



IAEA

International Atomic Energy Agency

**REPORT
OF THE
OPERATIONAL SAFETY REVIEW TEAM
(OSART)
MISSION
TO THE
SIZEWELL B
NUCLEAR POWER STATION
5 – 22 OCTOBER 2015
AND
FOLLOW UP MISSION
24 – 28 APRIL 2017**

**DIVISION OF NUCLEAR INSTALLATION SAFETY
OPERATIONAL SAFETY REVIEW MISSION
IAEA-NSNI/OSART/017/185F**

PREAMBLE

This report presents the results of the IAEA Operational Safety Review Team (OSART) review of Sizewell B Nuclear Power Station, United Kingdom. It includes recommendations for improvements affecting operational safety for consideration by the responsible United Kingdom 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 16 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 United Kingdom organizations is solely their responsibility.

FOREWORD

by the

Director General

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

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

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

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

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

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

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INTRODUCTION AND MAIN CONCLUSIONS

INTRODUCTION

At the request of the government of the United Kingdom, an IAEA Operational Safety Review Team (OSART) of international experts visited Sizewell B Power Station from 5 to 22 October 2015. The purpose of the mission was to review operating practices in the areas of Leadership and management for safety; Training & qualification; Operations; Maintenance; Technical support; Operating experience feedback; Radiation protection; Chemistry; Emergency preparedness and response; and Accident management. 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.

Sizewell B Nuclear Power Station is located on the North Sea coast approximately 100 miles (160 km) North-East of London. Sizewell B is the UK's only commercial pressurized water reactor (PWR) power station, with a single reactor and rated capacity 1198 MWe (net). The “nuclear island” at Sizewell B is based on a Westinghouse “4-loop” plant known as SNUPPS (Standard Nuclear Unit Power Plant System). Sizewell B uses two full-speed, 3,000 RPM (50 Hz), nominal 660 MW turbo-alternator sets. It was built and commissioned between 1988 and 1995, first synchronized with the national grid on 14th February 1995. The power station is operated by EDF-Energy.

The Sizewell B OSART mission was the 185th in the OSART programme, which began in 1982. The team was composed of experts from Brazil, Canada, France, Germany, the Russian Federation, South Africa, the United States of America and the IAEA staff members. The collective nuclear power experience of the team was approximately 390 years.

Before visiting the station, the team studied information provided by the IAEA and the Sizewell B station to familiarize themselves with the station's main features and operating performance, staff organization 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 summarize the findings in the review scope, according to the OSART Guidelines document. The text reflects only those areas where the team considers that a Recommendation, a Suggestion, an Encouragement, a Good Practice or a Good Performance is appropriate. In all other areas of the review scope, where the review did not reveal further safety conclusions at the time of the review, no text is included. This is reflected in the report by the omission of some paragraph numbers where no text is required.

MAIN CONCLUSIONS

The OSART team concluded that the managers of Sizewell B NPS are committed to improving the operational safety and reliability of their station. The team found good areas of performance, including the following:

- Accelerated pace Nuclear Leadership Programme (NLP) with Inclusion Workshops to train current and emerging leaders on important nuclear leadership principles and behaviour.
- The station's Periodic Safety Review (PSR2) process which is comprehensive and rigorous and based on benchmarking with wide range of modern safety standards.
- A single organizational Learning Portal enabling an easy collection and access to internal and external operational experience throughout all station departments.
- A well developed and documented process to ensure that the emergency exercises comprehensively cover the situations that could arise during emergencies.

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

- The station should enhance its policy and practices for handling and use of operating procedures and operator aids to ensure that current and correct documents are always available for use by operators.
- The station should improve the implementation of its foreign material exclusion (FME) programme.
- The station should enhance its corrective action programme trending so that adverse trends are identified and corrected in a consistent and timely manner.
- The station should continue its programme of reviewing and updating severe accident management procedures across all plant areas and conditions, incorporating experience from the 2011 Fukushima accident.

Sizewell B 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.

SIZEWELL B STATION SELF ASSESSMENT FOR THE FOLLOW-UP MISSION

In October 2015 Sizewell B Power Station was audited for the first time since its pre commissioning audit in 1992. This represented the first OSART audit in the UK since 1994. The OSART mission represented an opportunity to compare our organisation to the IAEA safety standards.

Sizewell B 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 whether a fleet approach was required.

The improvement plans were included as a separate section within the Station Improvement Plan and driven to completion through monthly accountability meetings with individual owners and the executive team.

The effectiveness of the actions at resolving the initial proposals for improvement were reviewed through periodic challenge board meetings between the Plant Manager and individual recommendation / suggestion owners and sponsoring managers.

