate the risk. This has been deemed successful and a quantity of metal pallets is maintained for general use and areas significant to safety.
- Torness adheres to The Fire (Scotland) Act 2005 and The Fire Safety (Scotland) Regulations 2006. To do this there is an area fire risk assessment process, which aligns Torness to this legislation. Furthermore, the laydown area authorisation process is effective in accounting for the fire loading of transient materials.
- The number of oil leaks (Jan-18 to July-19) has reduced by 17 from 56 to 39. The station fire risk assesses all oil leaks, focusing on rectification of those that are considered to be high risk. The number of high-risk leaks is tracked in the tier 2 key performance indicator and is consistently in single figures. Current leaks are high risk due to the plant that they are on rather than the risk of fire occurring.

IAEA comments:

The station conducted specific self-assessment and common cause analysis to address the issue. The cause was identified as a lack of enforcement of established Fire Safety process.

Management expectations regarding control of combustible materials were emphasised to all team leaders and field operators. Operators have been coached to control contents of laydown areas in accordance with 'Laydown area authorisation form'. The number of condition reports related to fire loadings grew from 35 in Q1 2018 to 77 in Q2 2019.

To reduce fire loads the station purchased a significant number of metal pallets to replace wooden ones.

To improve the quality of risk assessments performed prior to laydown area authorisation, information on permissible fire loads in significant plant areas has been obtained. Work is still underway to improve this process. Actual fire loads in plant areas are being checked and reviewed.

All registered oil leaks were assessed for risk. In some cases, additional compensatory and protective measures were taken based on results of these assessments.

A walk down of the Reactor 1 radiation controlled area and the turbine hall performed by the team did not identify any major gaps in laydown areas.

However, an inspection of several randomly chosen laydown areas showed that the station still needs to improve control of combustible materials in the field. During a walk down the team noted:

- Expired (since 16 May 2018) temporary laydown area with 200 litres waste oil drum and 3 plastic canisters at Circulation Water (CW) pump house, level -12 m, close to CW pump 1A;
- Unauthorised wooden beams and wooden box containing cardboard boxes were found in laydown area inside CW Forebay adjacent to seaweed drop area. There was no visible authorisation form for this laydown area;

- Contents of the turbine lubricating oil store found not compliant with the authorisation form placed on the entrance door, the area contained 3-barrel handling trollies which were not recorded on the area approval.

Condition reports were not raised for these deviations by the station personnel.

The station does not have a process requiring area owners to periodically check the laydown area.

Conclusion: Satisfactory progress to date

4. MAINTENANCE

4.2. MAINTENANCE FACILITIES AND EQUIPMENT

The station has a well-managed Loan Tools Facility. The traceability of equipment used for an activity is ensured by recording the ID of the equipment on the work permit. This is then logged in the database, so that it is easy to trace which work has been performed with a given tool and where. This is not limited to only measurement and test equipment. Due to the capacity of the workshop, it can support not only the maintenance department but also the contractors, even during an outage. This was recognised as a good performance by the team.

4.5. CONDUCT OF MAINTENANCE WORK

The team noted that in the maintenance department all staff members are encouraged to improve safety margins, work practices and reduce rework based on station Maintenance Fundamentals. This has led to the positive development of improvements made by employees. This was recognised as a good performance by the team.

4.6. MATERIAL CONDITION

Although the station has several improvements plans in place, such as the Corrosion Management Process and the Leak Reduction Programme, the team found examples where consistent high standards were not maintained. The team also noted a lack of attention to the state of lighting and the installation of cables. The team made a suggestion to continue, and in some cases accelerate, the improvement plans for material condition and correct the faulty lighting and incorrect mounted cabling.

4.7. WORK CONTROL

One challenge for the station is to reduce the backlog on lower prioritised actions to improve the overall material state of the equipment. The number of P3 prioritised items is 903 and P4 prioritised items 1754 with a rising trend in 2017.

The team encouraged the station to achieve a sustained reduction in the overall defect backlog.

4.8. SPARE PARTS AND MATERIALS

Spare parts and material requests are identified early in the work management process to support their timely delivery. There is also a fleet database (POMS) to record and prioritise obsolete equipment. The station is also working on improvements regarding repairable safety related stock items. However, the team found several instances in which return to service of equipment was delayed, or direct repair was not possible due the lack of spare parts, or insufficient quality of spare parts. The team made a recommendation in this area.

4.9. OUTAGE MANAGEMENT

To address an issue found in previous outages, where gaps in engagement from different departments were recognised during the outage preparation, the station has developed a Pre-Outage Milestone Plan (POMP) database for Outage accountability. The results of the last outage showed a significant improvement in POMP adherence with 65 of 69 of the milestones completed on time. At the time of the mission, POMP adherence for the 2018 outage was currently 100%. This was recognised as a good performance by the team.

DETAILED MAINTENANCE FINDINGS**4.6. MATERIAL CONDITION**

4.6(1) Issue: The material condition of equipment is not always appropriately maintained to support safe and reliable operation.

Although the station has several improvements plans for material condition in place, the team noted the following:

- Some cables are not well fixed to cable trays, due to missing cable ties or missing support over a greater distance than the station-specification allows:
 - Cooling Water pump 2A: several vertical cables not fixed with cable ties.
 - South East Essential Supplies building: cables to new alarm fire cabinets are not supported and fixed with cable ties (unsupported for more than 1 metre).
 - Junction Box 272992, cables not fixed with cable ties.
 - AY3 generator jacket secondary water, cable unsupported for about 3 metres.
- Leaks and corrosion are evident on some components:
 - Common cause failures (leaks on rubber gaskets) on radiators providing cooling for all the 8 diesels have several times resulted to 1 or 2 unavailable diesel generators, when the ambient temperature is above 15°.
 - Secondary Liquid Nitrogen Vaporiser 2 is heavily corroded.
 - A Nitrogen pipe by survey point 43 is corroded.
 - The total number of oil leaks shows a degrading trend in the last 10 weeks, at the time of the mission there were 56 active leaks.
 - The overall number of leaks, including air, chemicals, gas, oil, steam and water is 221.
- A significant amount of installed lighting is defective:
 - Room E023R01A, 5 defects
 - Room E02B02R01 6 defects
 - Turbine floor, 11 defects
 - RCA 1 Stair house, 5 defects

Degraded condition of equipment, which is not identified and reported in a timely manner, could lead to equipment failure adversely affecting reliable plant operation and safety.

Suggestion: The station should consider improving the material condition of equipment to support safe and reliable operation.

IAEA Bases:

SSR-2/2 (Rev.1)

Requirement 28: Material conditions and housekeeping

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

28. The operating organisation shall develop and implement programs to maintain a high standard of material condition.

7.10 Equipment that is degraded (leaks and corrosion for example) shall be identified and reported and deficiencies shall be corrected in a timely manner.

8.1 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.

NS-G-2.14

4.36. Factors that should typically be noted by shift personnel include:

- Deterioration in material conditions of any kind, corrosion, leakage from components, accumulation of boric acid, excessive vibration, unfamiliar noise, inadequate labelling, foreign bodies and deficiencies necessitating maintenance or other action;

Plant Response/Action:

A – Apparent Cause of Suggestion:

After the OSART Visit in February 2018, Torness conducted a Casual Analysis on this Suggestion under Assignment 1090571-08 with the key Objective to understand the causes and contributors behind the AFI and why we have the gap in the first place.

Findings from Review:

The OSART Mission made a suggestion that states the Facility should improve the material condition of equipment to support safe and reliable generation.

This is detailed in the key areas identified below (Maintenance 4.6, Technical Support 5.6 & Chemistry 8.2.1)

4.6 The material condition of equipment is not always appropriately maintained to support safe and reliable operation.

Although the station has several improvements plans in place, such as the Corrosion Management Process and the Leak Reduction Programme, the team found examples where consistent high standards were not maintained. The team also noted a lack of attention to the condition of lighting and the installation of cables. The team made a suggestion to continue, and in some cases accelerate, the improvement plans for material condition and correct the faulty lighting and incorrect mounted cabling.

Suggestion:

The station should consider improving the material condition of equipment to support safe and reliable operation.

Problem statement:

Include Problem statement/justification from reviewer report & relevant facts that were found.

It is perceived by the OSART team that Equipment Reliability still has gaps at Torness. The facts detailed in the report below highlight this. It should be noted that Equipment Reliability is closely monitored at Torness and across the fleet, however opportunities do exist to accelerate this further and aim for an Equipment Reliability Indicator (ERI) score of 100.

Future plans and actions should address this and ensure that the ERI does improve on site and ensure safe and reliable generation.

Fact 1 Comments:

Torness are quite specific in cable installation, please see BEG/SPEC/ENG/PSPEC/009 for Procurement Specification for Cabling specifics. It is expected that Cabling Design Principles be strictly adhered to when undertaking any cabling work at Torness, there is further installation information contained in E/DR/98/EC/174. However, it would appear that defects on plant result in some cables not being secured to the local cable trays.

Cause Codes:

EQ5b Shortfall in maintenance practice.

EQ7c Design codes/guidelines misapplied.

Fact 2 Comments:

There is currently a dedicated leak improvement team running at Torness. This team is tasked with driving down the backlog and ensuring that future plans are in place to maintain the leak backlog as low as reasonably practicable. The numbers presented to OSART show a continuing trend over a period of about 3 years. Specifically mentioned was the Diesel Radiator Grommets which are currently being upgraded for a new material which has been through design and testing and proven to halt the formation of glycol leaks at Torness. However, this replacement is over a three-year programme, thus time will be required to embed this fully.

Likewise, an improvement project is running on Corrosion where we now identify and address corrosion defects accordingly.

Cause Codes:

EQ7a Equipment not appropriate for conditions. (Diesel Grommets specific)

WD1e Work Scheduling.

Fact 3 Comments:

Due to the size of the station and the lighting systems, installed defects on lighting systems are to be expected. Any defect on plant should be identified via an orange defect tag hung near the defect and a Work Request should be created within AMS to identify the defect. These are then screened and prioritised accordingly and the Work Review Group and therefore planned in as per the AP928 process.

Cause Codes:

WD1e Work Scheduling.

MS1a No SPAC (Standards, Policies or Admin Controls) {potentially not strict enough}

B – Summary of action plan:

- Establish and ensure that a successful Site Excellence team is functional on site.
- Secure funding to continue to make the required plant improvements.
- Fix all identified issues identified in facts presented by OSART.
- Continue with Diesel Grommet replacement programme.
- Conducting lighting improvement project.
- Launch Corrosion Management programme to get Corrosion into normal business.
- Relaunch leak team as an OFI (Operational Focus Indicator) team

C - Action plan effectiveness review:

- Defects, leaks and corrosion events have decreased over the reporting period and show that considerable focus has been afforded and is giving effective results.
- Significant investment has been made in the plant via the Medium Term Plan, Minor Investment and Site Excellence Programmes.
- We are on plan to have completed 81% of grommet exchanges on all radiators.
- Corrosion board, metrics and plant walk downs all established.
- Torness maintains good Operational Focus Indicators and currently 2nd in fleet with drive to be 1st in fleet by year-end and exceed fleet set targets.
- All specific items identified during OSART have been resolved.

IAEA comments:

The station has conducted a Casual Analyses on the issue. The following root causes were defined; Shortfall in Maintenance practice, Design codes & guidelines misapplied and gaps in work scheduling process.

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

- Review and reinforce the Maintenance Standards.
- Resolve the common cause failures on radiators providing cooling for all the 8 diesels.
- Project 2019 'Lighting improvements'
- Reinforce the work practice regarding the standard for cabling.
- Reinforce the leak and corrosion programme.

Most of the actions are in progress:

- New set of Maintenance Standards is produced and used through the maintenance employees.
- The root cause of radiator failures has found in the type of grommets, 63% of the grommets has been changed according the work management schedule.
- Project 'lighting improvement' is on schedule.
- Facts find in 2019 are resolved and new installed cables are mounted according the specifications.
- The total number of leakages and corrosion is decreased.

The field visit, document review, plant walk down and interviews indicated that the corrective action programme regarding the issue is effective for improving the material condition of the plant. However, during the field visit several situations were found where material degradation had not been reported or was not repaired on a timely manner.

The programme, especially for reinforcing the maintenance standards, lighting improvements and the leak and corrosion programme, should be continued to maintain a high standard for material condition in all working areas.

Conclusion: Satisfactory progress to date.

4.8. SPARE PARTS AND MATERIALS

4.8(1) Issue: Spare parts are not always available in a timely manner to support the availability of safety related equipment and systems.

During the mission, the team observed the following:

- Quality of spare parts:
 - There are no preventive maintenance activities on rotating equipment spare parts in the station.
 - Spare parts for safety related equipment on stock, including Single Point Vulnerabilities (SPV), 80% are not checked if they are fit for purpose.
 - During a planned valve overhaul, the new actuator taken from stock appeared to be inoperable, as it was not correctly wired. Fault finding and repairing the actuator resulted in one-day delay on the fuel route outage.
 - Diesel generator BY was unavailable 2 to 3 days longer than planned, because of incorrect assembly of a spare part by the supplier.
 - Locking plates were removed from stores and found completely covered with rust.
 - Spare kits used for oxygen probe overhaul were found to have foreign material intrusion (a plastic like substance).
- Quantity of spare parts:
 - On 20-1-2018 the AX diesel was unavailable due to problems with the starting valve. The last spare part in stock was used in April 2017. No action had been taken to get this spare part for a safety related component back in stock.
 - A pressure valve, which is vital to refuelling activities, is identified as a non-stock item.
 - A new diaphragm required for the overhaul of valve and actuator R2CX-WT-0617 was registered as 1 in stock but actually there was none in stock
 - A degraded vent valve on polisher cation bed 1-WC-105B could not be replaced in November 2017 due a lack of spare parts on stock. Valve replacement is planned on 10/04/2018.
 - In the third quarter of 2017, twenty condition reports were related to spare parts availability. The station recognised this as an adverse trend.

Without the timely supply of spare parts, the availability of equipment and system may be adversely impacted.

Recommendation: The station should improve the availability of spare parts in a timely manner to support the availability of equipment and systems.

IAEA Bases:

SSR-2/2 (Rev.1)

8.17. The operating organisation shall ensure that materials, spare parts and components are available and in proper condition for use.

NS-G-2.6

8.23. The maintenance group should be responsible for ensuring that adequate spare parts and components, tools and resources for achieving its objectives are available. It should also be responsible for establishing stock levels and authorising the issue and use of spare items and components.

GS-G-3.5

153. Maintenance should be performed on certain items held in storage, such as large pumps and motors. Such maintenance should include periodically checking energising heaters, periodically changing desiccants, rotating shafts on pumps and motors, and changing oil on rotating equipment and other maintenance required by the vendor.

Plant Response/Action:

A – Apparent Cause of Recommendation

The station policy and practices with regard to handling and use of operating procedures and operator aids are not robust enough to ensure that current and correct documents are used by the operators.

Causal Code - MS1b - Standards, Policies or admin controls (SPAC) Need Improvement - Not strict enough.

B – Summary of action plan

The following actions have been taken to address the identified shortfalls

- The Supply Chain department has instigated a change to the focus of team members to enable a focus and acceleration to positively deliver improvements in Spares availability, this was after feedback was gained from a cross functional aspect on station of the Supply Chain Materials function.
- The changes in focus for the team covers numerous avenues, including, completing a comprehensive review of SPV spares, including identification, physical and technical walk downs. There are carry on actions progressing the purchase activity to support this review.
- Identification of spares associated with Critical plant and a sample inspection to understand focus areas has been carried out.
- A review of the Repair process to ensure the risks are mitigated and ensure parts that require repairing are done so in a timely manner, whilst overseeing the improved quality of works.
- Improvements have been made in the housekeeping within the stores and a plan is in place to address some of the packaging issues and environmental elements of the infrastructure.
- In-Stores maintenance is being initiated on key components to ensure maximum availability throughout the life of the component in stock.

C - Action plan effectiveness review

- Monitoring and work-down plans have been developed to track progress in numerous areas. This covers tasks such as projects that have an end date and areas that will need to be continually monitored to demonstrate / track improvements and risks.
- Feedback on a similar style to that gained initially will be sourced in Q4 2019 to help underpin the outcomes from the various tracks being prioritised as a department. This can be used to continue or tweak the service the department offers the station.
- CR trend analysis is being reviewed not only quarterly, but also over multiple months to help support our understanding of the journey on improvements.

IAEA comments:

The station has analysed the issue, using apparent cause investigation. They have reviewed documentation, database reviews and use of '360 Degree feedback' to identify the apparent causes of the issue. The apparent causes were found in unclear Roles and Responsibilities, no expectations for in-stores management and unclear priorities in the repair process for spare parts.

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

- Reinforce the Roles and Responsibilities of the Material team in the Supply Chain department.
- Review the repair process for Spare parts
- Develop the In-stores maintenance practise for components.
- Focus on Single Point of Vulnerability related spares.

Most of the actions are progressing according to schedule. The review of the Single Point Vulnerability related spare parts is completed. Agreed actions are in place for full completion by end of 2019. 90.5% of actions have been completed, 7% of Single Point of Vulnerability related spare parts are in the purchase process, 2.5% of them require remedial refurbishments to be complete. There are no actions behind schedule.

There is one project 'Storage environment improvements' started that will also support quality and availability of the components. This will be executed in 2020.

The effectiveness of the actions was monitored by several performance indicators such as, number of outstanding Spares, tracking of Single Point Vulnerability repairable items and Condition Reports regarding spare parts. All the indicators show that there has been improvement in the availability of spare parts to support safety related equipment.

In-store maintenance has been established.

The field visit, document review and interviews indicated that the station has taken the necessary actions to support the availability of safety related equipment and systems.

Conclusion: Issue resolved

5. TECHNICAL SUPPORT

5.1. ORGANISATION AND FUNCTIONS

The station initiated a corrosion programme for station specialists to proactively monitor, evaluate and measure corrosion processes. Corrosion cards have been provided to staff to help them identify different categories of corrosion. In parallel, the reporting of corrosion related issues has been simplified in a format that can be consistently tracked and trended. The team identified this as a good practice.

The seismic assessment has been proceduralised at the station. The procedure provides instruction on how to minimise hazards in seismic events related to mobile items like trolleys and access steps, as well as scaffolds. However, the team found that some controls of potential seismic hazards were missing or not in compliance with the procedure. The team made a suggestion in this area.

5.6. SURVEILLANCE PROGRAMME

The station surveillance programme was developed based on the industry process for equipment reliability. However, the team identified opportunities to act more proactively in predicting potential problems related to the reliability of the refuelling machine and safety related equipment like diesel generators. The team made a suggestion in this area.

5.7. PLANT MODIFICATION SYSTEM

The station has a web-based modification tool where all relevant processes linked to modifications are available to the project users. This includes the supporting documentation, tools, clear requirements and interrelationships. The station personnel are expected to follow the same procedure for implementation of both permanent and temporary modifications. However, not all aspects of the control and implementation of temporary modifications are properly implemented and formalised. The team made a suggestion in this area.

DETAILED TECHNICAL SUPPORT FINDINGS

5.1. ORGANISATION AND FUNCTIONS

5.1(1) Issue: Movable items in seismic controlled areas are not systematically secured to ensure equipment safety in case of seismic events.

The team noted the following:

- When questioned, station staff could not clearly explain which standards apply with regards to different classifications of seismic areas on site.
- In the Unit 2 Reactor Pile cap, which is designated as a seismic controlled area, many items were found not secured or fixed (for example: movable carts, radiation protection devices, waste collection bins).
- In the Unit 2 Decay heat/ventilation room, which is designated as a seismic controlled area, many items were found not secured or fixed (for example: fire extinguishers, SERT Training Rigs, wood cabinets & COSHH cupboards in the laydown area within the room).
- In the Reactor 2 Boiler Annexe 2A room R2A05R01A, long scaffolds were not fixed to the wall as required by the seismic requirements.

Movable items not properly secured in seismic controlled plant areas could pose a hazard to safe operation of station and equipment required to support nuclear safety during the seismic event.

Suggestion: The station should consider ensuring movable items are systematically secured in seismic controlled areas to prevent adverse effects on equipment important for safety.

IAEA Bases:

GSR Part 2

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

SSR 2/2 (Rev.1)

Requirement 8: Performance of safety related activities

The operating organisation shall ensure that safety related activities are adequately analysed and controlled to ensure that the risks associated with harmful effects of ionising radiation are kept as low as reasonably achievable.

4.26 All activities important to safety shall be carried out in accordance with written procedures to ensure that the plant is operated within the established operational limits and conditions. Acceptable margins shall be ensured between normal operating values and the established safety system settings to avoid undesirably frequent actuation of safety systems.