Improvement activities include:

- The Station business plan has been changed to give a longer term focus (the SZBeyond 40) to draw attention to the life extension potential and the longer term aspects of plant life and Operation.
- An outage performance improvement plan has been produced for multi cycle improvement activities to drive outage performance to higher levels; Benchmarking has been carried out internationally to develop the forward plans.
- A yearly routine has been established to audit the plant and control rooms for uncontrolled documents and un-authorized operator aids.
- The quarterly routine to audit existing operator aids as per BEG/SPEC/OPS/049 has been confirmed as active.
- To enhance Site collaborative working, an FME Working Group comprising of members from Maintenance, Investment Delivery and primary contractors Areva, GE and Doosan has been established. The group meets every 2 weeks and is a forum for exchanging operating experience and good practice regarding FME. 7 meetings have held to date.
- For Investment Delivery activities, the Pre-Construction Check sheet has been amended to include FME controls and Specification Authors trained in recognising FME risks in new article procurement from vendors.
- Targeting of leadership field observations of Plant work to FME-related activities began in October 2016 and has continued to date via the Maintenance Department Leadership Coaching Review [LCR] meeting meetings being held every 2 weeks.
- A new trending process has been implemented which requires minimum of a Condition Report and an Effectiveness Review (known as a FLUP) for all Trends. Complex trends also require a Gap Sheet to be produced. This process is used for all trends identified on site including equipment failures.

Sizewell B, as a station, is keen to host the OSART follow-up to illustrate and show evidence of the stations collective efforts and commitment to address the causes of each recommendation and suggestion.

FOLLOW-UP MAIN CONCLUSIONS

An IAEA Operational Safety Review Follow-up Team visited Sizewell B NPS from 24 to 28 April 2017. There is clear evidence that Sizewell B NPS management has gained benefit from the OSART process. The plant has analysed in a systematic way the OSART recommendations and suggestions and developed corrective action plans to address all of them.

The willingness and motivation of station management to use benchmarking with other nuclear power plants, consider new ideas and look for improvement was evident and is a clear indicator of the station's strong safety commitment. During the follow-up mission the station staff demonstrated openness and transparency. Sustainable positive results were obtained in many areas reviewed during the follow-up mission. 47% of the issues were fully resolved, 53 % were found to have achieved satisfactory progress.

The station has resolved issues regarding management strategic planning, root cause general applicability, the quality of corrective action programme trending, preparation and control of maintenance activities, FME programme, control of temporary equipment, management of radiation doses, and handling of chemicals.

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

To enhance the document management and control process the station has made arrangements with the corporate organization to establish clear accountability and monitoring for the revision of corporate documents applying at the station. The revision status of corporate procedures is available at the station at all times. Bimonthly audits are planned and conducted by the station quality assurance group to monitor the station documentation status. The station has demonstrated tangible improvements in the area of documentation management and revision control. Recent evaluations show that minor deviations in this area have been noted. There is formal station guidance for reviewing the operational and maintenance procedures that defines an extensive set of criteria to be used when reviewing such procedures. However, there is no evidence and record that those criteria are used by reviewers when carrying out reviews. The station would find it beneficial to apply this guidance systematically to the review process, and this should be based on the station graded approach.

The station has made noticeable improvements with regard to human behaviours in handling and use of operating procedures and operator aids. This has reduced the number of un-authorized operator aids and un-controlled documents. The improved operational document review process resulted in the update of 917 and 240 documents in 2016 and 2017 respectively. However, the work is not finished yet and some deficiencies were identified during the OSART Follow-up. Further actions are required to demonstrate that the new routine will prove the effectiveness of the actions put in place.

To improve the plant practices for identifying and resolving deficiencies in the field the station has adopted a strategy and a method for resolving the issue and imposed an action plan that was routinely monitored and regularly evaluated. This resulted in a tangible improvement in the concerned area. However, some of the activities are not finished yet. The importance of the field tours and the priority that shall be given to effectiveness of this activity as part of operations staff training is to be included in future continuing training.

Several operational station area tours procedures need to be revised and/or re-issued to be aligned with the enhanced standard.

To improve the arrangements for fire protection the station has made efforts that resulted in noted improvements, however, some actions have not been finished yet such as: the review of site fire team arrangements; further reduction of the number of oil leaks.

To install more rigorous practices in the RCA to support continuous contamination control improvement the station has developed and implemented two new guides. One is a detailed Coaching Guide for line supervisors to help them identify both good and poor practices. This guide shows actual photographs from the field and will be used to support training, to direct themed coaching focus areas and for use by leaders when performing task observations. The other is a detailed Personal Contamination Event (PCE) mitigation plan that details specific actions to improve contamination control performance, including actions specific to worker practices. The PCE Mitigation Plan includes for the first-time specific targets for Work Groups, to encourage line management accountability for their team's performance. The PCE plan will be tested during the outage in November 2017 and the behavioural change expected with the Coaching Guide will be tracked over a multi year period.