SSR 2/2 (Rev. 1)

Requirement 9: Monitoring and review of safety performance

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

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 walk downs of the plant by the plant managers.

NS-G-2.13

5.33. Plant walkdowns are one of the most significant components of the seismic safety evaluation of existing installations... These walkdowns may serve many purposes, such as: evaluating in-plant vulnerabilities of SSCs, specifically issues of seismic system interaction (impact, falling, spray, flooding); identifying other in-plant hazards, such as those related to temporary equipment (scaffolding, ladders, equipment carts, etc.); and identifying the 'easy fixes' that are necessary to reduce some obvious vulnerabilities, including interaction effects. Walkdowns should also be used to consider outage configurations that are associated with shutdown modes.

Plant Response/Action:

After the OSART Visit in February 2018, Torness conducted a Causal Analysis on this Suggestion under Assignment 1090571-09 with the key Objective to understand the causes and contributors behind the AFI and why we have the gap in the first place.

The apparent Cause is detailed below.

In January 2008 TBT/0043 (Toolbox talk) was issued detailing the safety case requirements for seismic storage, this procedure identified 3 general rules:

1. No unsecured materials or equipment should be stored in the reactor quadrants, reactor basement, SSD room, reactor services annexe, mechanical annexe or essential supplies buildings unless they are in a designated lay-down area.
2. Wheeled items must only be stored within the designated lay-down areas and must be adequately braked or secured to prevent movement. To assist with this, some laydown areas (e.g. those for storing switchgear access and maintenance equipment within the Essential Supplies Buildings) are equipped with chain restraints.
3. If there is no designated lay-down area, any wheeled items must be moved to an area that does not contain essential plant.

In June 2014, TBT/0178 (Tool box talk) was issued following the introduction of seismic requirements in BEG/SPEC/OPS/030 Site Excellence in Material Condition explains how seismic, fire loading, laydown, housekeeping and material condition is controlled to reduce the hazards to nuclear safety, the procedure goes on to state 'Seismic SQEP to review proposal and ensure that the laydown area and its contents will not affect the seismic qualification of the plant. There should be no Laydown or Storage in seismic sensitive areas except in exceptional circumstances.

Performance Gap:

Change to standard, Torness seismic areas are too general to be effective.

For example: 'Main Deaerator 37.4 m level' has been marked up as seismic area, the only seismic related equipment in this area are LP vent discharge pipes this is only a 6 square meter area.

Cause Categories:

- MS1c SPAC Standards, Policies, or Admin Controls (SPAC) confusing or incomplete.

TBT/0178 identified 23 seismic plant areas, rooms, quadrants etc. Additionally, access and egress to these areas were painted with a blue line identifying that seismic requirements were to be followed.

This toolbox talk also allowed for storage in a seismic area with a caveat that tools and material would be stored 1.5 X height +300mm from nuclear safety related equipment.

Performance Gap:

Seismic related equipment was not identified, making it difficult for plant personnel to easily determine what was essential. A reliance on individuals identifying essential equipment and requesting a laydown area in a seismic zone.

Cause Categories:

- MS1b SPAC Standards, Policies, or Admin Controls (SPAC) not strict enough

Performance Gap:

TBT/178 was issued to all teams, only 41/83, 50% of the TBT returns have been recorded. (Assumption is 50% of the teams did not get the brief)

The standard had not been communicated effectively to all staff.

Cause Categories:

- CO1a No Comm. Or Not timely Comm. system NI

In May 2015 CR 859119 was generated for Compliance with seismic safety case. SRD Surveillance, closure of this action was a housekeeping improvement plan, storage area authorisation, TBT/178 on changes to the standard, plant floor markings were claimed.

November 2017 Site excellence moved to OPDT for challenge, a new Site Excellence plan was developed, Key areas included Storage and Laydown areas approval utilising a new fleet database.

The Torness housekeeping monitoring spreadsheet currently records 62 observations under Material condition and seismic, 19 areas are in Amber.

OPEX

Fleet site excellence review in 2017 identified in theme 7.1 (Supports and Seismic arrangements) the station gained a mostly achieved rating. 11 observations have been documented recording gaps to our seismic arrangements. Improvements in approving storage areas and seismic restraints are being progressed through site excellence.

Fleet OPEX identified actual seismic equipment as seismic and local controlled areas around essential plant are implemented.

Causes of non-compliance:

Is there a clear, fit-for-purpose standard?

No, the standard has changed over several years, the current required reading TBT/178 is at odds with BEG/SPEC/OPS/030 Site Excellence in Material

Is it communicated & understood (via policy documents, training, briefing, etc.)?

No, TBT/178 was not recorded as completed by 50% of Torness employees.

Is it reinforced (through coaching and support)? And

No, Housekeeping spreadsheet has identified 19 areas in amber with 62 observations.

Is it followed?


The process cannot be followed effectively, the standard has changed, and the briefing note is not current, line managers are identifying issues, but gaps are still being identified.

Findings from Review - Include a short description of the fundamental overall problem (AFI).

Seismic standards, procedures and guidance notes are not clearly aligned to ensure Torness staff are cognisant of the seismic requirements.

This has left the station vulnerable to some gaps in seismic controls not in compliance with the procedure.

B - Summary of action plan:

Seismic Safety Standard Enhancements	
<ul style="list-style-type: none">All staff and contractor Toolbox Talk 0231	 <p>The screenshot shows a presentation slide for a 'Toolbox Talk'. At the top, it says 'NOT PROTECTIVELY MARKED'. Below that is a blue header with 'Toolbox Talk' in white. Underneath is an orange bar with 'TBT/0231 Revision 001 January 2019'. The main content is in an orange box titled 'Seismic Safety Standards' with a short paragraph. Below that is a white box titled 'OPEX/Reason for talk/introduction' containing three bullet points.</p>

- Seismic awareness on monthly brief

Site Excellence Improvement

As a seismic resilience improvement and based on international best practise, the use of brass chains as restraint in seismic laydown areas have been replaced with buckle straps. These straps have been designed with a breaking load capable of exceeding the force associated with the seismic peak ground acceleration predicted in the safety case. Our seismic safety standards require that no unsecured items are stored in locations where they may affect essential plant in the event of an earthquake. Areas containing seismically qualified plant are marked with a blue background line on the floor at the entrance with white lettering **SEISMIC**. Henceforth, only use approved restraint straps for securing equipment in seismic laydown areas, and these straps are available for collection from the main store with catalogue IDs (and lengths): 1089653 (3m), 1089663 (4m), and 1089665 (5m).



- Seismic WELL Sheet

Seismic Safety Standards



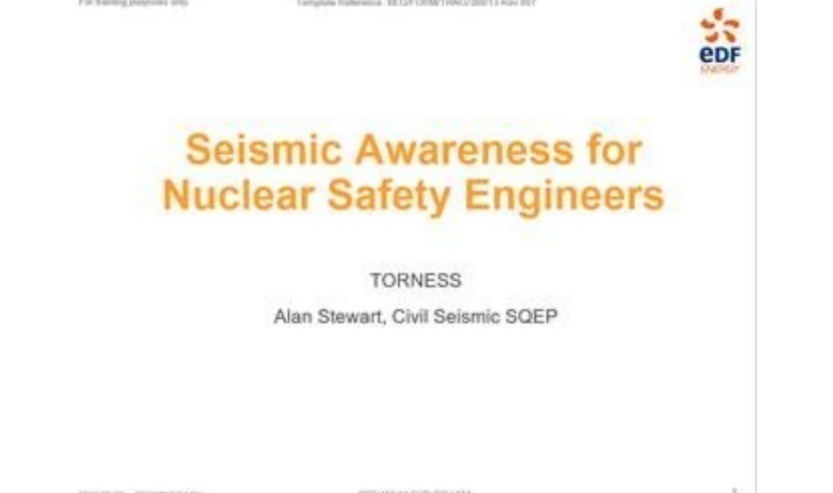
Equipment mounted on wheels (e.g. mobile maintenance trolleys and access steps) are capable of moving considerable distance during an earthquake. If they are required to be stored within a seismically sensitive area, they should be secured to the building structure using seismic qualified buckle straps and anchorages, or fixed with heavy secured bracks.

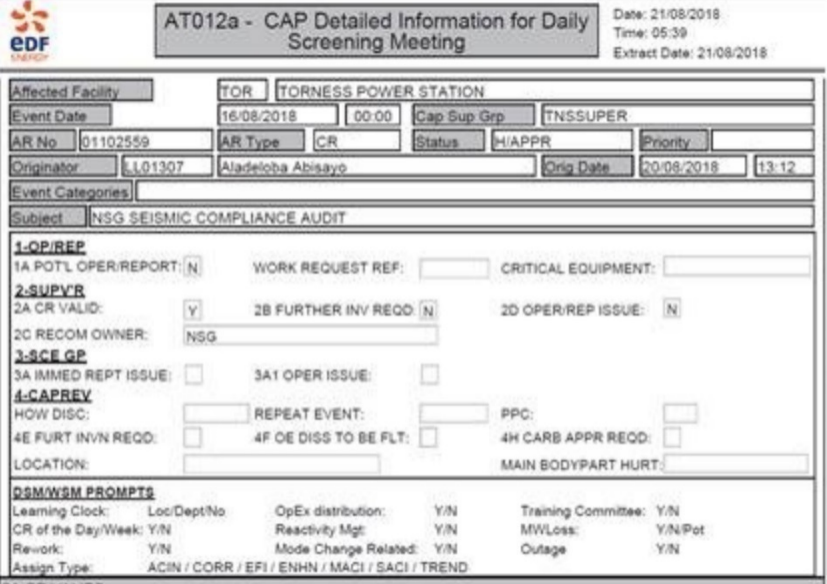

- Discuss seismic safety standards as part of pre-job brief and setting to work.
- Ensure that items are only stored in areas containing seismically qualified plant if it is not reasonably practicable to move them elsewhere.
- Ensure that items are stored within an approved laydown area and for the shortest practical duration.
- If there is no designated laydown area, items must be moved to an area that does not contain essential plant.
- Wheeled items must be adequately braked or secured to prevent movement.
- Any stored equipment must be at a distance greater than [1.5 x height of interacting material/equipment + 300mm] from the essential plant.
- Scaffolding with an aspect ratio (height-width) of less than 2.5 is judged to be seismically robust. If the aspect ratio is greater than 2.5, the scaffold must be secured to the building structure.
- Seismic buckle straps can be collected from the main store using consumable spare work order card number (1182123), and catalogue IDs (lengths): 1089653 (3metre), 1089663 (4metre), and 1089665 (5metre).
- All temporary laydown areas in areas containing essential plant must be removed as soon as possible after completion of work.

Seismic Safety Standards

Equipment mounted on wheels (e.g. mobile maintenance trolleys and access steps) are capable of moving considerable distance during an earthquake. If they are required to be stored within a seismically sensitive area, they should be secured to the building structure using seismic qualified buckle straps and anchorages, or fixed with heavy secured bracks.

Colour Rating (Score)	Observation Criteria
Blue (5)	<ul style="list-style-type: none"> No item is stored in areas containing seismically qualified plant. CR should be raised to share good practice.
Green (4)	<ul style="list-style-type: none"> Only few items are stored in seismic laydown area. Items are restrained with seismic buckle straps. Temporary laydown area signage is available and correct. Wheeled items (such as maintenance trolleys and access steps) are adequately braked or restrained to building structure. Immobile items (such as storage cupboards, step ladders and portable maintenance equipment) are stored at a distance greater than [1.5 x height of interacting material/equipment + 300mm] away from any essential plant. Gas bottles are stored at purpose built facilities or in bottle trolleys secured to prevent movement. Scaffold has aspect ratio of less than 2.5 or is secured to adjacent civil structure (i.e. reinforced concrete or steel structural members).
White (3)	<ul style="list-style-type: none"> 1 Green criteria not met.
Amber (2)	<ul style="list-style-type: none"> 2 Green criteria not met.
Red (1)	<ul style="list-style-type: none"> 3 or more Green criteria not met OR 1 significant AFI was observed.

<ul style="list-style-type: none"> Seismic-themed safety messages and quiz 	<p>19 – 25 August 2019 This week's theme is 'Seismic Safety Standards'</p> <p>Feedbacks from international peer reviews (WANO, OSART) and internal regulator have identified that the seismic safety requirements were not fully understood or consistently applied on the site. Earthquakes in the UK are frequent but much less severe in magnitude and damage. In order to protect essential plant from damage caused by moving objects during an earthquake, the seismic safety case requires that no unsecured materials or equipment are stored in area where they may affect essential plant.</p> <p>During the course of this week, we are seeking to raise awareness and improve behaviours of personnel on seismic safety standards across the site. Team leaders should divide their team into two to complete the attached quiz on Thursday.</p> <p>For further information, please contact: Abisayo Aladeloba 01368 873668 abisayo.aladeloba@edf-energy.com</p> <table border="1"> <thead> <tr> <th>Day</th> <th>Messages</th> <th>Supporting Information</th> </tr> </thead> <tbody> <tr> <td>Monday</td> <td>Could an earthquake really occur in the UK?</td> <td>Yes. Earthquakes in the UK are frequent but much less severe in magnitude and damage. The 2011 Japanese earthquake that affected Fukushima had a magnitude of 9 whereas magnitude less than 5 is typical in Britain, a difference of 4 units. Energy release was therefore about a million times greater than a typical UK event.</td> </tr> </tbody> </table>	Day	Messages	Supporting Information	Monday	Could an earthquake really occur in the UK?	Yes. Earthquakes in the UK are frequent but much less severe in magnitude and damage. The 2011 Japanese earthquake that affected Fukushima had a magnitude of 9 whereas magnitude less than 5 is typical in Britain, a difference of 4 units. Energy release was therefore about a million times greater than a typical UK event.
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<ul style="list-style-type: none"> Replacement of chains with seismic-qualified buckle straps. 							
<ul style="list-style-type: none"> Laydown area database – including seismic assessment and approval 							
<ul style="list-style-type: none"> Seismic awareness training for Engineers 							

<ul style="list-style-type: none"> Quarterly NSG seismic focus walk-down 	
<ul style="list-style-type: none"> Seismic signage and improvements on the plant <ul style="list-style-type: none"> -Seismic signage Nitrogen Compound Entrance -Seismic signage on floor 2AY/2BY EBF Pumps entrance door -Adding of seismic restraint to trolleys in pile-cap 	

C - Action plan effectiveness review:

IAEA comments:

The station has analysed the issue and identified that it was caused mainly due to change in staff demographic, with many retirements have taken place and new staff have been recruited. This has resulted in a drop in awareness of the seismic safety standard and requirement among station and contractor staff.

The station has revised the Toolbox Talks on seismic safety standards. This Toolbox Talks was communicated to all station and contractor staff (about 500-600 people) on site and it has a completion rate of over 90% at two weeks before the OSART follow-up mission.

The station also launched a seismic safety standard promotion week in 2019, the information included the seismic safety standards, the method to assess the status of a seismic controlled area, what excellence looks like, plant areas designated seismic controlled areas, newly approved seismic restraints for laydown areas, and seismic safety standard quiz.

A comprehensive station training package was also provided to engineers in engineering and nuclear safety departments (about 100 person) in the station to raise awareness on seismic safety standards and seismic qualification methods for plant modifications.

The station procedure on aspects related to seismic laydown areas was revised recently to include the new requirements.

The station point of contact for seismic control was established and is available to answer questions related to seismic control.

The seismic control requirements were also briefed to the station and contractor staff as a focus topic in previous edition of the monthly brief, a communication tool used to highlight key company information, stories, and performance indication in the station.

Nuclear safety group conducts specific seismic walk-downs on a quarterly basis. The site excellence team conduct monthly housekeeping walk-downs, which includes seismic aspects, and the operations department conduct daily field walk-downs in the plant.

The station housekeeping monitoring spreadsheet indicated that in the last round of field walk-downs conducted in August 2019, there were several deviations from the station expectations on seismic control in the areas of quadrants of reactor 1 and 2.

During the field visit, it was observed that a trolley was not secured with the station approved straps or the wheels braked in an electrical room designated as seismic controlled area, and other two trollies were observed not secured in the pile cap areas of reactor 1 and 2, which were designated as seismic controlled area.

Conclusion: Satisfactory progress to date

5.6. SURVEILLANCE PROGRAMME

5.6(1) Issue: The station's equipment reliability programme is not always effective in preventing abnormal conditions that challenge operational safety.

Overall station performance has improved in a several areas in the recent years. However, the team noted opportunities to improve equipment reliability in some areas:

Fuelling Machine Reliability:

- The fuel route performance indicator in recent years is lower than station target; for 2017 the indicator was 70.2 versus a year-end projection of 92.0. Refuelling machine reliability is a major contributor to the shortfall.
- The indicator reflects that, in the last four months in 2017, there were 6 times when the plant unavailability was greater than 7 days due to fuelling machine unavailability.
- In last four months in 2017 six temporary modifications were performed due to equipment deficiencies.
- The station has faced recurrent equipment failures. These recurrences have been attributed to insufficient preventive maintenance in the past, however to solve this problem, the station recently put in place a living maintenance policy.
- In last three years more than 120 condition reports (priorities 1-3) were initiated related to fuel route.
- In last 4 months of 2017, eight significant condition reports (priorities 1-2) were initiated related to fuelling machine.

Diesel Generator Reliability:

- AX Diesel Generator (DG) was unavailable more than 10 days, and the root cause has not been identified. At the time of the mission, technical fault finding was underway and the root cause was not expected to be determined until completion of a test run.
- The overall performance indicator on reliability of emergency generation (all DGs included) was red on three occasions in Q3/Q4 of 2017. This indicator covers all 8 diesel generators, and the metric can mask the real condition of the emergency generation. It can be red even if it has experienced issues with just one engine.
- In the last three years more than 30 condition reports (priority 2 and 3) were initiated related to diesel generators.
- In 2016/2017 there were common cause radiator leakages on AY2, BY3, BY4, CY1, CY3, DX1, DX2, DY3. On 6/09/2016 and 5/09/2017 until 13/09/2017 radiator leakages caused 2 emergency diesels to be unavailable at the same time. Issues related to radiators (rubber gaskets) started quite a long time ago. The first engineering change was performed around 2010, and after that, three additional solutions were evaluated. One further engineering change has been initiated to solve the problems with radiator leakages.

Without a proactive equipment reliability programme, the station may miss the opportunity to prevent abnormal conditions that challenge operational safety.

Suggestion: The station should consider enhancing its equipment reliability programme to prevent abnormal conditions that challenge operational safety

IAEA Bases:

SSR 2/2 (Rev.1)

Requirement 31: Maintenance, testing, surveillance and inspection programmes

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

8.4. Preventive maintenance should be of such a frequency and extent as to ensure that the levels of reliability and functionality of the plant's SSCs important to safety remain in accordance with the design assumptions and intent.

8.5. The frequency of maintenance, testing, surveillance and inspection of individual structures, systems and components shall be determined based on:

- a) The importance to safety of the structures, systems and components, with insights from probabilistic safety assessment taken into account;
- b) Their reliability in, and availability for, operation;

NS-G-2.6

2.11. The objectives of the surveillance programme are: to maintain and improve equipment availability, to confirm compliance with operational limits and conditions, and to detect and correct any abnormal condition before it can give rise to significant consequences for safety. The abnormal conditions which are of relevance to the surveillance programme include not only deficiencies in SSCs and software performance, procedural errors and human errors, but also trends within the accepted limits, an analysis of which may indicate that the plant is deviating from the design intent.

2.12. The operating organisation should establish a surveillance programme to verify that the SSCs important to safety are ready to operate at all times and are able to perform their safety functions as intended in the design. Such a surveillance programme will also help to detect trends in ageing so that a plan for mitigating the effects of ageing can be prepared and implemented.

4.7. Following any abnormal event, the operating organisation is required to revalidate the safety functions and the structural and functional integrity of any SSCs that may have been challenged by the event. Necessary corrective actions are required to include maintenance, surveillance and in-service inspection, as appropriate.

Plant Response/Action: (Fuelling Machine)

A – Apparent Cause of Recommendation

The fuel route within the station is a department that encompasses a multi-function approach to refuelling activities. The need for a more cross-functional approach to equipment reliability was needed to ensure maintenance policies were enacted through organisational learning.