To address the issues in concerning the emergency planning zoning and use of Operational Intervention Levels the station and the EdF Energy Emergency Preparedness Group (EPG) have taken a proactive approach to compare relevant practices from different countries and develop a position on the need to amend the UK NPP fleet approach. A 'Benchmarking questionnaire' was developed by EPG in November 2016 and circulated to all operators who are WANO members. Responses were received from 6 operators of PWR units in Europe. The preliminary results from the evaluation show some discrepancies that can be attributed to the differences in the legislative requirements. It was noted that many of the differences identified by the benchmarking activity were already recognized and understood and EdF Energy is eager to work with Lead Governmental Department and the UK Nuclear Safety Regulator to identify a solution to address IAEA recommendations through UK legislative work in response to the Basic Safety Standards Directive (BSSD). As discussed during the original OSART mission the station confirmed that the methodology for conducting emergency planning hazards assessment meets the national regulatory system requirements. However, based on the analyses and evaluation of the benchmarking results the EdF Energy EPG is fully committed to work via the UK Nuclear Emergency Agreement Forum alongside all stakeholders involved in emergency planning in the UK and propose amendments, if such are found necessary, in particular as a result of the forthcoming introduction of the new EU Basic Safety Standards Directive (BSSD) concerning radiation protection. The BSSD implementation process is to be completed by February 2018. In order to avoid any delays for gamma spectrometry analyses in case of emergency a project to upgrade the current Off Site Survey (OSS) vehicles to include new gamma spectrometry instruments was developed at EdF Energy level. The instruments will utilise Chromium Zinc Telluride crystals that do not require cryogenic cooling, therefore the instruments can be reasonably small in size and readily installed for processing in vehicles. This state-of-the art technology, when implemented will improve the timeliness of the station analysis of airborne samples.

The station has taken very comprehensive actions to review its approach to severe accident management (SAM) and to benchmark Sizewell B practices with Westinghouse owners group (WOG) ones. The station has recognized the need to update the severe accident and PSA level 2 analyses used for the initial development of severe accident mitigation procedures; the need to seek external technical support; and consider different options for updating the station approach and documentation to support SAM. Further consideration was

given to possible upgrading of the full scope simulator so it can be used for operator training in SAM. The plant is fully aware that the major updates to the SAM documentation will take some time and have factored this into their action plan. The station has secured support on this subject from the Company Central Technical Organization. During the OSART follow-up mission the phased approach proposed by the station for comprehensive review and upgrading of station documentation concerning SAM was discussed and found commendable. The prepared detailed action plan, which is part of the multi-annual Sizewell B Improvement Plan, allocates the requested resources and responsibilities up to January 2022. The immediate updates required to procedure SOI-8.8: Severe Accident Mitigation, SOI-5.13.4: Actions on Abnormal Conditions in Fuel Storage Pond and technical basis SOI-8.8 'BASES' underpinning these procedure were implemented and demonstrated to be available during the follow-up mission. Modifications which will require more detailed analyses e.g. concerning the possibility to inject sea water into the containment, unreliability of Reactor Vessel Level Indication System (RVLIS), acknowledging the differences in the Sizewell B and Westinghouse approach to SAM, etc. will be addressed at a later stage as part of the comprehensive review of Sizewell B's approach Severe Accident Management.

1. LEADERSHIP AND MANAGEMENT FOR SAFETY

1.1. LEADERSHIP FOR SAFETY

Current and emerging leaders were trained on important nuclear leadership principles and behaviours using the detailed and comprehensive Nuclear Leadership Programme. 136 leaders were trained in the space of 2 years. In addition, the station realized that the success of the Nuclear Leadership Programme could be maximized if some workers participated in Inclusion Workshops. A total of 134 workers have participated in these Inclusion Workshops. Leadership principles have been summarized in a model based on international standards of excellence. This model, called “behaviours for success” targets improved performance through behavioural changes. This model is promoted, deployed and used across the whole station. The team considers that the combination of Leadership training with the “behaviours for success” model as a good practice.

Although the station has had continuously improving records in safety and reliability for 3 consecutive years, during the mission the team observed deficiencies with the implementation of proactive measures to increase safety and reliability in the near and long term. Shortfalls were identified in three areas: adverse record/trending and recurrent issues, transition planning, and competencies and staffing. The team suggests the station continues implementing proactive measures to increase performance in the near and long term in order to continuously improve safety and reliability performance.

1.3. NON-RADIATION-RELATED SAFETY PROGRAMME

The station has a double Red / Green Line Policy to demarcate zones where essential Personal Protective Equipment (PPE) must be worn. The welfare and office zones of the site lie on the Green side while the operation and industrial zones are on the Red side of the site. The Red/Green Line policy helps make it clear where PPE must be worn. As a result of the clarity of the Red/Green policy, there is a good compliance by workers, which helps minimize the risk of injury. The team considers this to be good performance.

1.4. DOCUMENT AND RECORDS MANAGEMENT

The team observed deficiencies with respect to documentation control and use of uncontrolled documents. Shortfalls have been identified in different areas: corporate procedures applying to the station, Operations’ documentation, emergency preparedness documentation, RP documentation. Moreover, events involving documentation issues were also identified. The team suggests the station improves its documentation policy and control to ensure that station documents are always controlled in a consistent and compatible manner.

1.9. SAFETY CULTURE

A strong safety culture is composed of many attributes that collectively demonstrate the approach to promoting a safe working environment within an organisation. During the review period the overall experience of the team is utilized to capture those behaviours, attitudes and practices that characterise the safety culture in place at the station. The team identified a number of facts related to strengths and weaknesses in performance that may affect safety culture that could assist the ongoing management efforts to improve safety culture at the station.

With respect to observed strengths, the team identified that the station staff has demonstrated a strong commitment to safety at the station. Questioning attitude, no hesitancy to raise concerns, evidence that individuals understand the importance for adherence to high nuclear

safety standards, demonstrated high professional proficiency were some of the behavioural features supporting continuous identification of safety improvement opportunities.

The station holds short meetings to deliver the daily “Safety message and station status brief” prior to any activities on the site and thus ensure continuous staff safety awareness.

The staff proactive involvement in the discussions on these daily messages was considered by the team as a good practice.

There are other attributes that the team believes could be strengthened to improve the overall safety culture and safety performance at the station. The team noted that the management involvement in coaching during station field tours could be improved, and the station approach to analysing equipment reliability trends could be more proactive to ensure prevention of equipment failure or other operational events. The team also observed some cases of station deficiencies in the field not being promptly identified and reported, for example deficiencies relating to implementation of FME practices.

DETAILED LEADERSHIP AND MANAGEMENT FOR SAFETY FINDINGS

1.1. LEADERSHIP FOR SAFETY

1.1(a) Good practice: Accelerated pace Nuclear Leadership Programme (NLP) with Inclusion Workshops for employees.

A detailed and comprehensive Nuclear Leadership Programme trained current and emerging leaders on important nuclear leadership principles and behaviours. The Management Team went through the leadership programme first to ensure the tone was set and behaviours and knowledge were role modelled. The accelerated programme trained 136 leaders in the space of 2 years.

The station realized that the success of the Nuclear Leadership Programme could be maximized if some workers participated in Inclusion Workshops, where they were exposed to key modules of the programme. The workshops enhanced cross-functional working and minimised “departmental silo” attitudes. A total of 134 workers have now participated in these Inclusion Workshops.

There is a systematic approach to leadership & behavioural interventions through identifying performance gaps from trends in Condition Reports (CR), engagement survey results, nuclear safety culture survey results, Significant Operation Event Reports (SOER) & bespoke leadership surveys for leaders.

Examples of impact:

- Inclusion Workshops – Employee Engagement Survey results have improved since implementing this training especially in the area of teamwork (score increased by 6 points from 2012 to 2013).
- Accelerated Nuclear Leadership Programme – High Performance Index has improved from 50 in 2011 to 63 in 2013, recovering the previous existing gap with the fleet. Nuclear Safety Culture Survey Results 2014 have also improved since the leadership & behavioural interventions were introduced.

In addition to the initial NLP, Leadership principles have been summarized in a model developed by EDF-Energy based on international standards of excellence.

This model, called “behaviours for success” is a fleetwide programme which targets improved performance through behavioural changes. This model is promoted, deployed and used across the whole station.

Behaviours for success

Nuclear generation works best where people consider themselves to be part of 'one team', are able to work to their full potential in an environment where organisational silos are removed and people are working together to achieve desired results. We see world class performance in many areas of our business and one of our primary objectives is to build on this and enable all leaders and teams to achieve the highest possible levels of performance.

The behaviours we see in our high performing teams have been captured in the form of a model we have called "behaviours for success". These behaviours combined with our management system will ensure the long term success of our organisation.



1.1(1) Issue: The station arrangements to maintain current high level of performance in terms of safety and reliability are not refined enough to ensure proactive continuous improvement in the near and long term.