Causal Code

EQ2a PM did not exist

EQ9a OE not implemented effectively

B – Summary of action plan

The following actions have been taken to address the identified shortfalls

- A Fuel Route assist was carried out to achieve a high level learning from similar event in other places and implement a forward action plan. A Fuel Route Delivery Team (FRDT) was set up to replace the Fuel Route Oversight Board; this is chaired by the FR Manager and attended by all relevant station departments. The FRDT meets on a regular basis and includes a strategic review and a performance review (tactical), in order to prioritise and learn from past events.
- In combination with the FRDT, improvement teams have been established to target the top 5 issues for each of the key fuel route operational area including the fuelling machine, IFD and Pond & Flask. These have a cross functional team to aid delivery.
- The maintenance policy and MITS optimisation work continues as part of the FR business plan; these items have been aided by the Equipment Reliability Acceleration Team (ERAT) and using external contract resource through Fuel Systems Branch at Barnwood HQ. This is now beginning to show signs of improvement. Maintenance policy improvements are reported monthly to the Plant Health Committee.

C - Action plan effectiveness review

- The fuel route Delivery Team is now well established and growing in effectiveness. Maintenance policy work via MITS optimisation and equipment failure investigation are in progress to achieve more reliable plant. A specific improvement team is now established for the fuelling machine with cross-functional support including ERAT being dedicated to improving equipment reliability through maintenance policy updates.
- The quantity of P1/P2 repairs over the period is steadily dropping with the SHIP score, which is the cumulative reliability index for the fuelling machine that achieved white status for the first time. Rework on the fuelling has also improved over the period with long-term legacy repairs being fix to prevent reoccurrences. A higher level of investigations and target equipment failure investigations.
- In the first 6 months of 2019 the Fuel Route Performance Index (FRPI) has dropped to below 40. This has been caused as a lag effect of trained operators and an event recovery on the flask cell. An extra 16 days were used in the Jan 19 outage to repair 2 known defects to increase equipment reliability (fuelling machine gearbox, actuator oil leak) this had the impact for the forward fuel build which caused a drop in FRPI, however this has had the effect of reducing the FR delays due to machine bottom end.
- The fuelling machine has contributed to this in terms of repairing legacy equipment reliability issues, namely the fuelling machine valve actuator, gearbox and non-return valves. These have now had permanent fixes applied; the improvement team now have a systematic approach to identifying and improving the reliability of the plant.

Plant Response/Action: (Diesel Generators)

A – Apparent Cause of Suggestion:

After the OSART Visit in February 2018, Torness conducted a Casual Analysis on this Suggestion under Assignment 1090571-08 with the key Objective to understand the causes and contributors behind the AFI and why do we have the gap in the first place?

B – Summary of action plan:

SHIP Score

- Since January 2018, the D33 SHIP score has been red 3 times, amber 5 times and white 10 times. Most significantly, at the time of writing the SHIP score has been white for the last 6 months. The SHIP score during the last 6 months has seen the lowest scores in the last 3 years. This shows an improved diesel performance since the OSART visit. The unbanded score has improved and is currently at the lowest value in the last 3 years. The unbanded score is more sensitive to poor performance in one particular area.

Independent Nuclear Assurance (INA) Concurrence

- Reflecting the poor performance at the time, the station initiated the use of the EDF Energy Independent Nuclear Assurance (INA) Concurrence process to improve the diesel reliability. In March 2018, INA produced a scope document SRD/REP/CON/TOR/008A and Engineering created a set of actions to address the scope identified. These actions were tracked through the station top 10 process (see below). In November 2018, the INA agreed that sufficient improvement in diesel performance had been made for the concurrence to be closed. Closure was recorded in SRD/REP/CON/TOR/008B

Station Top 10

- Also in March 2018 Emergency Diesel Generators Reliability Issues were raised as a Station Top 10 issue. A problem statement was created, a scope of work, key milestones, effectiveness measure and actions.
- 38 actions were identified to improve reliability. Progress was monitored at the station plant health committee and in Q4 2018, it was agreed that the close out criteria for the top 10 statement had been met and the Emergency Diesel Generators Reliability could be removed from the station top 10 list.
- The full Top 10 scope statement including details of the action taken is attached.

MITS Test Runs

- To confirm the diesel availability and reliability there is a 10 week MITS test. The diesel is started from either the Central Control Room (CCR), locally or Post Trip Sequencing Equipment (PTSE), on rotation and loaded to the grid at approximately 80% load for 3 hours. A summary of the MITS tests and start demands from reactor trips is included for 2018 and 2019 and shows that the engines have performed on 98% of the demands. The most common issue recently has been around the engine governor. The system design is based on an electronic governor and mechanical governor to give redundancy. Carrying out test runs to the grid is not practical on only the mechanical governor but the engine can meet the safety case requirements for post trip cooling on only the mechanical governor. As noted in Fact 1 investment, work has started to replace the mechanical governors.

C - Action plan effectiveness review

- Diesel reliability has greatly improved and the use of the Station Top 10 scope statements has greatly helped the station focus on priority items.
- It should be noted that D33 Diesel SHIP score earlier this year has the lowest banded and unbanded score for the past 3 years. This shows the excellent improvements delivered by the station.

IAEA comments:

The station has carefully assessed the two key elements in this issue, one relates to reliability of fuel handling machine and the second to reliability of diesel generators.

The station concluded that the main causes for the fuel handling machine reliability were that some preventive maintenance activities did not exist, operating experience was not implemented effectively, and a multi-functional approach involving all relevant departments in the station was required to improve the fuel handling machine performance. A cross-functional team, (the fuel route delivery team: FRDT) with members from operations, maintenance, engineering, and safety departments, was established in January 2019, this replaced the previous oversight board within fuel route department. The FRDT meets twice per month to provide challenge and support to the fuel handling machine performance improvement programme. The resource of the whole station was mobilised in this effort. The fuel route improvement plan was broken down into three sub-focus areas: fuel-handling machine, Irradiated Fuel Disposal and Pond & Flask. Five top challenges were identified in each sub-focus area, and cross-functional resources were utilised to resolve these issues.

In the planned fuel handling machine outages in January and July 2019, the station was able to address some of the long-standing issues. Resulting from these concerted efforts, the team noted signs of improvement. The system health indication programme (SHIP) unbanded score for fuel handling machine has improved from about 60 in January 2018 to about 20 in recent months. The SHIP banded score for fuel handling machine showed a trend of slight improvement. The number of urgent defects of fuel handling machine has peaked and is showing signs of improvement, with the number decreasing from about 9 at the peak to about 5 in recent months. However, in June 2019, unplanned fuel handling machine unavailability arose due to a legacy issue. More time is required to fully demonstrate the effectiveness of actions taken at the station.

Regarding the diesel generator reliability, the station assessed that the plant performance improvement tools, such as TOP 10 issue management tool, were not rigorously implemented to improve diesel generator performance.

The station conducted a thorough investigation of the reliability of the diesel generator and placed the diesel generator into the station TOP 10 issue to accelerate the performance improvement. A detailed action plan was developed with clear owners, due dates, status tracking, and close out criteria. The Independent Nuclear Assurance function is also involved for action closure. A station procedure on diesel generator governor and starting faults was developed to ensure a standard systematic approaching for performing fault finding. With the experience gained, the station also developed a plan to proactive upgrade some of the problem prone devices of the diesel generators, such as electronic governors and mechanical ball-head governors.

There is a clear sign of improvement of diesel generator performance, the number of unsuccessful diesel generator tests has been reduced from 4 in 2018 to zero in the first eight months of 2019, the diesel generator SHIP unbanded score has improved from 24 in January 2018 to about six in recent months, the SHIP banded score has improved to 3 in July 2019. As a result, the diesel generator issue been removed from the station's TOP 10 issue list.

During the field visit, the team observed that there were several oil puddles underneath the DX and DY diesel generators. Some oil absorbers used to collect the oil leaks were completely soaked. It was difficult to assess if these are new leaks or leaks from previous operations or maintenance activities.

Conclusion: Satisfactory progress to date

5.7. PLANT MODIFICATION SYSTEM

5.7(1) Issue: Temporary modifications are not systematically controlled to minimise their cumulative effect on plant operation.

The station's Asset Management System (AMS) contains a record of the installed Temporary Modifications (TM). At the time of the mission there were 20 installed.

The team observed the following:

- Temporary modifications are not 'time-limited' and their duration can be extended. The station's procedure states the following: 'A temporary modification will primarily be used for time limited modifications, which then return the plant to its original state'.
- R2 Main boiler SRV B2BY-SS-R0007 flexible hose fitting of temporary restrain, installed in 2015, has been extended twice to date. Revision 1 states the following justification for extension: 'EC revised to extend expiry date to 14/09/15, in line with 2015R2 outage end date'. Revision 2 states the following justification for extension: 'EC revised to extend expiry date to 19/12/18. This is due to the deferral of bellows fitment from the 2015R2 outage to the S11R2 (2018) outage'. Inspection of the restraint assembly during the 2015R2 outage has confirmed it to be in good condition and suitable for a further three years' service.
- A temporary modification to remove of 3 out of 4 interlocking on Low Voltage Air Circuit Breakers (ACBs) to allow additional ACB maintenance was installed in 2014. It is still on the list of Temporary Modifications, however should have been created as a permanent modification. Topic Notes state that the shorting link will be removed when the M80 breaker is replaced under project 4A-710. This Engineering Change (EC) should be revised and closed.
- Temporary modification on mismatch monitor was installed in 2017 and has been revised 5 times to date. Revision 5 states the following justification for extension: 'Raised due to the inability to trace the reason for random failure of the mismatch monitor. This temporary EC will now be kept open until a replacement mismatch monitor is installed or justification has been made for permanent operation without mismatch monitor'. Permanent EC 360697 started, for mismatch monitor replacement. Justifications for previous revisions were related to different failures of the mismatch monitor.
- Temporary modifications are not labelled at their location. This is not in accordance with local procedure on implementation of modifications which states: 'Temporary plant modifications shall be labelled'.
- It is not clear who controls temporary modifications and how often they are reviewed. There is no clear requirement for informing relevant staff in appropriate time of temporary modifications and of their consequences for the safe operation of the station. Recently a Configuration Control Management Team run by Operations with Design Engineering Group Head in Attendance, has been established and reviews temporary modifications monthly (5 minutes is assigned for this task).

Without properly controlled temporary modifications, the current plant status might not be fully understood and safety may be diminished.

Suggestion: The station should consider strengthening control of temporary modifications to ensure their cumulative effect on safe plant operation is fully understood.

IAEA Bases:

Requirement 11: Management of modifications

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

4.41 Temporary modifications shall be limited in time and number to minimise the cumulative safety significance. Temporary modifications shall be clearly identified at their location and at any relevant control position. The operating organisation 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.

NS-G-2.3

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.

NS-G-2.3

6.5. The plant management should periodically review outstanding temporary modifications to consider whether they are still needed, and to check that operating procedures, instructions, drawings, and operator aids conform to the approved configuration. The status of temporary modifications should be periodically reported (typically at monthly intervals) to the plant manager. Those that are found to be needed permanently should be converted in a timely manner according to the established procedure.

NS-G-2.4

6.72. The operating organisation should establish a procedure to ensure the proper design, review, control and implementation of all permanent and temporary modifications. This procedure should ensure that the plant's design basis is maintained, limits and conditions are observed, and applicable codes and standards are met. A record of the review shall be made available to the regulatory body. The operating organisation maintains responsibility for safety implications of the modification and for obtaining the appropriate review and approval by the regulatory body if required.

6.73. Requests for modification should be evaluated based on their impact on plant safety and reliability, plant operation and performance, personnel safety and the fulfilment of regulatory requirements. Considerations should include the need for training upgrades and associated hardware.

NS-G-2.14

5.40. Tagging should be used to designate clearly that the modification in the field is approved for use. Operations personnel should maintain a tagging programme. Each approved modification should be assigned a unique number.

5.41. Control room operators should maintain a listing of the temporary modifications that have been made. The listing should identify each modification by its number and should include copies of the description of the modification made and of its reviews and approvals.

5.42. Operations personnel should review periodically all temporary modifications for their continued applicability and proper implementation.

Plant Response/Action:

A – Apparent Cause of Suggestion:

After the OSART Visit in February 2018, Torness conducted a Casual Analysis on this Suggestion under Assignment 1090571-10 with the key Objective to understand the causes and contributors behind the AFI and why do we have the gap in the first place?

The station has a web-based modification tool where all relevant processes linked to modifications are available to the project users. This includes the supporting documentation, tools, clear requirements and interrelationships. The station personnel are expected to follow the same procedure for implementation of both permanent and temporary modifications. However, not all aspects of the control and implementation of temporary modifications are properly implemented and formalised. The team made a suggestion in this area.

Temporary modifications are not systematically controlled to minimise their cumulative effect on plant operation.

Suggestion: The plant should consider strengthening control of temporary modifications to ensure their cumulative effect on safe plant operation is fully understood.

Problem statement – BEG/SPEC/OPS/058 states that the aggregate impact of temporary modification shall be periodically reviewed. There is no formal station process documenting this activity.

B – Summary of action plan:

Action 1:

Ensure BEG/SPEC/OPS/058 is complied with by ensuring that there is formal station process for periodic review

Close Out Criteria:

Formal written procedure for periodic review of temporary ECs is visible, clear and followed.

Station Progress:

EC's reviewed at Configuration Management Working Group on a monthly basis.
TSP/LIC/001 updated to show responsibility.

Action Complete.

Action 2:

Make clear what is an acceptable circumstance to revise a temporary. EC. This should be done through Engineering Change refresher training

Close Out Criteria:

AV2/3 trained staff will understand the standards for revising a temporary. EC and therefore understanding the length of the life of a temporary EC, which is acceptable

Station Progress:

EC refresher training package updated. EC training rolled out end of Q42018 & Q12019.

Action Complete.

Action 3:

Refresh standards for Temp ECs to ensure that labelling of temporary modifications takes place. This should be done through Engineering Change refresher training
Close Out Criteria:

Standards are clear and understood and all temp. ECs should have labels

Station Progress:

EC refresher training package updated. EC training rolled out end of Q418 & Q119

All Temporary EC's have now had labels applied.

Action Complete.

Action 4:

Make clear who is responsible for frequent review of temporary. ECs and what the role encompasses.

Close Out Criteria:

A clear and known owner for review of temporary ECs will be formally documented

Station Progress:

TSP/LIC/001 updated to reflect responsibility

Action Complete.

C - Action plan effectiveness review:

Station procedures have been amended and training delivered to Engineering Support Personnel, Configuration Management Working Group now reviewing temporary ECs with actions placed to manage backlog and temporary EC labels fitted on plant.

Current station temporary ECs have been reduced, now at 14.

As an additional measure, Temporary ECs are discussed at the Engineering department start of week brief.

It is considered that the measures put in place effectively manage our temporary Engineering Changes

IAEA comments:

The station has analysed the issue and identified that this issue was mainly because the plant had not established a clear expectation on the responsibility and ownership of temporary modification management and control.

The station has revised the plant procedure on implementation of modifications, which now includes clear expectations on how temporary modifications and its aggregated impact should be reviewed, who is responsible for the management of temporary modifications, and how a temporary modification should be labelled. The plant also established that the maximum duration of a temporary modification should not exceed three years, or it should be removed before the next outage.

The list of temporary modifications is currently reviewed in the configuration management working group meeting on a monthly basis as a dedicated agenda item with participations

from relevant departments from the station. This increased the ownership and visibility of the temporary modifications.

Dedicated training on engineering change process, including these new requirements on temporary modification has been provided to design engineers, technical engineers and engineers from technical advice group.

The station demonstrated that the current temporary modifications are labelled, however, it was noticed that the labels for temporary modifications were not consistent.

The station has reduced the number of active or installed temporary modifications from 23 in January 2018 to 13 in September 2019.

The field visit revealed that labels for temporary modifications are in place.

Conclusion: Issue resolved

5.1(a) Good Practice: Corrosion Cards

Corrosion is a growing concern in the station that can lead to significant nuclear, industrial or environmental safety events and/or a loss of generation. As part of a fleet-wide Corrosion Programme, station needs to be able to appropriately act to highlight risks in a format that allows for tracking and trending. To achieve this:

- Personnel are being provided with corrosion cards to be able to categorise Cases of Corrosion, to assign Corrosion Priorities and to know the further actions associated with each Priority.
- The station developed a way for personnel to be able to easily report corrosion related condition reports & working requests in a format that will enable tracking & trending.

Benefits include:

- Risk mitigation for corrosion vulnerable plant has been assessed (and assigned a grade: CV1 to CV4), and action plans undertaken to improve the plant.
- Staff awareness is heightened by distribution of corrosion identification cards with pictorial guidance.
- The ‘Work Request’ panel has been amended so that analysis and recording the ‘as-found’ condition can be investigated promptly.
- Essential plant areas such as Auxiliary Boiler Exhaust Stack, Diesel Generator Exhaust Stack, CO2 Storage Plant and Nitrogen Storage plant have been improved greatly.
- Plant investment strategy can be influenced on a risk based approach to improve value and efficiency.
- Toolbox talk 160 was distributed to raise awareness throughout the plant.

CATEGORIES

CORROSION CATEGORY	DESCRIPTION	WM JOB TYPE CODE	ALIGNS WITH
1	SEVERE substrate degradation	C1	Corrective
2	SIGNIFICANT substrate degradation	C2	Elective
3	NO SIGNIFICANT substrate degradation	C3	Other
4	SUPERFICIAL substrate degradation	C4	Other

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PRIORITIES (as per BEG/SEC/WMA/1/100)

PRIORITY	DESCRIPTION
1	Requires immediate evaluation. Begin immediately and work around the clock or as agreed with Operations.
2	Schedule at earliest opportunity (<5 weeks).
3	Schedule within the Execution Plan or within the 1st Cycle of the Cycle Plan (<30 weeks AGR/<15weeks SZB).
4	Schedule as resources allow within the normal process.
5	Work only when time allows.

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6. OPERATING EXPERIENCE FEEDBACK

6.2. REPORTING OF OPERATING EXPERIENCE

The station provides recognition and visibility to staff identifying and reporting particularly good findings. To achieve this, condition reports (CRs) of interest are selected at the screening meeting and the most valuable ones are awarded CR of the day, of the week or of the month. This has allowed an increased quality of event reporting and the team recognised it as a good performance.

6.4. SCREENING OF OPERATING EXPERIENCE INFORMATION

The prioritisation and categorisation process is not based on the explicit safety significance of the event but rather on the degree of acceptance by the station of the event to reoccur. The team found several CRs for which the priority level or the depth of investigation was not commensurate with the actual or potential safety significance. The team recommended that the plant enhance the screening and categorisation process to ensure that events are investigated in accordance with their actual or potential significance.

6.5. Investigation AND ANALYSIS

Event investigations are not concluded in a timely manner. Root cause analyses are often initiated too late and concluded after their initial due date, on average after 65 days. Apparent cause analyses are concluded on average after 55 days and equipment failures on average after 76 days. The team encouraged the station to complete event investigation in a timely manner, without jeopardising the necessary quality level.

6.6. CORRECTIVE ACTIONS

The station has progressively improved the quality of its corrective action programme. However, the team noted an elevated proportion of recurring events and events that had a significant amount of past operating experience (OE) that could have helped to prevent or minimise consequences of the event. Deficiencies in the use of past OE are rarely addressed by corrective actions (CAs). Repeat or recurring events are not always used to better define the CAs and CAs are often rescheduled. Among other things, the team found several root cause analyses (RCAs) without CA to prevent recurrence, and that some CAs are not specific, targeted or measurable; while some CAs are incorrectly, partially or not at all implemented. Some CAs contain no effectiveness review, some do not have the extent of condition or extent of cause adequately assessed; and others with adequate assessment but without appropriate corrective actions. The team suggested the plant consider ensuring that corrective actions are adequately defined and implemented in a timely manner to prevent recurrence.

6.7. UTILISATION AND DISSEMINATION OF OPERATING EXPERIENCE

The station has an organisational learning portal in place where external operating experience (OE) is easily accessible. A tool has been developed that allows all staff to customise automatic newsletters with recent events, based on coding. This facilitates the communication and use of external OE by all staff and the team recognised this as a good performance.

6.9. EFFECTIVENESS REVIEW OF THE OPERATING EXPERIENCE PROGRAMME

As already mentioned, the station has experienced an elevated proportion of repeat significant events, recurring issues, or events for which a significant amount of past OE could have

helped to prevent or minimise the event. However, the station does not collectively assess this information to find opportunities to improve the OE process and derive overarching corrective actions. The team also found several gaps in the self-assessment of the effectiveness of some of the plant safety-related programmes and in some key performance indicators. The team made a broader recommendation about this in the leadership and management area.

DETAILED OPERATING EXPERIENCE FEEDBACK FINDINGS

6.4. SCREENING OF OPERATING EXPERIENCE INFORMATION

6.4(1) Issue: The station processes for event screening and categorisation do not always ensure that events are assigned the appropriate priority and investigated in accordance with their actual or potential significance.

The team found the following:

- The screening and prioritisation process is not based on explicit safety significance of the event. It is rather based on the degree of acceptance by the station for the event to reoccur. Priority 1 events (high priority, leading to mandatory root cause analysis) are defined as events that the Station does not accept to reoccur at all. Priority 4 events are events that the station accepts to reoccur. Priority 2 and 3 events are events that the Station accepts to reoccur but less often. The prioritisation procedure also provides a list of illustrative examples clarifying the type of events within each category.
- The recent/ongoing issues leading to inoperability of the BY and later the CX emergency diesels have all been investigated under the initial BY diesel related condition report with priority 2, using only an apparent cause evaluation. Despite the repetition of these issues, the priority and the level of investigation have not been increased.
- The condition report (CR) related to marine ingress involving unplanned plant manoeuvring was categorised priority 1; however, no root cause analysis was performed, only a self-assessment of a procedure. There is no evidence of an assessment of the actual or potential consequences on safety. The duration of entry into Tech Spec Required Actions is not indicated in the report. This has not been flagged as a ‘repeat event’ by the station even though it should have been according to procedure. At least one reactor trip caused by marine ingress occurred after this CR was raised.
- A potential challenge to the reactor safety case led to a complex and long investigation. Despite its significant potential impact on safety, this event was categorised as priority 2 and investigated by a panel of technical experts, without any root cause analysis (RCA). They focused on finding the most probable cause, rather than on finding the root cause. Deviations with high potential safety consequences (‘route 4’) are handled by multidisciplinary teams of highly skilled experts, but not using RCA methods.
- In April 2017, a fuel assembly was assembled in the wrong order. The corresponding CR was categorised as priority 3 only, and only the actual consequences on nuclear safety were assessed, not the potential safety consequences.
- The CR related to tripping of a control computer automatically controlling feedwater to the main boilers was categorised as priority 4 at the screening meeting on 26/01/2018. The trip has an indirect effect on safety and could have led indirectly to a reactor trip. According to procedure, only events that can be accepted to recur without a frequency limit should be categorised with priority 4 or lower. Two further failures of a control computer occurred just 3 days later (29/01/2018).
- The CR involving electric shock risk with an actuator remaining live after its supply fuse had been removed was categorised as priority 2 by the station. Only a minor apparent cause analysis was requested by the screening committee. However, the CR was closed without performing any minor apparent cause analysis.

- During the screening of OE, a lower level or no investigation may be applied where the cause of the event is, or is thought to be, known. The station performed no investigation in about 20% of the priority 2 events over the last 3 years. For priority 3 events, the figure was about 48% over the last 3 years.
- The priority 1 CR involving reactor trip repeated 3 times was not analysed using an RCA because the RCA following the second occurrence was issued only 2 months before.

Without ensuring that events are assigned the appropriate priority and investigated in accordance with their actual or potential significance, some avoidable events could occur and some learning opportunities could be missed.

Recommendation: The station should enhance its event screening and categorisation process to ensure that events are assigned the appropriate priority and are investigated in accordance with their actual or potential significance.

IAEA Bases:

SSR-2/2 (Rev.1)

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

NS-G-2.11

3.1. Screening of event information is undertaken to ensure that all significant matters relevant to safety are considered and that all applicable lessons learned are taken into account. The screening process should be used to select events for detailed investigation and analysis. This should include prioritisation according to safety significance and the identification of adverse trends.

4.3. The level of the investigation carried out should be commensurate with the consequences of an event and the frequency of recurring events. Significant factors that would influence the magnitude of an investigation may include the following: whether a similar occurrence has taken place earlier.

Plant Response/Action:

A – Apparent Cause of Recommendation

It was recognised that our event screening and prioritisation process was not based on explicit safety significance of the event. It was rather based on the degrees of acceptance by the station for the event to reoccur. With that in mind, we have revised our procedures to enhance our focus on the actual and potential significance of an event and reset the standards through our event screening meeting. Our Corrective Action Programme (CAP) has been incorporated into our Torness Target One business plan to driving improvements to our business through CAP in our ambition to be the best power station in the world.

Causal Code

PR1 – Procedure not followed

PR3e – Procedure details need improving

MS2 – SPAC not used

MS4b – Corrective action not yet implemented

MS2c – SPAC enforcement needs improving

B – Summary of action plan

- Post OSART Operating Experience (OE) recommendation and suggestion facts were assigned an owner with overall accountability for addressing the performance gap.
- Causal analysis was conducted in the form of a self-assessment that was taken through our Self-Assessment Review Board (SARB) process.
- Changes to personnel within the Corrective Action Programme (CAP) has reset the standards and changed the stations approach to the CAP process.
- Station incorporated the CAP into the Torness Target One business plan as 1 of the 4 key breakthrough areas, in order to drive improvements to our business through the CAP programme.
- The Screening and Categorising Company Specification document has been revised and amended to enhance the focus on the actual or potential consequences of events rather than the acceptance for them to reoccur.
- The amendments to the company specification document have been briefed to Daily Screening Meeting (DSM) members and key stakeholders.
- OE training has been delivered to personnel new to the company as well as to selected staff from Maintenance, Operations, Engineering, Independent Nuclear Assurance (INA) and Fuel Route.
- The DSM minutes (coversheet) has been streamlined to maintain focus on high priority actions.
- Removal of low value assignments to allow bias for action on high priority events.
- Communications provided to Department Evaluators to ensure that any department challenges to the DSM categorisation of an event, must be brought back to the DSM to be re-screened.
- Station specific Organisational Learning (OL) Dashboard created to provide clear visibility on improvement progress and allows us to create measurable end of year targets.
- Benchmarking is planned to learn from others with the Site Lead for CAP attending IAEA training scheduled for October 2019 on Continuous Improvement of Operational Safety Performance.

C - Action plan effectiveness review

The introduction of the station OL dashboard (below) provides clear visibility of the improvements made within the OL organisation. The OL dashboard is reviewed at a number of the stations key performance meetings to ensure actions are being delivered to plan with governance and oversight.

The enhanced focus and visibility of the OL process has driven our Response to Significant Events Indicator (RSEI) to best in fleet, with all sub-indicators ahead of the fleet plan and well on target to achieve Station end of year target.

OSART and Follow-up Missions to Torness NPS

Torness 2019 Org Learning Dashboard	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18
Timeliness of Trip MEVLs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Timeliness of investigation (SACI)	65	65	65	64.2	52.5	44.3	44	37.7	37.7	36.7	35.3	33.5
Timeliness of Investigation (ACIN)	55	58.4	60.4	53.1	45.37	47.9	48.6	46.5	44.5	43.4	41	37.2
Significant Investigation Quality (SACI)	86.7	86.7	86.7	86.7	87.7	86.7	87.2	88.8	88.8	88.8	87.8	87.7
Corrective Action to Prevent Recurrence (CAPR) Quality	84	84	81.5	81.5	83.5	83.5	86	87.5	87.5	87.5	86	89
Response to Significant Events (RSEI)	57	57	52	58	66	72	72	76	78	81	82	85

Torness 2019 Org Learning Dashboard	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Fleet Year End Target	Torness Transformational Target
Timeliness of Trip MEVLs	N/A	75	68.2	65	72.4	55	55.6	50.7	54	53	51	50	<55	<50
Timeliness of investigation (SACI)	34.7	34.3	34.3	34.3	35.2	35.2	35.2	32.2	35.2	35.2	35.2	35.2	<55	<45
Timeliness of Investigation (ACIN)	28.7	31.3	30.5	30.5	32.2	32.9	31.8	28.7	29	27	26	25	<30	<25
Significant Investigation Quality (SACI)	85.8	71.5	84.8	84.8	85.2	85.2	85.2	85.7	87	88	89	89	85>	89>
Corrective Action to Prevent Recurrence (CAPR) Quality	88	87.5	86.5	86.5	86.5	84	84	84	85	86	87	89	80>	89>
Response to Significant Events (RSEI)	88	59	73	76	70	79	79	84	83	86	90	92	N/A	92

IAEA comments:

The station has analysed the issue and recognised that its event screening and prioritisation process was not based on explicit safety significance of the events, several actions have been taken to address the issue.

The fleet procedure on condition report screening was revised most recently, with more focus on safety significance of actual or potential consequences of events. Examples of events that should be assigned with different priorities were provided in the revised procedure.

Relevant training was provided to representatives of different departments, event evaluators, departmental heads, and duty emergency controllers to ensure consistent screening and assigning of priorities. Briefings were also given to attendees during event screening meetings.

The EDF Energy fleet is planning an operating experience oversight visit to the plant in September 2019 with screening and prioritisation of events as one of the topics.

The station has elevated the plant Corrective Action Programme as one of the top four performance drivers with defined actions plan, which include the improvement of screening and prioritisation of events. This increased the visibility of the CAP programme.

The numbers of events assigned for significant adverse condition investigation has increased from 6 to 8 from the previous 12 months to the last 12 months, adverse condition investigation from 25 to 31 and equipment failure investigation from 23 to 45.

At the same time, the number of investigations for events with low safety significance has been reduced, this led to the station to focus more on the safety significant events and improved the timeliness of investigations. Timeliness of investigations for significant adverse condition has been improved from 65 days in January 2018 to 32 days in August 2019.

Conclusion: Issue resolved

6.6. CORRECTIVE ACTIONS

6.6(1) Issue: Corrective actions are not always adequately defined and implemented in a timely manner to prevent event recurrence.

The station is progressively improving the quality of its corrective action programme (CAP). However, the team found the following:

- Of the 10 root cause analyses (RCA) performed in the last 3 years and reviewed by the team, 4 are repeat events and 4 others had significant amounts of past OE that could have helped to prevent or minimise the consequences of the events. Examples include:
 - On 13/05/2012, Unit 2 tripped during a test following loss of 11kV power due to Grid Disturbance Protection. On 21/11/2014, Unit 2 tripped again during the same test, due to failure of the same relay. The corrective action (CA) after the first trip was closed in the system and was only partially implemented. The root cause identified for this repeat event is that corrective actions were not implemented in a timely manner. The corrective actions had not been sufficiently challenged to ensure actions have been fully completed and that actions taken will prevent repeat events. On 26/03/2015, the same test led to the failure of the same type of relay. On this occasion a reactor trip was avoided because the test was performed at a lower reactor power. The cause of this third occurrence is a lack of timely implementation of the corrective actions from the previous failure (replacement of the relays).
 - On 14/12/2015 a reactor trip occurred following a quadrant trip. This was identified as a repeat event with 3 previous occurrences. The previous investigations had mainly tried to identify the direct cause, or root cause of the direct fault, but not the underlying issues. The terms of reference of all previous RCAs have been heavily weighted towards the direct cause and immediate actions. As a result, the station has experienced several repeat events of quadrant trips leading to reactor trips that may have been avoided.
 - On 22/11/16, marine ingress led to a reactor trip. This was identified as a multiple repeat event for which corrective actions from previous investigations have not been implemented. The root cause is that the organisation had not fully prioritised and implemented the necessary measures to protect the station the plant from all adverse sea conditions. A significant proportion of the proposed actions in all previous investigations were not completed and/or were closed ‘to a promise’. Several key actions were not effective. For example, the reactor service water auto vents were found to be incorrectly installed. In summary, the issues experienced by the station have happened before. At the time of the mission, the station had yet to implement adequate prevention measures, many of which have been recommended on several occasions. This had been based on choice primarily driven by financial considerations, and therefore it was a conscious decision to not implement recommendations based on previous OE. The team also noted deficiencies in the corrective actions following the 22/11/16 trip.
- Deficiencies in the use of past OE when identified in RCAs are almost never addressed by CAs. Repeat or recurring events are not always used to better define the CAs.

- Only priority 1 events (significant events, numbering about 10 over the last 3 years) are checked whether they are repeat events or not. As there are very few priority 1 events each year, this is a very narrow definition. The CAP coordinator and the screening meeting members also identify ‘recurring events’. These are considered repeat events that do not meet the strict definition (for instance, CRs with a priority lower than 1). The Station flagged 830 CRs as being ‘recurring events’ in 2017.
- Corrective actions (CAs) in RCAs often lack several expected attributes, in particular:
 - Several RCAs have no CAPR (Corrective Action to Prevent Recurrence) as allowed by station procedure, others with a CAPR addressed only part of the root cause.
 - Some CAs are not specific, targeted, or measurable.
 - Some CAs have been incorrectly, partially, or not implemented.
 - Some CAs have had no effectiveness review performed, and in some cases the effectiveness review was performed using too generic criteria.
 - Some RCAs did not adequately assess the extent of cause and in some other cases, the assessment was adequate but was not addressed by any corrective action.
 - One case occurred where CAs did not address the root cause.
 - Some cases where the extent of condition was not adequately assessed and other cases where the assessment was adequate but was not addressed by any action.
 - A few CAs in the tracking system do not fully match the CAs in the RCA report.
- Corrective actions associated with RCAs are often rescheduled.
- A review of a sample of 6 apparent cause analyses by the team highlighted some lack of quality of corrective actions and a significant proportion of recurring events.
- Over the last 3 years, half of the CAs to prevent recurrence (CAPRs) had their due date extended. 3 out of 8 have had 2 extensions, 1 CAPR was extended 3 times.
- There are currently 388 open corrective actions tracked in the CAP. Their average age is 214 days. The average age of open corrective actions for P1 (priority 1, highest priority) events is 556 days, 419 days for P2 events, 219 days for P3 events, and 166 days for P4 events.

Without adequately defined and timely implemented corrective actions, events can reoccur.

Suggestion: The station should consider ensuring that corrective actions are adequately defined and implemented in a timely manner to prevent recurrence of events.

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 prioritised, scheduled and effectively implemented and shall be reviewed for their effectiveness.

NS-G-2.11

5.2. The development of recommended corrective actions following an event investigation should be directed towards the root causes and the contributory causes, and should be aimed at strengthening the weakened or breached barriers that failed to prevent the event. Personnel at nuclear installations are responsible for implementing corrective actions promptly and effectively.

IV.3. Factors that should be considered in the formulation of corrective actions include the following:

- Whether the proposed corrective action addresses the fundamental problem;
- Whether the corrective action has been taken before and with what results;

IV.4. The plan for corrective action should include a provision for verification of the effectiveness of the actions.

Plant Response/Action:

A – Apparent Cause of Suggestion

Visibility and accountability of Corrective Action completion was in some occasions not established to ensure Corrective Actions are clearly defined, tracked and appropriately closed out. Priority 1 and 2 Corrective Actions are at times rescheduled without strong challenge and therefore not closed in a timely manner.

Causal Code

MS3c – Employee communications

MS3e – Employee feedback

MS2e - Accountability

B – Summary of action plan

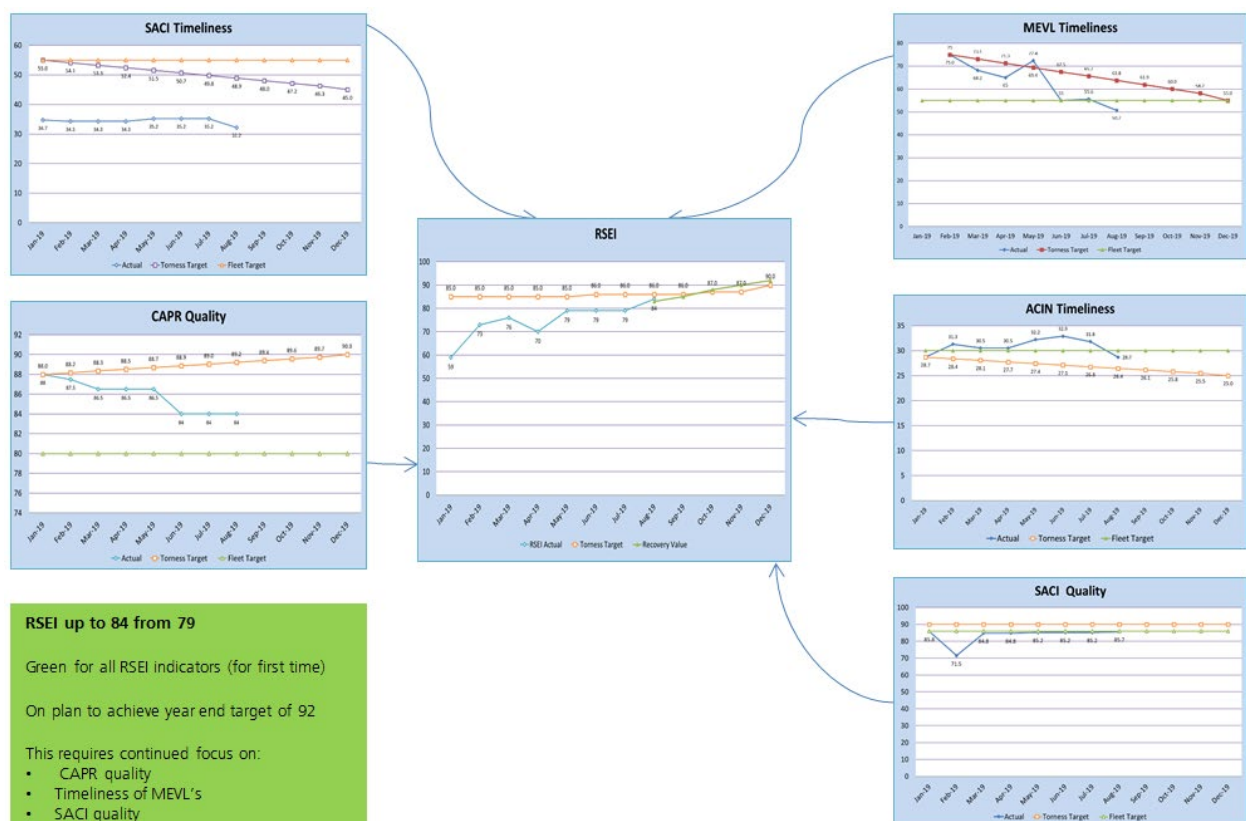
- Significant Adverse Condition Investigation (SACI) training delivered to select staff.
- Post SACI debriefs have been introduced to capture learning from previous investigations and to share this learning as part of future SACI pre job briefs.
- Standards reset during SACI pre job briefs to ensure priority 1 investigations have a Corrective Action to Prevent a Repeat (CAPR) and an Effectiveness Review (EREV) assigned.
- The Station Top Ten Corrective Actions introduced, which provides visibility of the Station CAPR's as well as priority 1 and 2 actions.
- A WELL (What Excellence Looks Like) guidance sheet has been create and communicated to ensure corrective actions consist of
 - A problem statement (What is the gap)
 - A clearly defined action (What is the assignee to do)
 - Clear close out criteria (Has the gap been closed)
- Mandatory Evaluations (MEVL) are now reviewed weekly to ensure appropriate focus and progress is made in learning from events around the fleet.
- Standards reset at the Daily Screening Meeting (DSM) and the Corrective Action Review Board (CARB) that any request to reschedule a priority 1 action must be

approved by the Plant Manager, with a Priority 2 requiring approval from the assignees department Manager.

- Station and Fleet Corrective Action completion quality checks carried out monthly.
- All priority 1 and 2 Corrective Actions closure are reviewed and approved by the CARB.
- Project Manager assigned to co-ordinate, drive and monitor progress of SACI actions.

C - Action plan effectiveness review

- All Response to Significant Events Indicators (RSEI) in green for the first time and on plan to achieve year-end target.
- Significant Adverse Condition Investigation (SACI) timeliness is best in fleet, well ahead of fleet and station target.
- The quality scoring of SACI completion remains green and on plan.
- The quality of Corrective Actions to Prevent a Repeat (CAPR) remains best in fleet and ahead of fleet target.
- Apparent Cause Investigation (ACIN) timeliness is best in fleet and on plan to achieve year-end target.
- Mandatory Evaluation (MEVL) timeliness ahead of fleet and station year-end target.
- There is currently a downward trend of repeat events and on plan to achieve zero repeat events by the end of the year.



IAEA comments:

The station has assessed the issue and concluded that the visibility and accountability of corrective actions were in some occasions not established to ensure corrective actions are clearly defined, tracked, and appropriately closed out.

The station has categorised the Corrective Action Programme as one of the top four performance drivers, with a defined action plan that includes the improvement of corrective actions.

A 'What Excellence Looks Like' Sheet on Corrective Actions was developed with detailed expectations on how to define a corrective action and the close out criteria, and how to track corrective actions to completion. Observation criteria of corrective actions were provided to drive improvement in the quality of corrective actions.