The station has had continuously improving records in safety and reliability for 3 consecutive years, however, during the mission the team observed deficiencies with the implementation of proactive measures to increase safety and reliability in the near and long term. Shortfalls were identified in three areas:

Adverse record/trending and recurrent issues:

- Current CC1 (Critical Components) backlog is at industry norms but is static at approximately 100. However the Defect Backlog is higher than industry norms. Defect Backlog has increased since the beginning of the year 2015.
- Record of past generation losses: the overall performance of the station over the past 3 rolling years in terms of UCF (Unit Capability factor) is 88,19% which places the station in the middle of the second quartile of worldwide PWRs although the station has a favourable 4 trains design which could enable better performance.
- The total number of unwanted (spurious) fire alarms is 51 since the beginning of the year. This is a potentially adverse trend since 44 were reported in 2013 and 54 were reported in 2014. Each time a spurious alarm is received, Operations are required to intervene and this is an unnecessary distraction.

Furthermore, high number of spurious alarms may reduce staff attention to such alarms.

- On the 24th of November 2014 there was a spill of sodium hypochlorite from the Hydrogen Disentainment Tank bounded area onto the adjacent ground. The approximate strength of the Hypochlorite was 0,024%. Root causes are the following: inadequate use of operating experience feedback; this is a repeat event; design inadequate; preventive maintenance inadequate; the high level switch did not operate due to silt blockage (it was a known problem). Not solving root causes from the previous event leads to this repeated events.

Transition planning:

- The Off Site Radiological Survey Function was transferred from Sizewell A to Sizewell B in March 2015. Although INA (Independent Nuclear Assurance) recommended to bridge gaps with respect to requirements compliance some were still pending at the end of June 2015, eg: revision to Surveillance Programme 2 is still outstanding and competency development is needed (License condition 11).
- The first transfer of spent fuel to the Dry Fuel Storage, which is still under construction, is scheduled to take place before the next outage. The contingency delay plan for the project is 2,5 years and includes:
 - The Safety Case for the Dry Fuel Storage has been challenging. A number of aspects of the safety case caused delay; one of them being the design of the cask with two barriers required by EDF-Energy nuclear safety principles. ONR still has two licensing hold points to release before spent fuel can be transferred to the Dry Fuel Storage.
 - Since the initial contract was placed, the schedule slippage has been 6 months over a total duration 3.5 years.
 - The PFHM (Pond fuel handling machine) was originally scheduled for an upgrade in 2008, but this was delayed. The completion of the modification is due in February 2016.
 - Euratom design shortfalls are still pending with the Ion Fork installation.

If any more major delays occur (such as emergent issues during commissioning with adapted equipment for Sizewell B such as cooling system) or new challenges are brought by ONR or Euratom, the project could be delayed with possible impact on the station operability.

- There are no Radiation Protection monitors at the exit of the site. Proactively implementing this additional RP barrier could lead the plant to meet best international world practice.
- The station has a secure improvement/investment plan for the next 5 years. The corporate level has launched a 40/60/80 years life time duration equipment reliability, investment plan and business case analysis programme to secure a complete and deliverable extended life plan for Sizewell B. A progress meeting took place at the plant on the 13th of October with a presentation to the Engineering staff. The deliverables and presentation to the Boards are expected within 2 years (8 years before plant mid life time considering 60 years). Uprates and load follow modifications may be considered in the future. Should any major investment be decided at the corporate level with respect to a 30 years mid life, contract for long lead

equipment will need to be placed with no further delay in order not to miss the mid life target.

Competencies and staffing (in the context of the large staff renewal that will occur in 5 to 10 years time):

- The station does not use a unique tool for competencies mapping. Inconsistent use of tools could lead to difficulties in identifying competencies weaknesses at the station level.
- The PSR2 review identified the following as one of the 44 priority observations. “The justification of the Staffing Levels for the roles which are identified within the Sizewell B Safety case is not well documented within the nuclear baseline.”
- INA (Independent Nuclear Assurance) identified in a report issued in June 2015 that Operations does not have a robust long term resource station commensurate with the lead times for key positions.
 - Several acting managers have been identified throughout the station organisation chart:
 - 1 acting manager (Work Management) for 3 weeks;
 - 3 acting group heads acting:
 - Maintenance/Process Computing Group (PCG) group head: incumbent retiring in 2017;
 - Work Management/ Work planning control group head: due to succession chain for Work Management Manager;
 - Engineering/Programmes and components group head: group head covering two sections until arrival of external recruit in Jan 2016).

Temporary positions in line management imply less guidance to subordinates.

- INA (Independent Nuclear Assurance): 3 positions exist at the station for INA. One has been vacant since April 2015. Out of 24 INA positions for EDF-Energy fleet, 4 positions are vacant (one being at Sizewell).

Not implementing proactive measures to increase safety and reliability in the near and long term may put long term performance at risk.

Suggestion: The station should consider implementing proactive measures to enhance performance in the near and long term in order to continuously improve safety and reliability of the station performance.

IAEA Basis:

NS-G-2.4

5.11. The operating organization should demonstrate a commitment to achieving improvements in safety wherever it is reasonably practicable to do so as part of a continuing commitment to the achievement of excellence. The organization's improvement strategy for achieving higher safety performance and for more efficient ways to meet existing standards should be based on a well-defined programme with clear objectives and targets against which to monitor progress.

Plant Response/Action:

A – Apparent Cause of Suggestion

The apparent cause of the suggestion is the organisation having a short term rather than a strategic focus. At the time of the review it was not clear who had the responsibility for the longer term focus (Sizewell B or the central function) and what the barriers were to improving the strategic focus.

Causal Code - **MS1** - Standards; Policies and Admin Controls Need Improvements

B – Summary of action plan

The action plan has been designed to address the specific findings as well as the overall suggestion. Individual actions were placed to solve the cause of the finding and these have been tracked via the station improvement plan (SIP). The performance of the station has been benchmarked internationally as well as within fleet and these insights used to develop the SIP for the last 12 months.

C - Action plan effectiveness review

The action plan has been successful in closing the majority of the specific issues identified. In summary

CC1 defect backlog has reduced with the year-end target for 2017 of 55. The upward trend of the deficient backlog has been reversed and is now at INPO upper quartile performance.

There have been no unplanned reactor manual trips for 2543 days and no automatic reactor trips for 1689 days. Sizewell B ran at full output for cycle 14, breaking the UK nuclear fleet output record for the 2015 year. UCF year to date is 99.6%.

Fire alarm trends have been reviewed with the number of spurious fire alarms currently generated being considerably lower than the expected failure rate quoted in British Standard BS 5839-1:2013

Further training has been given in root cause analysis to both the SACI authors and to CARB members. This training has been successful in raising the quality of the SACI presented and the level and appropriateness of the Corrective Action Review Board (CARB) challenge. All SACIs produced since the OSART review have been conducted in line with these revised standards.

The offsite radiological survey function was successfully transitioned six months ahead of the original plan, all follow on actions have been closed.

On the dry fuel store all internal and external hold points have been satisfied, the first cask has been loaded and transported to its final storage position in the dry store building. The ion fork is in use.

The PFHM upgrade has been completed and the PSR priority observation closed.

Life extension proposals have been presented to the project board set up post OSART. The future investment requirement is under development and will commence in 2018.

Lessons learned from the dry fuel store and other long range project development is being considered by the PCS/DCS project, the next large project at Sizewell which will be implemented in outage 16.

The advantage of Portal monitors has been recognised and this is in the future investment plan and will be completed in 2018. This was discussed at the Station Performance Review Meeting and agreed as part of the station Excellence plan.

The PSR 2 action on Nuclear Baseline has been closed. The SZB baseline document has been revised and is now seen as the company best practice. The Sizewell HR Manager is the lead HR manager for Management of Change and Nuclear baseline.

The Work Management Manager post has been deleted from the structure and combined with the Maintenance Managers role.

There is currently one Group Head in an 'acting role' (nuclear safety group) and one 'acting' (human Resources) Manager. Recruitment for a new HR manager is in progress.

For station based INA personnel, there are no current vacancies (24 of 24 posts filled). The vacant SZB position has been filled. The new staff is currently at HNB undergoing his INA induction and initial training – he's due to start at SZB on 26/03/17. Currently one SZB INA position is filled with a secondee, with this secondment due to finish in Sept'17. Recruitment action is now starting to fill this position.

Actions have been taken to increase the focus on strategic items, and this was discussed at the last management away day.

In the business year after the OSART visit the business plan was changed to give a longer term focus (the SZBeyond 40) to draw attention to the life extension potential and the longer term aspects of plant life and Operation. This has been followed up by leader's alignment and leaders away days to discuss and align the organisation toward a longer operating life and what this means in terms of people and equipment. The same forums have also been used to discuss the CAP 2030 project and to develop an integrated business plan for 2017.

An outage performance improvement plan has been produced for multi cycle improvement activities to drive outage performance to higher levels; Benchmarking has been carried out internationally to develop the forward plans.

These efforts have seen improvements in people's engagement with and understanding of CAP 2030 and the stations future aspirations for life extension. The alignment of business plans will produce future improvements in terms of overall site performance and understanding of contributions toward reaching these targets.