The station also introduced a TOP 10 corrective actions mechanism to increase the visibility and accountability of high priority corrective actions. All priority 1 and 2 corrective action closures are now reviewed and approved by Corrective Action Review Board, any rescheduling of a priority 1 corrective action must be approved by the station manager and rescheduling at priority 2 requires approval from the assignee's department manager. Previously, the reschedule required lower level manager approvals.

Most recently, the corporate organization issued a procedure on proactive use of Operating Experience, with more detailed guidance on how to seek out and learn from operating experience, how to capture and share operating experience. Detailed instructions were given on how to search for relevant information from different databases.

The corporate organization has also established a tier 2 Key Performance Indicator on Response to Significant Events with five supporting performance indicators, timeliness of Trip Mandatory evaluations, timeliness of investigation for Significant Adverse Conditions, timeliness of investigation for adverse conditions, significant investigation quality, and corrective action to prevent recurrence quality. The performance indicator is reported to station and corporate senior executives and has shown a trend of improvement in the past 18 months. Since November 2018, there has been no repeat event in the station.

Conclusion: Issue resolved

7. RADIATION PROTECTION

7.3. RADIATION WORK CONTROL

Since late 2017, there has been an adverse trend regarding the number of personal contamination events. The team encouraged the station to keep focusing on analysing the causes and contributors to these events as well as developing and implementing corrective measures.

The operating status of the Radiation Controlled Area exit monitors can be remotely viewed and interrogated from any network personal computer in the station. The instances where events are not reported have been eliminated by use of the remote viewing system. The team considered this a good practice.

7.4. CONTROL OF OCCUPATIONAL EXPOSURE

The monthly dose constraint for Category A workers is not sufficiently challenging. The constraint should give more emphasis to the optimisation of radiation exposure to keep doses as low as reasonably achievable (ALARA). The team encouraged the station to review the monthly dose constraint for Category A workers.

7.5. RADIATION PROTECTION INSTRUMENTATION, PROTECTIVE CLOTHING AND FACILITIES

The station has taken an initiative to develop a programme of fleet-wide inter-calibration and comparison measurements in radiochemistry. This approach has improved control of the status of radiation protection instrumentation. This was recognised by the team as good performance.

7.6. RADIOACTIVE WASTE MANAGEMENT AND DISCHARGES

Since 2009, the station has cleared a large amount of legacy waste and refurbished the active solid waste building. Measures have been taken to raise awareness of the importance of good radioactive waste practices. The amount of metal waste cleared as non-radioactive has nearly doubled. In addition, the amount of waste bags requiring additional hand sorting has been greatly reduced. In 2016, the station's radiological waste fleet indicator result was 100%, a fleet first. The team considered this a good performance.

7.8. USE OF PSA, PSR AND OEF

At present, large amounts of Radiation Protection (RP) data (such as extensive results from surveys) are stored in different databases and systems. There is no easy, effective way of searching for results, trending or drawing conclusions. The team encouraged the station to improve data display and trending of RP related information.

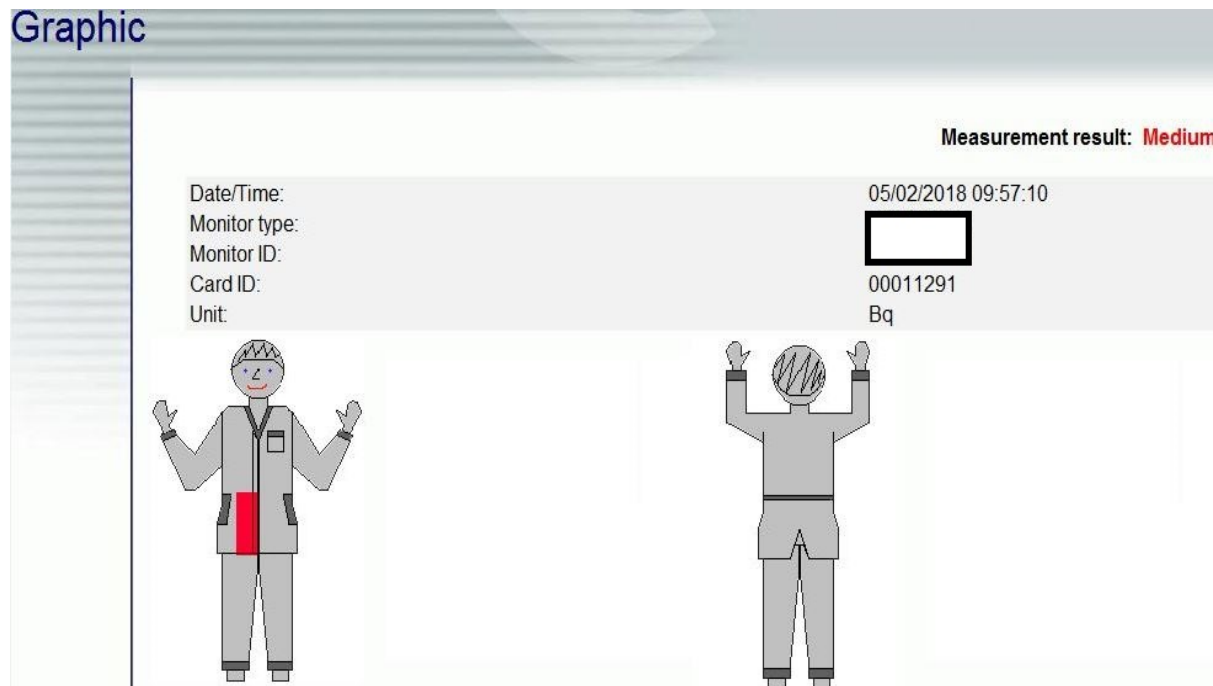
DETAILED RADIATION PROTECTION FINDINGS**7.3(a) Good Practice:** Remote viewing of Radiation Controlled Area contamination monitors.

The operating status of the Radiation Controlled Area exit monitors can be remotely viewed and interrogated from any networked personal computer (PC) in the station. This enables verification that all alarms are investigated and reported as well as early reporting of defects. The system software enables the user to trend results for individuals working in the Radiation Controlled Area.

The previous version of the Radiation Controlled Area exit monitors could not be remotely interrogated in this way, which led to some events (approximately 2 events per calendar month) going unreported. This has now been eliminated.

The station has also identified other benefits of using networked Radiation Controlled Area monitors, such as:

- The ability to remotely view individual monitor operating performance improves ease of fault finding and early reporting of instrument faults.
- The ability to trend sub-alarm, low-level build-up of chronic contamination on worker clothing. This enables early intervention by Radiation Protection personnel to reduce the number of unnecessary alarms by suggesting laundering the personal protective equipment (PPE).

Graphic

8. CHEMISTRY

8.2. CHEMISTRY SURVEILLANCE AND CONTROL PROGRAMME

To reduce carbon deposition inventory on boiler and fuel cladding that can lead to fuel failures and boiler tube fouling, carbonyl sulphide (COS) is injected into the primary coolant. The injection systems have been operating continuously for seven years preventing or slowing carbon deposition formation. Since the addition of COS in 2011, the station has seen progressive improvement in the boiler heat transfer impairment (HTi) and an improvement in fuel failures, with no fuel failures in the last four years. The team recognised this as a good performance.

The chemistry control of station systems is in general well controlled within the normal action level limits. However, equipment supporting the control of chemistry conditions is not always maintained available to prevent the potential of adverse system component corrosion or fouling. Chemistry related equipment deficiencies for a few systems such as the raw cooling water chlorination and turbine generator hydrogen dryer requires frequent chemistry and maintenance interactions to return the systems to desired chemistry conditions. The team noted that the reliability of chemistry related equipment is degraded, affecting the chemistry function's ability to maintaining system chemistry specifications and minimise the potential of adverse system component corrosion and fouling. The team made a suggestion in this area.

Corrective actions to avoid reaching chemistry action levels are not always proactively initiated to ensure chemistry parameters stay within the specified target range. Stator cooling water pH, boiler feedwater hydrazine to oxygen ratio, and emergency diesel antifreeze pH frequently challenge or exceed the corporate established target bands. In the case of the emergency diesel antifreeze pH issue, the station has received corporate dispensation to control at a lower pH value with acknowledgement that the low pH could increase component corrosion rates. Without proactively controlling system chemistry within the specified target range, system component degradation may increase. The team made a suggestion in this area.

Most system chemistry diagnostic parameters are not routinely monitored to establish a normal baseline and aid recognition of developing abnormal conditions. For example, the makeup water treatment plant product is monitored for conductivity but the diagnostic parameters of chloride, sulphate, and sodium are not routinely monitored. The team encouraged the station to periodically monitor the diagnostic chemistry parameters specified in the corporate guidance.

When the decay heat boiler (DHB) is placed in service the water chemistry is typically outside specifications for chlorides, sulphates, and oxygen. The DHB system and storage tank vents are open to the atmosphere that allows rain ingress containing chlorides and sulphates. The DHB circulating water requires monthly flushing to lower the chlorides and sulphate contaminants and replenish the hydrazine that has been consumed. The team encouraged the station to enhance the DHB system preservation and operational practices to provide adequate protection from corrosion.

Data collected from various instrument computers, including on-line chemistry instrumentation, is interrogated and trended using the Pi Historian and Babel fish tools. Multiple parameters can be trended together to provide insights into causes of adverse chemistry trends, necessary purging/flushing time requirements, and time to achieve target levels. These on-line monitoring tools have enabled a reduction in outage time and improved optimisation of demineraliser and desiccant performance. The system also provides alerts via

email for adverse developing chemistry trends and other on-line monitor performance such as reduced flow. The team recognised this as a good performance.

DETAILED CHEMISTRY FINDINGS

8.2. CHEMISTRY SURVEILLANCE AND CONTROL PROGRAMME

8.2(1) Issue: Equipment supporting the control of chemistry conditions is not always maintained available to prevent the potential of adverse system component corrosion or fouling.

During the mission, the team observed the following:

- Circulating water hypochlorite dosing system failures have resulted in over 50% insufficient treatment time in the last four months and failures have been reported every month since January 2017.
- Since 2016, reactor gas dryer multi-port valve operational problems have contributed to several core life loss events in both units, even though core life loss has been reduced in 2017.
- Turbine generator hydrogen dryer equipment problems have resulted in the dryer being out of service since June 2017. This has adversely affected hydrogen purity control and required intermittent purging to maintain chemistry within action limits.

Without reliable equipment, that supports control of system chemistry conditions, long-term system and component reliability may be adversely affected.

Suggestion: The station should consider improving the reliability of equipment that supports the control of system chemistry specifications, to prevent adverse system and component corrosion or fouling.

IAEA Bases:

SSR-2/2 (Rev. 1)

7.14 Chemistry surveillance shall be conducted at the plant to verify the effectiveness of chemistry control in plant systems and to verify that structures, systems and components important to safety are operated within the specified chemical limit values.

SSG-13:

3.4. In the chemistry programme, it should be ensured that:

- 3.4(g) There is a timely response to correct any deviations from normal operational status, such as small deficiencies, adverse trends or fast transients of chemistry parameters.
- 3.4(e) Appropriate chemistry controls and diagnosis parameters are applied to verify safe and reliable operation.
- 3.4(k) There is support to the station ageing management programme in order to ensure safe and long-term operation of the station.
- 5.5. The chemistry control programme should support the production of high quality water and should include the following:
 - The specification and application of a suitable chemical treatment (e.g. oxygen control) for the minimisation of corrosion processes, and hence reduction of the amounts of corrosion products in the water.

Plant Response/Action:

A – Apparent Cause of Suggestion:

After the OSART Visit in February 2018, Torness conducted a Casual Analysis on this Suggestion under Assignment 1090571-08 with the key Objective to understand the causes and contributors behind the AFI and why do we have the gap in the first place?

Findings from Review:

The OSART Mission made a suggestion that states the Facility should improve the material condition of equipment to support safe and reliable generation.

8.2.1 The chemistry control of plant systems is in general component corrosion and fouling.

The team made a suggestion in this area. Equipment supporting the control of chemistry conditions is not always maintained available to prevent the potential of adverse system component corrosion or fouling.

Suggestion:

The station should consider improving the reliability of equipment that supports the control of system chemistry specifications, to prevent adverse system and component corrosion or fouling.

Problem statement:

It is perceived by the OSART team that Equipment Reliability still has gaps at Torness. The facts detailed in the report below highlight this. It should be noted that Equipment Reliability is closely monitored at Torness and across the fleet, however opportunities do exist to accelerate this further and aim for a KPI score of 100.

Future plans and actions should address this and ensure that the ERI does improve on site and ensure safe and reliable generation.

Fact 6:

Circulating water hypochlorite dosing system failures have resulted in over 50% insufficient treatment time in the last four months and failures have been reported every month since January 2017.

Comments:

The issues with Sodium Hypo reliability and leaks at Torness are well known and a standalone team has been established to tackle these issues and resolve any current issues and thus improve this system considerable. Actions currently in progress with the team are detailed below:

All 4 pumps inlet and outlet spools to continue to be fabricated from PVCU. These are to be standardised in length to allow off the shelf spare to be readily available preventing any in line delays for fabrication. Each spool will have a performed hydraulic test at an agreed pressure to ensure fit for service, each fabrication to be carried out as per supplied instructions using the correct glue, when complete the replacement spools will be bagged with all relevant certificates.

New backing rings on HDPE stub pipes to be consistently exchanged for HDPE modern equivalent as opposed to steel.

Attempt to improve the filter lid connection point, we currently have a spare that was removed from the plant previously, as this is an American supply filter the attachment thread is a coarse small diameter, which is difficult to match in either HDPE or PVCU. The intention is to re-drill and tap larger to a size that will be compatible with PVCU supplied, further advice to be sought on completion to deem if this fix will be adopted.

New pipework supports, but not too many to obstruct plant accessibility but enough to support existing pipework better and hopefully remove some of the connection point stresses currently experienced.

To make Chemistry's life easier;

- New quick fit hose connection point to be added between towns water hose and flush connection point to prevent poor stooped operation to allow pumps to be flushed.
- Re-route filter drain valve to allow easier access for draining of the filter preventing clambering over plant to access the valve.
- Addition of a small handrail at the east of the pit to assist access egress if the need to move around the back of the pumps.
- Re-route 4 x pump priming valves to face south preventing chemist having to clamber through the back of the plant to collect the drained fluid.
- Re-route filter vent discharge location so as daily venting operations to collect in container, which is difficult to manoeuvre at the present, is less cumbersome.
- Addition of a universal union either side of the pulsating damper for ease of maintenance when complying with MITS requirements.

Cause Codes:

EQ7a Equip not appropriate for conditions

EQ5c Consumables not fit for purpose

Fact 7:

Since 2016, reactor gas dryer multi-port valve operational problems have contributed to several core life loss events in both units, even though core life loss has been reduced in 2017.

Comments:

Ageing, obsolescence and onerous plant conditions have led to challenges regarding the reliability of the multiport valves and is a contributor to core life loss at Torness but also at other stations. A fleet programme is in place to address the replacement and improvement of plant condition, reliability and ease of maintenance and has been implemented at Torness on Reactor 1 to prevent further operational issues, with Reactor 2 replacement to be completed in S11R2 Statutory Outage (September – 2018).

Cause Codes:

EQ9b Aging or Obsolescence not proactively addressed

EQ7a Equip not appropriate for conditions

Fact 8:

Turbine generator hydrogen dryer equipment problems have resulted in the dryer being out of service since June 2017. This has adversely affected hydrogen purity control and required intermittent purging to maintain chemistry within action limits.

Comments:

Defects have been raised for this equipment failures. However, these have failed on the plan due to various reasons and the priority does not appear to be high enough to ensure that these are delivered in a timely manner. Investment plans are underway to

We have established a list of what has to be done to get the existing arrangement compliant regarding DSEAR, address all the defects and to enhance the panel to give us hydrogen leakage detection which should tick all the boxes for the existing risk mitigations. We currently budget covering the non-conformances. The defects have been walked down and are being addressed under OMS and the investment to carry out the hydrogen mass flow installation and pressure regulation is covered by investment. This will get us to a position and we will then confirm to CTS/111.

Cause Codes:

EQ9b Aging or obsolescence not proactively addressed

EQ7a Equip not appropriate for conditions

WD1e Work Scheduling.

B – Summary of action plan:

The action plans for the three specific facts are detailed below.

However, since the OSART visit we have improved the relationship between Engineering and Chemistry to ensure that we are better aligned and aiming for a common goal.

Action 1

Chemistry to provide regular update to Plant Health Committee, thus ensuring that there is alignment regarding risk and priority.

Action 2

Use Station Top 10 Scope Statements to identify plans and actions on problematic systems to ensure that there is sign on and accountability from all parties.

Action 3

Alignment of future investment projects and the requirement to have accurate Definition of Needs (DoN) submitted prior to the investment planning rounds.

C - Action plan effectiveness review:

Action 1

Chemistry are now regular attendees at the Plant Health Committee held each month. An example of the data shared between engineering and chemistry is shown below:

Plant Health Committee - Chemistry

Period: November 2018 to January 2019

Successes	Focus Areas		Targets / Milestones / Metrics																									
<ul style="list-style-type: none"> • Good S11R2 timesaving CO₂ purging strategy • Safe delivery of 700 tonnes of fuel oil to auxiliary boilers and diesel generators. 	<u>Chemistry PHC Top 5 issues:</u> <ul style="list-style-type: none"> •CW Hypo dosing reliability. •R1 BPGP multiports reliability •PVCS degassing reliability/operation •Decay Heat Boiler oxygen control. •ATAC cell chemistry burden. 		System Specific Scores	SHIP CODE	Nov 18	Dec 18	Jan 19	Comments (if score<10)																				
			Primary Circuit	B22	9.8	9.6	8.8	R2-CH4-58 valve replacement. R1-G-206 issues.																				
<p style="text-align: center;">Core Life Loss. Target < 6 days per reactor per year</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">R1</th> <th style="text-align: center;">R2</th> <th style="text-align: center;">Comments (if amber or red)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Nov 2018</td> <td style="text-align: center;">0.92</td> <td style="text-align: center;">0.02</td> <td>R2-CH4-58 methane control valve replacement, which affected both units.</td> </tr> <tr> <td style="text-align: center;">Dec 2018</td> <td style="text-align: center;">5.42</td> <td style="text-align: center;">0.00</td> <td>R1-G-206 mitigations and failure</td> </tr> <tr> <td style="text-align: center;">Year Total 2018</td> <td style="text-align: center;">31.1</td> <td style="text-align: center;">3.98</td> <td>Bulk of core life loss was due to R1-G-206 failures in May and December</td> </tr> <tr> <td style="text-align: center;">Jan 2019</td> <td style="text-align: center;">30.75</td> <td style="text-align: center;">0.00</td> <td>R1-G-206 BPGP outage</td> </tr> </tbody> </table>				R1	R2	Comments (if amber or red)	Nov 2018	0.92	0.02	R2-CH4-58 methane control valve replacement, which affected both units.	Dec 2018	5.42	0.00	R1-G-206 mitigations and failure	Year Total 2018	31.1	3.98	Bulk of core life loss was due to R1-G-206 failures in May and December	Jan 2019	30.75	0.00	R1-G-206 BPGP outage	Secondary Circuit	C42	9.8	10.0	10.0	U2 BF high KH after start up.
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			Stator	C31	10.0	10.0	10.0																					
			PVCW	B32	9.2	9.4	9.0	1Y2, 2Y1 and 2Y2 Hi dissolved O ₂																				
			Pond	A23	10.0	10.0	10.0																					
			CW	F11	9.5	9.4	2.6	Various Hypo pump, pipework and anti syphon valve issues.																				
CCWSt1	B32 F14 F15	10.0	10.0	10.0																								
Turbine LO	C22	10.0	10.0	10.0																								
GCLO	B21	10.0	10.0	10.0																								
FRF	C22	10.0	10.0	10.0																								
DHB	C12	9.7	9.2	10.0	Hi anions and O ₂ whilst steaming during trips.																							
Fuel Oil	D33	10.0	10.0	10.0																								
Monthly Average		9.8	9.8	9.2																								



Action 2

Station Top 10 Scope Statements have been a great tool to ensure that a problem is fully understood by all, there is a clear criterion to remove the item from the Top 10 list and this plan is created by a team including Engineering, Maintenance, Operations and Chemistry for example. One successfully example was resolving Diesel reliability via this method.

Action 3

Chemistry now regularly meeting with Engineering staff to agree future funding requirements and planning prior to the investment planning round, thus ensuring alignment and ensuring that we are focusing on the correct things are the right time.

IAEA comments:

The station identified the causes of this issue to be the relationship between Engineering and Chemistry that did not ensure alignment to common goals.