IAEA comments:

The station has considered a full set of findings made during the original OSART mission and analysed the potential causes associated with the identified deficiencies. As a result of the investigation the station came up with the following apparent cause: ‘Short term planning rather than strategic focus’, supplemented by an unclear distribution of responsibilities for the longer term planning between the station and the Corporate organization. The station has developed and implemented an action plan aimed at fixing specific deviations as well as modifying the approach for the planning the station’s long term activities significant for safety. The vast majority of the specific deviations identified by the OSART team have been fixed and closed out via the station improvement plan. Examples of the station long term safety related activities involve the following: life time strategies, power up-rate feasibility, extended refuelling cycles feasibility, new construction at the site. The station has created an organization involving both the station and the corporate representatives for systematic planning, coordination and monitoring of activities under the projects. Responsibilities and accountabilities within the organisation, such as technical reviews, financial modelling, consideration of operating experience, supply chain and workforce matters are clearly defined and maintained during the course of projects execution. The station has demonstrated current tangible results and a progress under the projects achieved within the specified timeframes. The station has used the operating experience from the major projects to improve the strategic planning of other lower level projects; one example is the production of an integrated long term asset management plan. This plan ensures that investment in the materiel condition of plant is managed over the plant lifetime. Upgrades to plant consider the long term resilience of the systems, for example a software (WISCO) replacement has a lifetime support element included as part of the initial contract, and the replacement of cooling water pipe systems will be completed in high density polyethylene which is a solution that is viable to the end of the stations life. The plant also uses lessons learned from the past long range projects, such as dry fuel store, for the next safety related activities for the forthcoming outages. The Station has with the central organisation carried out a review of suitably qualified and experienced person (SQEP) and succession management as part of a periodic safety review (PSR2) response. The report concludes: The processes in place to manage workforce planning, succession and talent, and performance are judged to satisfactorily ensure the availability of adequate, qualified human resources and to maintain access to suitably qualified internal and external technical, maintenance and other specialised staff. From this review it appears that since the PSR2 review that management of those processes has improved, and that normal business is now appropriately managing SQEP and succession. In the Engineering department organisational changes have been carried out to increase the resilience of the organisation to future staff changes.

Conclusion: Issue resolved

1.4. DOCUMENT AND RECORDS MANAGEMENT

1.4(1) Issue: The station policy and processes do not ensure that station documents are always controlled in a consistent and compatible manner throughout the station.

During the mission the team observed deficiencies with respect to documentation revision control and use of uncontrolled documents. Shortfalls have been identified in several areas: corporate procedures applying to the plant, Operations' documentation, Emergency preparedness documentation, and RP documentation.

Corporate documentation applicable to the station:

71 corporate documents that apply to the station have not been reviewed within the 3 year period required by corporate policies.

Operations' documentation:

- POIs (Plant Operating Instructions), SOIs (Station Operating Instructions) and STOs (Surveillance Test Operations) are not all reviewed periodically and uncontrolled documents are available to Operations staff.
- The PSR2 review identified the following as one of the 44 priority observations: “Infrequently used Nuclear Safety related procedures are not periodically reviewed, except during their occasional use”. The following deviations were observed in the Auxiliary Shutdown Room (ASR):
 - Sizewell B Emergency plan drawing of the main buildings on the site is as of 1999. Buildings such as Spent Fuel Dry storage and Security staff buildings are not included.
 - About 9 folders with “Uncontrolled” station system drawings are available in the ASR. In one of the folders “controlled” and “uncontrolled” copies were found.

Emergency preparedness documentation:

Documents that are used for emergency response, but not controlled by Emergency Preparedness staff, are not consistently maintained and updated in a timely manner. Personnel from Operations, Maintenance, Technical Support, Radiation Protection and Chemistry add uncontrolled documents to reference binders to complement existing controlled documents at the Emergency Control Centre, the Technical Support Centre, the Strategic Coordination Centre, Muster Points and the Access Control Point. A total of 12 deficiencies were identified including existence of: old documents, incorrect revisions and uncontrolled documents, document with absence of date.

RP documentation:

2 types of radiation protection related procedures exist at the station (RWP – Radiological Work Permit- & Health Physics Instructions). These procedures are managed electronically and controlled copies exist in the offices, however the team noted the following:

- A hard copy of a small number of RWPs past their expiry date: in this case the version printed from AMS (Asset Management System) onto the WOC (Work Order Cards) showed that the version had expired and should not be used.

- HPCIs (Health Physics and Chemistry Instructions) still labelled with ‘British Energy’ masthead (HPCI SN153, SN162, SN164, SN176)
- White paper copies present instead of the expected ‘gold’ copy. (HPCI-SN330 & SN400).

Events involving documentation issues

Significant Events:

- On the 20th of November 2014, reactor cooling was changed from RHR train A to RHR train B. The requirement to analyse the stand by RHR train boron concentration within 3 hours prior to placing in service was not completed. The potential consequence is inadvertent dilution of the RCS affecting reactivity and shut down margin. Root cause: over reliance on Operator training and memory to identify the need for sampling and failure to incorporate adequate barriers within procedures to mitigate the risk.
- On the 18th July 2012 an automatic reactor trip occurred following MG set 2 return to service. Besides actions to improve equipment reliability, one of the actions taken by the plant to tackle the issue was to revise the POI SU02 to include specific checks of the state of the circuit breaker status relays 1X08/2X08 prior to synchronising either MG Set to the other.
- Additional events related with procedure root cause include Priority level 1 and 2 (4 events recorded between May 2013 and December 2014) and Priority level 3 and 4 (8 events recorded since October 2013).