To enhance the relationship between Engineering and Chemistry, the station improved the involvement of Chemistry in the monthly Plant Health Committee. At this committee, Chemistry now presents information against targets reports on any chemistry milestones. This encourages the whole organisation to pay special attention to any chemistry deviations from expectations. Chemistry issues within the station's 'Top10' are assigned an agreed priority, responsible personnel and a corrective action plan is created to resolve the issues. This supports clear understanding of chemistry issues by relevant station personnel.

Based on the enhanced communication between Chemistry and other functions including Engineering, the station organised cross-functional teams dedicated for each selected problem. Examples of improvements made by these teams are;

- Cooling water hypochlorite dosing system failure was analysed and a wide range of actions was planned and implemented. New pipework was installed with fewer joints, and a change of glue to one compatible with corrosive environment. With this and other activities completed the number of leaks from the system improved.
- Preventive maintenance was performed on the turbine generator hydrogen dryer systems. Some equipment, such as diaphragm valves, was replaced. The out of service period of the dryers was improved from more than 6 months in 2017 to several days a year in 2018/2019
- Reactor bypass gas plant multi-port valves were replaced with an enhanced design type in 2018. The new valve is designed to make replacement easier and the work period necessary to service and maintenance a valve has been shortened from 3 weeks to 7 days. The number of events that need replacement of the valve has remained constant, but the station has already established a strategy for further improvement during discussions in the cross-functional team.

In addition to the above, the station has made efforts to identify improvements to the reliability of equipment related to plant chemistry. The chemistry input at the Plant Health Committee directly affects the Equipment Reliability Indicator, which motivates other parts of the organisation to support work. Further improvement measures such as hydrogen mass flow instrumentation has been also installed demonstrating step-by-step progress.

The station has been effective in improving the reliability of equipment to prevent adverse system and component corrosion or fouling, by the enhanced relationship between Chemistry and Engineering.

Conclusion: Issue resolved

8.2(2) Issue: Proactive actions to avoid reaching action levels are not always initiated to ensure chemistry parameters stay within their specified target range.

During the mission, the team observed the following:

- Stator cooling water pH is frequently below the target value of 8.5 and periodically near action level 1 for several weeks without prompt chemistry correction. This may be a contributor to turbine generator 2 copper being above the upper target value of 5.0 ppb for four of the last nine months.
- Unit 2 boiler feedwater hydrazine is frequently below the hydrazine to oxygen ratio target range of 2.0. This is a reduction of margin to ensure that boiler water is depleted of oxygen by the time it reaches the stainless (316) steel section since there is no way to measure oxygen in this location.
- Emergency diesel antifreeze pH is frequently below the target and action level range. Even though corporate chemistry has approved temporary dispensation to allow pH values as low as 7.5, it was acknowledged that the low pH could increase component corrosion rates.

Without proactively controlling system chemistry within the specified target range, system component degradation may increase.

Suggestion: The station should consider taking more proactive actions to ensure chemistry parameters stay within their specified target range.

IAEA Basis:

SSG-13

3.4. In the chemistry programme, it should be ensured that:

(d) The chemistry programme for auxiliary systems is in accordance with the material intent to preserve their full integrity and availability. 4.4. If a control parameter is outside its limit values, degradation of conditions for structures, systems and components may occur in the long term and may result in unavailability of safety systems.

6.2. The objectives of a chemistry surveillance programme are:

(c) To detect and thus permit early corrective action for any abnormal chemistry condition before it becomes a consequence significant for safety

Plant Response/Action:

A – Apparent Cause of Suggestion

Causal analysis was undertaken in the form of a self-assessment present to the Station Action Review Board (SARB). The Chemistry team discussed findings with the fleet peer group to enlist required support. The apparent cause was a reliance on broad permitted ranges to steer chemistry parameter control, and track compliance when industry best practice drives to narrower expected ranges.

B – Summary of action plan

Four major improvement areas were identified – Proactive chemistry trending, control of Stator Water pH, Control of feedwater hydrazine/oxygen ratio and control of emergency diesel generator glycol coolant pH.

On chemistry trending, monitoring and reporting, enhancements were undertaken including:

- Action Levels and adverse trends have been made a chemistry daily meeting topic.
- Live white board established for tracking compliance issues.
- Condition Reports (CRs) raised for every action level or adverse trend observation.

C - Action plan effectiveness review

Data summary of the improvement areas show that control has enhanced and parameter compliance improved. Chemistry have been frequently raising trending non-conformance reports (CRs) and have worked with Plant Engineers where expected ranges have been deviated from. The input from the OSART review has enhanced our Stations chemistry parameter compliance and team engagement more generally.

IAEA comments:

The station identified the causes of this issue to be a reliance on broad permitted ranges to steer chemistry parameter control, and track compliance.

To ensure proactive action is taken on chemistry parameters, the station has established expected ranges for key chemistry parameters, including Stator Water pH, Feedwater hydrazine/oxygen ratio and emergency diesel generator antifreeze glycol coolant pH. The expected ranges for these parameters were formally incorporated in the Company Technical Specification in June 2019.

Using the new expected ranges, the station's control of chemistry parameters has been improved as following;

- Stator Water pH level has been raised in line with its new expected range (target range:8.7-9.0, lower permitted range:8.5). This change of control resulted in significant drops in turbine generator 2 stator water dissolved copper and the level has been maintained below 5.0 ppb since the pH change was made in November 2018.
- Control of boiler feedwater Hydrazine/Oxygen ratio has been also improved together with an increase in the calibration frequency of dissolved oxygen instrumentation. The ratio of hydrazine to oxygen has not been below the expected range since April 2019.
- Emergency diesel generator glycol coolant pH has not been less than 8.0, which was allowed by temporary dispensation.

Furthermore, the station has made efforts to enhance the awareness of chemistry parameter control. Action levels and adverse trends are shared at the chemistry daily meeting and compliance is tracked using a white board. When an action level is approached or an adverse trend has been observed, condition reports have been issued. Those activities have improved communications between Chemistry staff and Station Engineering staff.

The team concluded that the station has been effective in improving proactive control of chemistry parameters.

Conclusion: Issue resolved

9. EMERGENCY PREPAREDNESS AND RESPONSE

9.1. ORGANISATION AND FUNCTIONS

EDF Energy has a Central Emergency Support Centre (CESC) located at its central offices in Barnwood, Gloucester. This facility is maintained in a state of readiness with on-call staff able to provide technical and logistical support to the station. The facility allows the station to concentrate on its actions within the site boundary and pass all other tasks to the CESC to manage.

The off-site emergency centre (Strategic Co-ordination Centre, SCC) is located in Macmerry, about twenty miles from the station. The prime function of the SCC is to decide on the actions to be taken off-site to protect the public, to ensure that those actions are implemented effectively, and to ensure that information and advice is passed to the public. The SCC is well equipped and provides good co-operation with the station.

During genuine event exercises and demonstrations, the emergency services (police, fire, and ambulance) send liaison officers to the Emergency Control Centre at the station to support the onsite organisation. This ensures the emergency services are fully aware of and can align to the onsite priorities, as well as provide up-to-date information on casualty treatment, fire and rescue support, and police liaison.

In an 'off-site nuclear emergency', the station sends two vehicles off-site to take various contamination and radiation readings. Contamination samples are taken into a Maypack sampler module that previously had to be stored within the vehicle and then returned to a laboratory for analysis. The station has now installed mobile gamma spectrometry devices within these off-site vehicles. This enables the operator to analyse the samples at the point of measurement and immediately send the result back to facilitate appropriate countermeasure advice. This saves time and allows processing of the data and timelier direction of the survey vehicles to the next appropriate location.

The team considers all these arrangements for the off-site support as a good performance.

9.2. EMERGENCY RESPONSE

The station utilises Beta Hood protective equipment that is an improvement over the normal flash hood and provides enhanced protection to the responders. The benefit is that any possibly contaminated water runs down and off the responders, rather than inside the protective clothing and putting them at risk. The team recognised the use of Beta Hoods as a good practice.

The station has created an on-site fire training facility that consists of a main heat and smoke area, a hotbox fire rig, and welfare buildings. The allocated space, a fenced-off area just outside the main security fence, has scope for further future enhancements. The facility is fabricated from six shipping containers joined together to form three levels. Lesson plans have been developed in line with the generic training model and the facility is now routinely used as part of the Emergency Preparedness and Response training programme. In return for utilisation of the facility, Scottish Fire & Rescue service provides instructors for staff training days. The main benefit of the facility is that it ensures a realistic training environment specific to the site. The team noted this as a good performance.

9.3 EMERGENCY PREPAREDNESS

Habitability of on-site emergency facilities under radiological conditions that could be encountered during the emergency response has not been ensured against radiological conditions by hermetic sealing and air intake filtration. The station follows the company practice to rely on use of alternative emergency facilities to mitigate loss of habitability of the main emergency facilities. The evacuation of on-site personnel has not been subject to real time exercise at the station. The exercises have been only conducted as table tops during Level 2 demonstration exercises. Benchmarking the applied practices and their effectiveness in relation to nuclear industry practices elsewhere could be beneficial for assuring good safety practices and standards. The team made a suggestion in this area.

DETAILED EMERGENCY PREPAREDNESS AND RESPONSE FINDINGS

9.2. EMERGENCY RESPONSE

9.2(a) Good Practice: Beta Hood – Protection of emergency responders from skin contact with radioactive water.

During an emergency event, responders could be exposed to contaminated water runoff. In a normal fire kit of flash hood and tunic, this water can run down into the clothing and contaminate the skin of the responders. Any beta contamination within the water will then irradiate the skin and cause harm to the responder. To address this the station now provides Beta Hoods that improve on the normal flash hood and provide enhanced protection to the responders. They add a covering to the shoulders of the responders that is incorporated into the hooded protection for the face. The benefit is that any possibly contaminated water runs down and off the responders, rather than inside the protective clothing.



9.3. EMERGENCY PREPAREDNESS

9.3(1) Issue: The station has not extensively benchmarked its applied approach to emergency facilities' habitability and on-site personnel evacuation to ensure that they provide optimal safety benefits.

The team noted the following:

- Inhabitability of emergency facilities including the Central Control Room (CCR), Emergency Control Centre (ECC) and Access Control Point (ACP): under credible radiological conditions that could be encountered in an emergency, these facilities are not protected against radiological conditions by sealing and intake filtering.
- EDF Energy practice, followed by the station, is to rely on use of alternative emergency facilities to mitigate loss of habitability of the main emergency facilities.
- The evacuation of on-site personnel has not been subject to real time exercise at the station. The exercises have only been conducted as table tops during Level 2 demonstration exercises.
- The evacuation of on-site personnel takes place with significant support from the Central Emergency Support Centre (CESC) at Barnwood and is assisted by the local police (in relation to both traffic arrangements and bus service arrangements).
- Real evidence and learning have been obtained (for example in a recent Heysham 2 Site Incident), where non-essential staff were gradually released without incident.

Without comparing the chosen practices to those applied elsewhere in the nuclear industry, the station cannot be assured these approaches represent best practice.

Suggestion: The station should consider benchmarking its applied approach to emergency facilities' habitability and on-site personnel evacuation and consider effectiveness of these arrangements in relation to nuclear industry practices elsewhere.

IAEA Bases:

GSR Part 7

Requirement 24: Logistical support and facilities for emergency response

The government shall ensure that adequate logistical support and facilities are provided to enable emergency response functions to be performed effectively in a nuclear or radiological emergency.

6.22. Adequate tools, instruments, supplies, equipment, communication systems, facilities and documentation (such as documentation of procedures, checklists, manuals, telephone numbers and email addresses) shall be provided for performing the functions specified in Section 5. These items and facilities shall be selected or designed to be operational under the conditions (such as radiological conditions, working conditions and environmental conditions) that could be encountered in the emergency response, and to be compatible with other procedures and equipment for the response (e.g. compatible with the communication frequencies used by other response organisations), as appropriate. These support items shall be located or provided in a manner that allows their effective use under the emergency conditions postulated.

6.25. These emergency response facilities shall operate as an integrated system in support of the emergency response, without conflicting with one another's functions, and shall provide

reasonable assurance of being operable and habitable under a range of postulated hazardous conditions, including conditions not considered in the design.

GSR Part 7

Requirement 25: Training, drills and exercises for emergency preparedness and response

The government shall ensure that personnel relevant for emergency response shall take part in regular training, drills and exercises to ensure that they are able to perform their assigned response functions effectively in a nuclear or radiological emergency.

6.30. Exercise programmes shall be developed and implemented to ensure that all specified functions required to be performed for emergency response, all organisational interfaces for facilities in category I, II or III, and the national level programmes for category IV or V are tested at suitable intervals. These programmes shall include the participation in some exercises of, as appropriate and feasible, all the organisations concerned, people who are potentially affected, and representatives of news media. ...

GS-G-2.1

Table 15 (in Characteristics of Emergency operations facility):

- Access to the information required to coordinate on-site and off-site response decisions;
- Reliable communications with on-site and off-site response centres and organisations;
- Continuous monitoring of radiation levels; security to prevent unauthorised access.

If located within the UPZ, it should be provided with sufficient protection to remain habitable^{*a} during an emergency or provided with a backup. Activation time: within 1 hour of declaration of a site area or general emergency.

^{*a} This should include provisions to monitor and control radiological exposures and contamination, to control other hazards (e.g. heat, air quality) and to meet human needs (e.g. with food, water and sanitary and sleeping arrangements) if the facility may be isolated for an extended period during an emergency.

Plant Response/Action:

A – Apparent Cause of Suggestion

The apparent cause of this shortfall is the lack of benchmarking emergency arrangements at other facilities other than Advanced Gas Cooled Reactors.

Causal Code – MS4d – Management Systems, Corrective Action, Use of OPEX less than adequate.

B – Summary of action plan

Observation 1

Inhabitability of emergency facilities including the Central Control Room (CCR),

Emergency Control Centre (ECC) and Access Control Point (ACP): under credible radiological conditions that could be encountered in an emergency, these facilities are not protected against radiological conditions by sealing and intake filtering.

Action:

EPG has undertaken a comprehensive benchmarking activity with a number of other international operators via our WANO contacts.

Two recommendations from the benchmarking report

Emergency Planning Group (EPG) to revise the BEG/SPEC/OPSV/EPG/077 suite of documents to confirm that the NUREG-0696 standards and the benchmarked good practices identified from other operators are included in the specifications.

The emergency handbook section BEG/SPEC/OPSV/EPG/002/8.4 to be updated to provide guidance on the tolerability of operating conditions in all emergency facilities. This will be completed along with updates for the new Radiation Emergency Preparedness and Public Information Regulations (REPPIR) 2019.

Observation 2

EDF Energy practice, followed by the station, is to rely on use of alternative emergency facilities to mitigate loss of habitability of the main emergency facilities.

Action:

From the benchmarking report from Observation 1, a third recommendation is for Torness to complete a gap analysis against the 077-document series and the good practices mentioned in the report, to determine any gaps or deviations from best practice. This is ongoing.

Observation 3

The evacuation of on-site personnel has not been subject to real time exercise at the station. The exercises have only been conducted as table top exercises during Level 2 demonstration exercises.

Action: A full site Evacuation Exercise (Exercise Apollo) was arranged and carried out on the 4th July 2019 to demonstrate an evacuation in a safe and controlled manner. This involved moving people to the car park as part of the exercise, but not transporting people away from site physically (instead this element was completed as a workshop).

Observation 4

The evacuation of on-site personnel takes place with significant support from the Central Emergency Support Centre (CESC) at Barnwood and is assisted by the local police (in relation to both traffic arrangements and bus service arrangements).

Action: A Torness Evacuation Workshop was held on 25th April 2019 at the SCC (Penston House). The workshop was attended by representatives from Emergency Planning group, Torness Emergency responders, Civil nuclear constabulary, Emergency services and local authority, Sellafield, and Central Emergency Support Centre responders (via teleconference). There were also observations by the Office for Nuclear regulation – Civil Nuclear Security and Safeguards. Five scenarios were reviewed to look at the cross-functional support required between the agencies.

Observation 5

Real evidence and learning have been obtained (for example in a recent Heysham 2 Site Incident), where non-essential staff were gradually released without incident.

Without comparing the chosen practices to those applied elsewhere in the nuclear industry, the station cannot be assured these approaches represent best practice.

Action: All EDF events are reviewed by station EPEs via a 'Call Down' facilitated by the Emergency Planning Group to capture and disseminate any learning. This takes place as soon as possible after the event.

The Evacuation Workshop held on 25th April 2019 included representatives from other parts of the Nuclear Industry to share their best practice and learning with the station representatives.

C - Action plan effectiveness review

Learning from the Station Site evacuation was circulated to member of the EPRG for discussion at the next meeting and for actions have been placed.

The main learning points are:

Improve the flow and release of staff evacuating site by using designated car park marshals.

- Look to install telephone landlines at external muster points as a back up to the radios and remove the need for staff to re-enter buildings.
- The declaration section of the Fire Response Plan TSP/EP/2.2 is to be clarified for the Emergency Controller.
- Enhance the logging and record keeping by introducing an additional Support officer to undertake the role of a logger.

IAEA comments:

The station identified the cause of the issue as the lack of benchmarking emergency arrangements at other facilities other than Advanced Gas Cooled Reactors.

One main aspect of the benchmarking was the habitability of emergency facilities, and another one was the evacuation exercise of on-site personnel.

The station took the following actions to resolve the issue:

- Benchmarking with several international operating organisations, focusing on the habitability of emergency response facilities has been conducted during June to September 2018.
- Based on the result of benchmarking, Emergency Planning Group revised standards for equipment and facilities important to emergency response to confirm clear reference of the NUREG-0696 standards. In addition, the table of habitability level was developed for the emergency handbook and temporarily distributed.
- The Torness Evacuation Workshop was held on 25th April 2019 by representatives from all related emergency organisation for preparation of exercise.
- The first full site Evacuation Exercise (Exercise Apollo) was delivered on 4th July 2019. Fire on waste compound was assumed and evacuation of non-essential staff was successfully demonstrated, using security cameras to monitor it and dedicated radio channel to communicate etc.

- The exercise report was issued in August 2019, which identified learning areas for improvement and actions such as car park control, external muster communication, recording key decisions by a logger, etc.

The station has the following remaining actions to complete:

- Formal updating of the emergency handbook along with updating the new Radiation Emergency Preparedness and Public Information Regulations.
- A gap analysis against the Torness NPP document series of standards for equipment and facilities important to emergency response and good practices identified on the benchmarking.
- Actions raised on the exercise report to improve the effectiveness of evacuation process.

Conclusion: Satisfactory progress to date

10. ACCIDENT MANAGEMENT

10.1. ORGANISATION AND FUNCTIONS

Emergency personnel are required to have a comprehensive understanding of the strategy for Severe Accident Managements (SAM) for decision making when responding to severe accidents. They also need to be highly familiar with the use of equipment for mitigatory actions, depending on each assigned role. However, the team identified the training programme regarding SAM does not always provide sufficient refresher training. The refresher training for Deployable Back Up Equipment (DBUE) on site is only performed as a station walk down without demonstrating the actions to install and operate the equipment, and the refresher training for Severe Accident Guidelines (SAGs) is not routinely performed. The team made a suggestion in this area.

10.4. DEVELOPMENT OF PROCEDURES AND GUIDELINES

The station has Symptom Based Emergency Response Guidelines (SBERGs) and Severe Accident Guidelines (SAGs) that provide SAM guidance. The SBERGs have already been extended to cover all station states (including unit outage condition - SBERG 7) and fuel route accidents (SBERG A–D), (development of SAGs for fuel route accidents are still in progress). The team encouraged the station to ensure the timely integration of SAGs for fuel route accidents as planned.

The station has proactively made efforts to improve the user-friendliness of emergency procedures. SBERGs and the Emergency Response Procedures for connecting the Deployable Back Up Equipment have been designed with colour pictures and flow-charts. These take into account Human Factors assessments based on the operators' request, and in a format that aids the operators to perform their role in a highly stressful environment during a severe accident condition. The team recognised this as good performance.

10.5. PLANT EMERGENCY ARRANGEMENTS WITH RESPECT TO SAM

The station has a number of deployable back-up equipment for responding to severe accidents such as a high-pressure water pump, diesel generators, unimogs etc. They are housed off-site in the Strategic Storage Facility and can be transported to the Staging Post (a pre-designated location adjacent to the plant) in the event of an 'Off-site nuclear emergency'. The equipment includes the Mobile Command and Control Centre ('Pod City') which consists of containerised modules for various functions. It provides a flexible, mobile facility for use if all other on-site facilities and alternative facilities are uninhabitable. The team recognised this as a good performance.

DETAILED ACCIDENT MANAGEMENT FINDINGS

10.1 ORGANISATION AND FUNCTIONS

10.1(1) Issue: The training programme for Severe Accident Management (SAM) does not always provide sufficient refresher training to ensure continued capability of response to severe accident conditions.

The station is implementing a project to provide many types of equipment for severe accident both on site and off site. However, during the mission the team observed the following:

- Training for Deployable Back Up Equipment (DBUE) is performed annually for all Standby Emergency Response Team (SERT) members. Initial training is conducted off-site, at Bellshill near Glasgow, and confirms SERT members' ability to lay out, connect hoses and cables, and operate equipment. However, refresher training is only performed on site as a plant walk down, as the DBUE is only located at Bellshill.
- DBUE has never been deployed at Torness site but exercised at a sister site (Heysham 2) in 2014. An exercise that includes deployment of DBUE at Torness is scheduled for a level 1 exercise in 2019.
- Training on Severe Accident Guidelines (SAGs) is provided only in the form of tabletop training for a new person. For the last major revision in December 2013, dedicated update training was provided for all operators and staff who have a technical role in the emergency plan, but refresher training is not routinely performed.
- Emergency exercises are typically performed on scenarios that do not use SAGs. This is because operator actions cannot be practiced at the site and the station perception of the low probability of occurrence.

Without sufficient refresher training, emergency staff may not be able to perform the duties assigned to them when responding to severe accident conditions.

Suggestion: The station should consider enhancing the training programme regarding SAM to provide sufficient refresher training to ensure continued adequate response to severe accident conditions.

IAEA Bases:

SSR-2/2 (Rev.1)

Requirement 19: Accident management programme

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

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

NS-G-2.8

4.33. They should also receive specialised training relevant to the duties they will have to perform in an emergency. The purpose of this training should be:

- to verify that all individuals participating in the exercise are familiar with, and capable of performing, the emergency duties assigned to them;

- to verify that emergency response and all related duties can be carried out in a timely manner according to the planned schedule and in stressful situations.

NS-G-2.15

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.

3.108. Initial training as well as refresher training should be developed. Refresher training should take place at regular intervals that are compatible with the plant's overall training programme. A maximum interval for refresher training should be defined; depending on the outcome of exercises and drills held at the plant, a shorter interval may be selected.

Plant Response/Action:

A – Apparent Cause of Suggestion

Slow progress via the station's JER programme and station board on the training aspects of the project¹. Priority of focus was on the design and installation of plant enhancements and written emergency response procedures on which training would be based.

OSART's review highlighted the need to expedite the totality of the JER project.

Causal Code - TBC

B – Summary of action plan

- With the help of the centre (Design Authority and Fleet EPRG) resources have been realigned to help enhance the performance of the Emergency Response Organisation and thereby improve station resilience within the boundaries of the existing Emergency Scheme Training Programme².

The current status of the action plan is:

Refresher training for Deployable Back Up Equipment (DBUE) on site:

- On-site hands-on training on DBUE from regional centre is now part of an 8 yearly rolling fleet-wide matrix for exercises³ – this is booked for March 2020 (originally the planned BDBA/DBUE exercise was in 2019 but swapped with counter terrorism exercise on a priority assessed basis of likelihood of occurrence following a request from CNC). The Torness scenario is being created⁴ – the exercise will be a Level 1 regulatory assessed exercise (with pre-cursor coached exercise the day before). Its aim is to ensure that operators practice using the JER equipment and ERPs (emergency response procedures) on site. It will demonstrate the adequacy of the equipment, connections, interfaces and documentation.

¹ Originally highlighted through AR894959 - WANO Performance Objectives and Criteria – Severe Accident Management Guidelines MEVL and AR930451- Self Assessment of WANO PO&C for Emergency Preparedness

² Programme described in BEG/TRNG/TPD/601/001, individual profiles detailed in BEG/RTP/EPG/001 to 076 and mentor guides BEG/TRNG/MPSG/601/001 to 076

³ On site JER equipment training continues to be refreshed with SERT team

⁴ Scenario being devised by EPE

- Although there has been a change to the Torness exercise date this has not prevented shared benchmarking/learning via the structure that has been set up so that all can learn from each other's exercises⁵. Torness personnel have benchmarked Dungeness and Heysham training and this has led to invaluable learning that Torness are currently progressing for using during Dec 2019 training which is a precursor session to the L1 BDBA exercise in March 2020.

Refresher training for Severe Accident Guidelines (SAGs):

- The OSART review led to further review of SAG information by Fleet EPRG team member - GC)⁶.
- Training needs analysis (TNA) created
- TNA (also known as PGNAW) presented to the CESC TEWG (April 2018) and agreed
- Updated SAG training material created October 2018⁷.
- Training rolled out February 2019⁸ (initial plan was for this to be Q3 2018 but aligning availability of trainees from both regional parts of HQ and station led to delay to Q1 2019)
- Feedback from training⁹ also included feedback on drafts of updated Fuel Route Severe Accident Guidelines (FRSAGs) and SBERG 7¹⁰ - updated FRSAG issued June 2019, the reseal and re-pressurise SBERG 7 is undergoing verification and due for issue end of Q4 2019.
- Feedback from training being actively worked into updated material via Fleet EPRG representative - this will be issued as GEST1508 and rolled out twice yearly as part of 5-year continuation training to assure sustainability. Target audience is CESC, EC, AEC, Emergency Reactor Physicist (EmRP). Booked date for delivery at Station is 4/5 November 2019, next delivery to CESC is Q1 2020
- Further sustainability drives being considered by station contact in Fleet EPRG (GC) include setting a regular review period to confirm if the analyses supporting the SAGs

⁵ See also Feedback from DGB Vanguard exercise and HAR Gibraltar exercise and CESC wiki notes from exercises - [http://engwiki/wiki/index.php/Central_Emergency_Support_Centre_\(CESC\)#Exercise_Programme](http://engwiki/wiki/index.php/Central_Emergency_Support_Centre_(CESC)#Exercise_Programme)

⁶ GC review – Self Assessment AR1042334

⁷ A scenario was created that took into account the long timescales for severe accident to develop in an AGR environment. It focussed on the actions and thought processes required to deal with SAM irrespective of the initiating causes/phenomena. It covered differing actions for both reactors, complex combinations of issues such as the effect that a magnetic flux event would have on control rods, damage to feed and steam systems/electrical boards/ post trip sequencing equip, damage to fuel pond/decay store, loss of life, fire, competing demands for expertise from similar events at other locations, limited station and central resources. – GC will articulate during OSART revisit

⁸ The exercise contained 20 representatives across the CESC roles. One person from station acted as Station Emergency Control Centre covering roles of Emergency Controller and Emergency Reactor Physicist.

⁹ Feedback was positive with everyone agreeing that the trainers had created a very realistic, challenging and demanding atmosphere that made them all feel suitably 'uncomfortable'. Suggestions for improvements included having a 'grab pack on a page', changing the layout of the CESC engineering assistance tables to be able to better split up personnel to deal with different issues affecting individual reactors and possible need to deal with a situation on other sites too (if event was UK wide), potential simultaneous use of normal and alternative CESC locations, more direct contact with station counterparts (EC/AEC/EmRP) for addressing technical queries.

¹⁰ OSART review had sight of first draft of these docs

require updating (see also WANO AR930451) and practicability of using the new simulator as part of BDBA/SAM exercises if fidelity allows

IAEA comments:

The plant identified the cause of the issue that priority of focus was on the design and installation of plant enhancements and written emergency response procedures on which training would be based.

The plant took the following actions to resolve the issue:

- The refresher training for Deployable Back Up Equipment (DBUE) was developed and continuously conducted with the new training tool, which enables trainee to practice the practical operation of DBUE, since 2018.
- Following the new training needs analysis (TNA) agreed by the working group of the Central Emergency Support Centre (CESC) in April 2018, the updated SAG training material was created in October 2018.
- The first Severe Accident Guidelines (SAG) training rolled out for CESC members in February 2019.

The station has initiated the refresher training both for DBUE operation and SAG. Feedback from the SAG training are already utilised to improve the CESC functionality and the updating of the Fuel Route Severe Accident Guidelines (FRSAG).

The station has the following remaining actions to complete:

- On-site exercise that includes deployment of DBUE at Torness NPS. (Rescheduled for March 2020).
- SAG training for emergency responsible personnel on site is planned for November 2019. Feedback and effectiveness assessment will be performed after that.

The on-site exercise which DBUE will be demonstrated at Torness for the first time, and SAG training for on-site personnel will ensure the response capability and provide further feedback for improvement from the viewpoint of station personnel.

Conclusion: Satisfactory progress to date

11. HUMAN-TECHNOLOGY-ORGANISATION INTERACTION

11.3 CONTINUOUS IMPROVEMENT/LEARNING ORGANISATION (MONITORING AND ASSESSMENT)

The station has organised a leadership club that support leaders by refreshing their knowledge and skills on a variety of subjects. The leadership club provides training for all leaders on behavioural, leadership and process management topics. Workshops are leader-led and designed to fully engage leaders and encourage them to share their operational experience. Problems arising in the field are the focus. Topics have included: absence management, difficult conversations, outage, unconscious bias, navigating inclusion, security for leaders, mediation, effective communications, and development of people. The club workshops are typically conducted during an outage. The team recognised this as a good performance.

The team identified that knowledge management (KM) is not systematically implemented at the station to ensure effective knowledge acquisition, transformation, transfer and retention. The station strategy and associated key performance indicators for KM have not been developed. The station has not trained and qualified personnel in KM. The procedure linked to KM does not include requirements for KM attributes such as knowledge gaps, critical knowledge identification, and knowledge mapping. Knowledge preservation is more focused on 'tacit-to-tacit' than 'tacit-to-explicit' knowledge transfer. The team made a suggestion in this area.

11.4. SAFETY CULTURE

The team identified that the nuclear safety culture (NSC) self and independent assessments are not sufficiently conducted at the station to continuously improve nuclear safety culture. Procedures to conduct NSC assessment have not been developed. Not all NSC assessment tools have been used to gather initial data and respondent profiles are not used to fully analyse the gathered data. The team made a suggestion in this area.

DETAILED HUMAN-TECHNOLOGY-ORGANISATION INTERACTION FINDINGS

11.3(1) Issue: Knowledge management (KM) is not systematically implemented at the station to ensure effective acquisition, transformation, transfer and retention of knowledge.

The station implements KM activities. A new edition of 'Knowledge Management and Retention within Nuclear Generation' procedure has recently been developed to replace previous one issued in 2016. However, the team observed the following:

- A station policy regarding KM has not been developed.
- The station has not developed and implemented a set of key performance indicators specifically linked to KM.
- The station has not conducted a self-assessment of KM.
- The implementation plan to introduce the new edition of 'Knowledge Management and Retention within Nuclear Generation' procedure has not been approved.
- The new specification does not include requirements for KM attributes such as knowledge gaps, critical knowledge identification and knowledge mapping.
- The fleet procedure defines few triggers to transfer knowledge such as 'project work', 'outage work', 'external contacts', 'event, incident, accident', 'identified knowledge shortfall'. The main trigger used is 'personnel leaving'.
- 'Knowledge transfer' has been identified as a critical subject in both the annual personnel engagement and nuclear safety culture surveys.

Without the systematic implementation of KM the station might miss opportunities to ensure effective acquisition, transformation, transfer and retention of knowledge.

Suggestion: The station should consider measures to improve KM implementation to ensure effective acquisition, transformation, transfer and retention of knowledge.

IAEA Bases:

GSR Part 2

4.21. Senior management shall make arrangements to ensure that the organisation has in-house, or maintains access to, the full range of competences and the resources necessary to conduct its activities and to discharge its responsibilities for ensuring safety at each stage in the lifetime of the facility or activity, and during an emergency response.

4.27. The knowledge and the information of the organisation shall be managed as a resource.

GS-G-3.1

4.4. Data should be converted to information for the continual development of an organisation's knowledge, and senior management should treat information as a fundamental resource that is essential for making factually based decisions and stimulating innovation. To manage information and knowledge, senior management:

- Should identify the organisation's information needs;
- Should identify and access internal and external sources of information;
- Should convert information to knowledge of use to the organisation;
- Should use the data, information and knowledge to set and meet the organisation's strategies and objectives;

- Should ensure appropriate security and confidentiality;
- Should evaluate the benefits derived from the use of the information in order to improve the management of information and knowledge;
- Should ensure the preservation of organisational knowledge and capture tacit knowledge for appropriate conversion to explicit knowledge.

SSR-2/2 (Rev.1) Requirement 2

3.2. The management system, as an integrated set of interrelated or interacting components for establishing policies and objectives and enabling the objectives to be achieved in an efficient and effective manner, shall include the following activities:

- Policy making for all areas of safety, which includes:
 - Setting management objectives;
 - Establishing the policy for safety;
 - Developing management and staff who value learning, have skills in creating, acquiring and
 - transferring knowledge, and can adapt the organisation on the basis of new knowledge and
 - insights.

Plant Response/Action:

A – Apparent Cause of Recommendation

Following the recommendation from OSART, a causal analysis was conducted and concluded that there is no formal procedure in place to ensure knowledge management takes place across the business as it is difficult to create a ‘one size fits all’ process which will work in every situation.

B – Summary of action plan

The following actions have been taken to address the identified shortfalls;

- Implement a Torness Specific Process for knowledge management to bridge the gaps between the Company process and excellence.
- Develop and introduce a key performance indicator.
- A knowledge management self-assessment was conducted.
- Ensure that the BEG/SPEC/OL/103 is approved.
- Ensure the Torness Specification includes additional knowledge management attributes and triggers.
- Embed knowledge management into everyday operation.

C - Action plan effectiveness review

- A Torness Specific Process has been introduced to bridge the gap between the fleet process and excellence. Whilst a Torness Specific Process is not best practice, it will be piloted at Torness and then best practice will be shared across the fleet. The Torness Specific Process includes additional knowledge management attributes such as

knowledge gaps and critical knowledge identification and knowledge management triggers in addition to the existing trigger of personnel leaving.

- A key performance indicator has been developed and introduced to monitor the station's knowledge management performance. The KPI takes into consideration the percentage of station employees who are considered a high knowledge management risk, the percentage of high-risk employees who have a plan in place to reduce the risk and the number of high-risk plans that have been in place for more than 12 months. The KPI is monitored monthly through the People Delivery Team.
- A knowledge management self-assessment was conducted to identify the station's gaps. This good practice was also introduced across the fleet and in future will be completed on a three-yearly basis.
- The fleet procedure (BEG/SPEC/OL/103) has been approved.

Knowledge management was introduced as a sub-section of Excellence through People in the Torness Business Plan. This meant that it was deemed a priority to the station and the progress was monitored through various delivery team meetings

IAEA comments:

The station made an analysis to understand the causes and contributors behind the suggestion made by OSART team. As a result of the assessment, the cause was identified as a lack of formal process and procedures for Knowledge Management (KM) to ensure knowledge transfer takes place across the station departments and working groups and associated with that a set of Key Performance Indicators (KPIs).

The station has established and applied the knowledge management implementation plan that includes the following major steps:

- Conduct knowledge management self-assessment
- Completion of people risk identification spreadsheet by department and group leader
- Identification of high risk individuals and completion of associated risk plans
- Launch risk management KPIs
- Identify medium risk individuals and completion of risk plans
- Review success of the KM implementation plan

A Torness Specification – 'Knowledge management and retention within Nuclear Generation' was introduced at the station to guide the station managers and provide tools which have to be used when receiving notification that a member of their team is leaving the business through resignation, leaving the team through an internal move or where the leader perceives a knowledge management shortfall. Attributes of knowledge management such as 'Tacit' and 'Explicit' knowledge are embedded into the management and retention specification.

The station has developed knowledge management risk reduction plans for each member of the team dependant of their 'Risk category' via 'Risk Identification Tool' and documented it in a database detailing all staff and their risk profile for leaving their current role.

The station introduced a set of specific KM KPIs that provide a clear picture of a status with the knowledge management and retention process at the station, allow management team to

track the success of the knowledge management intervention at Torness and undertake appropriate corrective actions.

Knowledge management was introduced as a sub-section of 'Excellence through People' in the Torness Business Plan. This meant that it is deemed a priority to the station and the progress is monitored through various delivery team meetings.

Conclusion: Issue resolved

11.4(1) Issue: The station's tools, techniques and performance indicators for nuclear safety culture self and independent assessment are not sufficient to fully assess nuclear safety culture.

The station conducts a survey of the nuclear safety culture on a 2-year basis using an external organisation. However, the team noted the following:

- The station has not developed and implemented a set of key performance indicators specifically linked to the NSC.
- The integrated company profile document for management of human performance (HU) and NSC requires the station to maintain oversight of the NSC survey. Currently the requirement to perform NSC self-assessment is not included as an accountability in the human performance lead post training profile.
- Procedures to conduct regular NSC assessment do not exist.
- The station set of tools to assess NSC is not complete. For example, there is no requirement for document analysis.
- NSC survey results are not fully analysed in respect of a respondent profile.
- NSC Survey uses an online questionnaire as the only tool to gather data. Other assessment tools such as observations, interviews, focus groups and document analysis are not employed.

Without the use of comprehensive nuclear safety culture assessment techniques, the station may miss the opportunity to understand and make improvements to improve nuclear safety culture.

Suggestion: Station should consider enhancing its nuclear safety culture assessments and indicators.

IAEA Bases:

SSR-2/2 (Rev.1)

4.34 Self-assessment by the operating organisation shall be an integral part of the monitoring and review system. The operating organisation shall perform systematic self-assessments to identify achievements and to address any degradation in safety performance.

GSR Part 2

6.9. Senior management shall ensure that self-assessment of leadership for safety and of safety culture includes assessment at all organisational levels and for all functions in the organisation. Senior management shall ensure that such self-assessment makes use of recognised experts in the assessment of leadership and of safety culture.

6.10. Senior management shall ensure that an independent assessment of leadership for safety and of safety culture is conducted for enhancement of the organisational culture for safety.

GS-G-3.1

2.32. The management system should provide structure and direction to the organisation in a way that permits and promotes the development of a strong safety culture together with the achievement of high levels of safety performance.

6.3. Self-assessment should be conducted at all levels in the organisation to assess performance and safety culture. At the organisational level it can be carried out by senior management. At the unit or work group level, other managers and individuals can carry it out.

Plant Response/Action:

A – Apparent Cause of Recommendation;

OSART Fact 1- The station has not developed and implemented a set of key performance indicators specifically linked to the NSC. - **EQ3g – System monitoring not specified correctly**

OSART Fact 2- The integrated company profile document for management of human performance (HU) and NSC requires the station to maintain oversight of the NSC survey. Currently the requirement to perform NSC self-assessment is not included as an accountability in the human performance lead post training profile. - **MS2e - accountability NI**

OSART Fact 3- Procedures to conduct regular NSC assessment do not exist. - **Incorrect BEG/ICP/OPS/014 clearly sets out the Fleet Purpose, Scope, Responsibilities and Practice for Human Performance and Nuclear safety Culture activities up to and including internal controls.**

OSART Fact 4- The station set of tools to assess NSC is not complete. For example, there is no requirement for document analysis. - **MS3b Audits and evaluations lack depth**

OSART Fact 5- NSC survey results are not fully analysed in respect of a respondent profile. - **EQ3d Data collected not evaluated effectively**

OSART Fact 6- NSC Survey uses an online questionnaire as the only tool to gather data. Other assessment tools such as observations, interviews, focus groups and document analysis are not employed. - **MS3c Audits and evaluations not independent**

Plant Response/Action:

B – Summary of action plan

- A SET OF Human Performance Key Performance Indicators to be developed and embedded fleet wide.
- Review the current Human Performance (Station) lead Role training Profile.
- Torness will seek an independent Nuclear Safety Culture assessment to understand and make any improvements to our Nuclear Safety Culture on site.
- Torness will develop a ‘Pulse’ survey that will be an effective tool for future Nuclear Safety Culture assessment.
- Torness will develop and conduct Nuclear Safety Culture Focus Groups.

C - Action plan effectiveness review

- Executive Team analysis of NSC results from NSC fleet lead Gillian Vaughan and independent expert Kathrin Mearns.
- Torness Top 3 Nuclear safety Culture focus area’s identified as;
 - Respectful Work Environment.

- Continuous Learning.
- Effective Safety Communications.
- Torness Top 3 Nuclear safety Culture focus area's identified and embedded into Torness Station and Department Business Plans;
 - Respectful Work Environment – Excellence Through People breakthrough area
 - Continuous Learning – Corrective Action Plan breakthrough area
 - Effective Safety Communications – Cross Functional working group led by the Human Resources dept.
- Human Performance Indicator (HUPI) designed and introduced at a fleet level across EDF Energy BEG/SPEC/NOS/003/797
- Monthly commentary inputted into BAER based on current HUPI score. This input used to generate an overall monthly fleet view.
- The current HU lead Role and Training Profile 'BEG/RTP/CI/010 – HU LEAD (STATION' clearly states under Key Responsibilities and Outcomes;
 - Take on the role of Nuclear Safety Culture Lead providing oversight of the Nuclear Safety Culture Survey (NSCS) on site, facilitating the communication and analysis of the results, implementation of actions and evaluating the effectiveness of station action plans.
 - Analyse and assimilate multiple data inputs and to identify performance shortfalls and recommend appropriate corrective action to ensure the programme remains effective.
 - Participate in and provide oversight of HU / NSC activities on site including training, workshops and team meetings
 - Coordination and assimilation of the Station/Centre HU Self Assessments.
- The overall Nuclear Safety Culture Programme is fleet owned and managed in accordance with
 - BEG/ICP/OPS/011 – Fleet Performance Management through the Fleet Approach
 - BEG/ICP/OPS/014 – Management of Human Performance and Monitoring Improvement of Nuclear Safety Culture.
 - Individual station Nuclear Safety Culture procedures are not in place as station level Nuclear Safety Culture activates form part of the overall fleet GOSP function.
- NSC focus groups developed and conducted by Kathryn Mearns (Independent NSC expert. (Operations, Maintenance, Engineering and Contract partners) results to be fed back to exec team.
- Pulse survey developed (based on Torness NSC 3 focus areas) to be used for Torness NSC assessment.
- Independent Nuclear Assurance (I.N.A)/Office of Nuclear Regulation (O.N.R) conducted a weeklong Independent Nuclear Safety Culture surveillance utilising various Nuclear Safety Culture assessment tools.

- I.N.A rating was a ‘Strong’ Nuclear Safety Culture demonstrated – Report number - SRD/REP/SUR/TOR/151.
- O.N.R concurred with the conclusions of the Independent Nuclear Safety Culture surveillance and rated the surveillance process as ‘Green’ – Report number – ONR-OFD-IR-19-005.
- Fleet level ‘Process Controls Self-assessment’ conducted and Torness rated as effective in all areas.

IAEA comments:

The station made an analysis to understand the underlying causes of the suggestion made by the OSART team. The cause was identified as a lack of directives, techniques, practices and related metrics to ensure comprehensive assessments of the station's nuclear safety culture (NSC).

An action plan has been developed and introduced at the station addressing the causes of the problem and includes several actions such as:

- to develop and conduct NSC Focus Groups activities.
- to review the current Human Performance station lead 'Role Training Profile'.
- to develop a method of survey that will be an effective tool for future NSC assessment.
- to seek an independent Nuclear Safety Culture assessment to understand and make any improvements to Torness Nuclear Safety Culture
- to develop and introduce fleet wide a set of human performance KPIs

The station conducted a set of workshops with representatives from operations, engineering, workplace solutions and maintenance focusing on how to improve the NSC at Torness. The following NSC traits were identified as requiring improvement focus areas and embedded into Torness Station and Department Business Plans:

- effective safety communication
- respectful work place
- continuous learning

A newly developed 'Pulse' survey technique will be used for that purpose.

The Human Performance coordinator now takes on the role of Nuclear Safety Culture Lead providing oversight of the Nuclear Safety Culture Survey (NSCS) on site, facilitating the communication and analysis of the results, implementation of actions and evaluating the effectiveness of station action plans.

The station conducted a set of training sessions dedicated to Safety Culture for the Senior Leadership and the station personnel resulting in 255 station staff being trained in NSC attributes and traits. A Human Performance Indicator (HUPI) has been designed and introduced across all EDF Energy stations to generate an overall monthly fleet view. An independent evaluation of the station NSC in March 2019 made by the Corporate Independent Nuclear Assurance (INA) with participation of the Office for Nuclear Regulation (ONR) inspector identified the station NSC process as 'strong'.

Conclusion: Issue resolved

12. LONG TERM OPERATION

12.1. ORGANISATION AND FUNCTIONS

The station uses an integrated asset management system to trend station risk and manage station investment. The integrated system has allowed lifetime threats to be identified and mitigating actions including investments to be planned until end of life, rather than just the usual 5 year planning cycle. The system usage is related to avoidance of future output loss by planned work to mitigate identified safety and lifetime threats. The team considered this a good practice.

The station personnel responsibilities for long-term operation (LTO) are described in the appropriate Post and Training Profiles (PTP) however, some of these have only very general descriptions. For example: there is only one PTP for Engineering Group Head, which covers all five positions in the Engineering Department. The documents have no specification of duties and responsibilities regarding Plant Life Extension (PLEX) activities, specific competences and the required training. The team encouraged the station to develop and implement comprehensive and detailed job profiles with the required skills and competences of the personnel.

A clear corporate policy regarding ageing management and LTO has been developed. The station senior management's commitment to provide the necessary resources is ensured through the Station and Engineering Business Plans. All PLEX projects are covered by the Business Plan, however, a PLEX concept and approach description were not in place. The team encouraged the station to develop a PLEX concept and approach description.

12.2. SCOPING AND SCREENING, AND PLANT PROGRAMMES RELEVANT TO LTO

All systems, structures and components (SSCs) are in the PLEX project scope, however the scoping and screening process is not well documented and traceable. A classification of the equipment regarding lifetime management arrangements is assigned by the station, which is not based on the safety classification. Commodity groups in the scope of PLEX project were formed according to their functions but there is no written methodology with grouping criteria. The team made a suggestion in this area.

12.3 REVIEW OF AGEING MANAGEMENT AND AGEING MANAGEMENT PROGRAMMES, AND REVALIDATION OF TIME LIMITED AGEING ANALYSES

Principal ageing effects and degradation mechanisms, materials and environments are described in the Technical Guidance Notes, as are the necessary activities for monitoring and detecting the effects of ageing. Critical locations are described in the Intention Document before every outage with a description of types and frequency of inspections. However, there is no description or consideration of the potential degradation mechanisms in these documents. The team encouraged the station to take into account the potential degradation mechanisms to ensure continued safe operation of SSCs during the PLEX period.

The indicator 'Physical Condition' has been mostly red and sometimes amber for the last 3 years. The Maintenance, Inspection and Test Schedule Safety System review of Decay Heat Boiler Primary and Secondary Cooling System from 2016 contains analyses of defects and trending however, there is a conclusion about the trend of defects of only one system. There is no determination of the defect trends of the rest of the systems. The station has not applied International Generic Ageing Lessons Learned (IGALL) on site. The team encouraged the

station to perform a self-assessment to take into account of IGALL, to ensure all applicable international best practices and lessons learned regarding ageing management and LTO are being taken into account.

Safety analyses will be carried out during the next license period for different safety and safety related equipment (for example: the graphite moderator). The results of these analyses will support the station decision for further operation beyond the design lifetime. The team encouraged the station to revalidate the residual lifetime assessments prior to the intended period of LTO so that the safe operation is ensured beyond the design lifetime.

DETAILED LONG TERM OPERATION FINDINGS

12.1. ORGANISATION AND FUNCTIONS

12.1(a) Good Practice: The station uses an integrated asset management system to trend station risk and manage station investment.

Risk Management

The Risk Management System (Nuclear Generation Risk Log – NGRL) is used to monitor and control station risk. The system assigns a risk value based on the annualised probability of a risk occurrence multiplied by the consequence of the risk should it occur. It monitors Nuclear Safety, Industrial Safety and Generation risks and ranks them to allow prioritisation and focus. Mitigations are then raised to reduce either the probability or the consequence of the risk and these are monitored over time to ensure risk reduction. This integrates with the investment management system and asset management.

Investment Management System (IMS)

The investment management system uses risk and mitigation information from NGRL and aligns this with a request for funding. The risk information is used to prioritise which station to invest in on a risk-informed basis. IMS is then used to manage the investment until it is completed with the benefits being reflected back into the risk log.

During 2017, the station planned and executed work that reduced lifetime risk by approximately £200M. In real terms, this related to avoidance of future output loss by planned work to mitigate identified safety and lifetime threats. An example is the gas circulator lifetime research project. This work cost £2.5M and justified, through physical testing, the suitability of the gas circulator motor windings for extended life. This avoided early shutdown of Torness and Heysham 2 and hence eliminated over £80M of risk of future output loss.

The Integrated Management system brings considerable benefits to the stations LTO programme. It has allowed lifetime threats to be identified and mitigations and investments to be planned until end of life, rather than just the usual 5-year planning cycle. The station can predict investment requirements up to its current expected lifetime.

12.2. SCOPING AND SCREENING AND PLANT PROGRAMMES RELEVANT TO LTO

12.2(1) Issue: The scoping and screening process is not well documented and traceable to ensure that the safe operation of systems, structures and components (SSCs) is guaranteed to continue during the LTO period.

During the mission, the team observed the following:

- Equipment classification regarding lifetime management arrangements assigned by the station is not based on the safety classification. No comparison was performed between the safety classification and the station classification and the conformity between both classifications cannot be demonstrated.
- All systems and components are included in the PLEX project scope, however, it cannot be demonstrated. For example, system B34 (Core Components) contains 13,390 components according to the Fleet Asset Information Register (FLAIR). There are 51 projects concerning PLEX activities regarding these 13,390 components. However, in the project documentation it is not specified which components are covered by a particular project. Functional groups (valves, pumps etc) are presented without component identifications. There is no clear evidence that these 13,390 components are covered by these 51 projects.
- Commodity groups in the scope of PLEX project were formed according to their functions. There is no written methodology for the grouping criteria.
- There is no interface between the master list of the equipment in Fleet Asset Information Register (FLAIR) and PLEX project scope.

Without well documented and traceable scoping and screening process, it cannot be ensured that the safe operation of SSCs is guaranteed to continue during the LTO period.

Suggestion: The Station should consider improving documentation and traceability of the scoping and screening process to ensure that the safe operation of systems, structures and components (SSCs) is guaranteed to continue during the LTO period.

IAEA Bases:

GSR Part 2

Requirement 8

The management system shall be documented. The documentation of the management system shall be controlled, usable, readable, clearly identified and readily available at the point of use.

SSR-2/2, rev.1

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

- a) Setting the scope for all structures, systems and components important to safety;

NS-G-2.12

4.15. To ensure that the ageing management review is resource effective, the list of identified structural elements and components important to safety that are susceptible to ageing degradation should be arranged into generic groups.

SRS-57

4.1. Scope Setting Process

The SSCs within the scope of LTO are those that perform the following safety functions [11]:

- a) All SSCs important to safety that ensure the integrity of the reactor coolant pressure boundary;
- b) All SSCs important to safety that ensure the capability to shut down the reactor and maintain it in a safe shutdown condition;
- c) All SSCs important to safety that ensure the capability to prevent accidents that could result in potential off-site exposure or that mitigate the consequences of such accidents.
- d) Other SSCs within the scope of LTO are those whose failure may impact upon the safety functions specified above.

DOCUMENTATION

The activities and results of the LTO evaluation are recorded and documented in a systematic and auditable manner that complies with the quality assurance programme in effect at the plant, and in accordance with the requirements of the national regulatory body.

Plant Response/Action:

A – Apparent Cause of Recommendation

Following the recommendation from OSART, a review was conducted of the company arrangements and documentation that led to the OSART suggestion. Gaps in our documentation were identified.

B – Summary of action plan

The following actions have been taken to address the identified shortfalls;

- Provision of company level documentation regarding the EDF approach to ageing Management and how this relates to IAEA Standards. DAO/REP/JIEF/083/GEN/18 Refers.
- Review and document maintenance strategy for Critical Components with a comparison to company / industry best practice.
- Provision of Torness specific summary document assessing the approach taken for our PLEX campaign in relation to the requirements of DAO/REP/JIEF/083/GEN/18.
- Formation of a fleet level ageing management working group to share learning.

C - Action plan effectiveness review

- A company level document (DAO/REP/JIEF/083/GEN/18) has been produced to document the EDF Energy approach to ageing management. This document reviews the expectations from IAEA guidance and relates them to our 36 company processes.
- The station has approximately 24000 identified critical components. These components are by definition the ones most important to safety or reliable operation. A maintenance basis template was produced and is being applied to all 24000 components. This includes a review of current maintenance and comparison with company and industry best

practice, including ageing management guidelines. This is complete for 70% of components with a plan in place to complete the remaining components.

- Following the publication of DAO/REP/JIEF/083/GEN/18 a review has been conducted comparing the approach taken by Torness specifically with comparison to the guidance in the fleet document.
- A fleet working group on ageing management has been formed and meets on a monthly basis.
- The actions identified during the review have been completed as per the action plan above. It is judged that the work done adequately addresses the issue identified during the OSART review.

IAEA comments:

The station has analysed the issue by reviewing the IAEA methodology from Long Term Operation to fully understand the suggestion. The root cause of the issue has been identified as weaknesses in the approach and documentation to establish the scope of the Long Term Operation programme.

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

- A company level document has been produced to document the EDF Energy approach to aging management.
- The station has reviewed critical components and their maintenance strategies and defined long-term operation actions for these components.
- The station benchmarked the new approach within the EDF Energy fleet.
- A fleet working group on Ageing Management has been formed and meets on monthly basis.
- The Plant Lifetime Extension Programme (PLEX) is linked to critical components for the traceability of the scope.

Most of the actions are fully implemented. The review of Critical Components is 70% completed, it will be 100% completed in the first quarter of 2020. This covers 24000 components.

The actions have been verified using document reviews and interviews. The effectiveness of the actions is monitored by several Key Performance Indicators such, failures on critical components, system performance and effectiveness of the maintenance and investments programmes.

Necessary actions have been taken and the actions are effective to support the safe operation of systems, structures and components.

Conclusion: Issue resolved.

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 - FOLLOW-UP MISSION

Issue resolved - Recommendation

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

Satisfactory progress to date - Recommendation

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

Insufficient progress to date - Recommendation

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

Withdrawn - Recommendation

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

Issue resolved - Suggestion

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

Satisfactory progress to date - Suggestion

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

Insufficient progress to date - Suggestion

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

Withdrawn - Suggestion

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

LIST OF IAEA REFERENCES (BASIS)

Safety Fundamentals

SF-1 Fundamental Safety Principles (Safety Fundamentals)

General Safety Requirements

GSR Part 1 Governmental, Legal and Regulatory Framework for Safety

GSR Part 2 Leadership and Management for Safety

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

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

GSR Part 5 Predisposal Management of Radioactive Waste

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

Specific Safety Requirements

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

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

SSR-5 Disposal of Radioactive Waste

General Safety Guides

GSG-1 Classification of Radioactive Waste

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

Safety Guides

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

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

NS-G-2.2 Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants

NS-G-2.3 Modifications to Nuclear Power Plants

NS-G-2.4 The Operating Organization for Nuclear Power Plants

NS-G-2.5 Core Management and Fuel Handling for Nuclear Power Plants

NS-G-2.6	Maintenance, Surveillance and In-service Inspection in Nuclear Power Plants
NS-G-2.8	Recruitment, Qualification and Training of Personnel for Nuclear Power Plants
NS-G-2.13	Evaluation of Seismic Safety for Existing Nuclear Installations
NS-G-2.14	Conduct of Operations at Nuclear Power Plants
GS-G-2.1	Arrangement for Preparedness for a Nuclear or Radiological Emergency
GS-G-3.1	Application of the Management System for Facilities and Activities
GS-G-3.5	The Management System for Nuclear Installations
GS-G-4.1	Format and Content of the Safety Analysis report for Nuclear Power Plants
RS-G-1.8	Environmental and Source Monitoring for Purposes of Radiation Protection
WS-G-6.1	Storage of Radioactive Waste
WS-G-2.5	Predisposal Management of Low and Intermediate Level Radioactive Waste

Specific Safety Guides

SSG-2	Deterministic Safety Analysis for Nuclear Power Plants
SSG-3	Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants
SSG-4	Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants
SSG-13	Chemistry Programme for Water Cooled Nuclear Power Plants
SSG-25	Periodic Safety Review for Nuclear Power Plants
SSG-28	Commissioning for Nuclear Power Plants
SSG-50	Operating Experience Feedback for Nuclear Installations
SSG-54	Accident Management Programmes for Nuclear Power Plants

INSAG publications

INSAG-4	Safety Culture
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INSAG-10	Defence in Depth in Nuclear Safety
INSAG-12	Basic Safety Principles for Nuclear Power Plants, 75-INSAG-3 (Rev. 1)
INSAG-13	Management of Operational Safety in Nuclear Power Plants
INSAG-14	Safe Management of the Operating Lifetimes of Nuclear Power Plants
INSAG-15	Key Practical Issues In Strengthening Safety Culture
INSAG-16	Maintaining Knowledge, Training and Infrastructure for Research and Development in Nuclear Safety
INSAG-17	Independence in Regulatory Decision Making
INSAG-18	Managing Change in the Nuclear Industry: The Effects on Safety
INSAG-19	Maintaining the Design Integrity of Nuclear Installations throughout their Operating Life
INSAG-20	Stakeholder Involvement in Nuclear Issues
INSAG-23	Improving the International System for Operating Experience Feedback
INSAG-25	A Framework for an Integrated Risk Informed Decision-Making Process

Safety Report Series

SRS No.11	Developing Safety Culture in Nuclear Activities Practical Suggestions to Assist Progress
SRS No.21	Optimization of Radiation Protection in the Control of Occupational Exposure
SRS No.48	Development and Review of Plant Specific Emergency Operating Procedures
SRS No. 57	Safe Long-Term Operation of Nuclear Power Plants

Other IAEA Publications

Safety Glossary	Terminology used in nuclear safety and radiation protection 2016 Edition
Services Series No.12	OSART Guidelines 2015 Edition
EPR-ENATOM-2002	Emergency Notification and Assistance Technical Operations Manual
EPR-METHOD-2003	Method for developing arrangements for response to a nuclear or radiological emergency, (Updating IAEA-TECDOC-953)
EPR-EXERCISE-2005	Preparation, Conduct and Evaluation of Exercises to Test Preparedness for a Nuclear or Radiological Emergency

TEAM COMPOSITION OF THE OSART MISSION

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Review area: Team Leader

Years of Nuclear Experience: 33

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Division of Nuclear Installation Safety

Review area: Deputy Team Leader

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DUTTO, Jean-Baptiste – France

EDF

Review area: Leadership and Management for Safety

Years of nuclear experience: 24

MAGUIRE, Paula – Canada

Consultant

Review area: Training & Qualification

Years of nuclear experience: 31

Tarnoy, Laszlo – Hungary

MVM Paks NPP Ltd

Review area: Operations 1

Years of nuclear experience: 27

TARARIN, Aleksei – Russian Federation

Leningrad NPP

Review area: Operations 2

Years of nuclear experience: 15

TRAAS, William - The Netherlands

N.V. EPZ

Review area: Maintenance

Years of nuclear experience: 21

BILIC ZABRIC, Tea – IAEA

Division of Nuclear Installation Safety

Review area: Technical Support

Years of nuclear experience: 29

NOEL, Marc – Belgium/European Commission

EC-Joint Research Centre

Review area: Operating Experience Feedback

Years of nuclear experience: 18

NILSSON, Virva – Sweden

Forsmarks Kraftgrupp

Review area: Radiation Protection

Years of nuclear experience: 25

BURKE, Bill – United States of America

INPO

Review area: Chemistry

Years of nuclear experience: 39

TUOMISTO, Harri Juhani - Finland

Fortum Power and Heat Oy

Review area: Emergency Preparedness and Response

Years of nuclear experience: 40

SUGAHARA, Jun – IAEA

Division of Nuclear Installation Safety

Review area: Accident Management

Years of nuclear experience: 17

VOLKOV, Eduard - Russian Federation

Science Research Centre 'PROGNOZ'

Review area: Human-Technology-Organisation Interaction

Years of Nuclear Experience: 22

KIRILOVA, Desislava – Bulgaria

Consultant

Review area: Long Term Operation

Years of Nuclear Experience: 17

Observer:

OZEROV Evgenii – Russian Federation

ROSENERGOATOM

Years of Nuclear Experience: 14

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SUGAHARA, Jun – IAEA

Division of Nuclear Installation Safety

Review area: Accident Management,

Emergency Preparedness and Response,

Chemistry

Years of nuclear experience: 19

TARARIN, Aleksei – Russian Federation

Leningrad NPP

Review area: Operations

Years of nuclear experience: 17

TRAAS, William - The Netherlands

N.V. EPZ

Review area: Maintenance,

Long Term Operation

Years of nuclear experience: 23

Observer:

PAMPANO VACA, Daniel – Spain

Almaraz NPP

Observer

Years of nuclear experience: 28