Existence of uncontrolled document copies and inconsistent document revision policy may impact nuclear safety.

Suggestion: The station should consider improving its documentation policy and control to ensure that station documents are always controlled in a consistent and compatible manner throughout the station.

IAEA Bases:

NS-G-2.4

6.75. Documentation should be controlled in a consistent, compatible manner throughout the plant and the operating organization. This includes the preparation, change, review, approval, release and distribution of documentation. Lists and procedures for these functions should be prepared and controlled.

6.76. A records administration and documentation system should be established to ensure the appropriate keeping of all documents relevant to the safe and reliable operation of the plant, including design documents, commissioning documents, and documents relating to the operational history of the plant as well as general and specific procedures. Particular care should be taken in order that, although all versions of each document are appropriately filed and kept as a reference, only the correct, up to date versions are available to the site personnel for day to day activity.

Plant Response/Action:

A – Apparent Cause of Suggestion

The station policy and process are not robust enough to ensure that station documents are always controlled in a consistent and compatible manner throughout the station.

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

Personnel from Operations, Maintenance, Technical Support, Radiation Protection and Chemistry add uncontrolled documents to reference binders to complement existing controlled documents at the Emergency Control Centre, the Technical Support Centre, the Strategic Coordination Centre, Muster Point and Access Control Point.

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

B – Summary of action plan

Review of the station arrangements for Control of Documentation has been carried out and the following actions have been put in place to address this suggestion.

- Review of the arrangements for ensuring that corporate periodic reviews are conducted in accordance with agreed timescales.
- Review of the corporate procedure which describes Periodic Reviews to determine the scope and applicability of the Station Manual suite and agree a review methodology based on Safety significance, frequency of use and complexity.
- Review of the arrangements for control of Emergency Preparedness, Operations and Radiation Protection Documentation and agreement of a way forward.
- Removal of uncontrolled documents from reference binders associated with Auxiliary Shutdown Room, Emergency Control Centre, the Technical Support Centre, the Strategic Coordination Centre (Martlesham Heath), Muster Points and Access Control Points.
- Carry out frequent audit of Reference Binders in Auxiliary Shutdown Room, Emergency Control Centre, the Technical Support Centre, the Strategic Coordination Centre (Martlesham Heath), Muster Points and Access Control. This will examine the status of the documents in each of the areas and confirm compliance with revised local arrangements.

C- Action Plan Effectiveness Review

The arrangement for the management and control of corporate document periodic reviews via the accountability process is working well with overdue documents now in single figures. A more rigorous process has been put in place for ensuring that the corporate documents subject to periodic review are being controlled, reviewed and managed in accordance with the agreed timescales. This has been achieved by formalizing the forward looking plan and using the accountability process to ensure that the documents are prioritized and delivered. The status of the progress of the documents is regularly tracked and monitored.

Specific Operational documents for Normal Operation, Off-normal Operation and Emergency Operation are being reviewed during the Simulator scenarios performed in Initial and Continual Training programmes. These training programmes are discussed in “BEG/ICP/OPS/001 Management of operations at nuclear sites”. During the training specific reference is also made to “BEG/SPEC/OPS/036A Procedure use and Adherence” which

includes and describes the controls for reviewing and implementing Operational procedures. This graded approach to procedure review is based on Safety Significance, frequency of use and complexity.

POI's not reviewed during training programmes are evaluated prior to use as stipulated above.

STO's performed at power tend to be frequent use or fall into the category of IPTE (Infrequently Performed Test or Evolution) where procedure will be reviewed prior to use.

SOI's, POI's and STP's to be used during outage periods are identified and reviewed as necessary during the outage preparation phase for which there is a specific milestone to ensure completion.

The current policy is considered adequate to ensure Operations Personnel use current up to date procedures during operations on the plant. Where procedures have not been reviewed for some time this is covered by procedure use and adherence rules and categorization as IPTE operations where safety significant operations are to be performed.

This process is compliant with IAEA guidelines and also has been benchmarked with two US utilities.

Emergency preparedness documentation and RP documentation which was not being controlled satisfactorily has been removed and arrangements are in place to prevent re occurrence.

Some historic Controlled copy documents such as the Station Safety Report will remain in the BE branded files, however their revision control status will be maintained.

Removal of uncontrolled documents from reference binders associated with Auxiliary Shutdown Room, Emergency Control Centre, the Technical Support Centre, the Strategic Coordination Centre (Martlesham Heath), Muster Points and Access Control Points has been carried out. A meeting has been held with Operations, Emergency Preparedness, Document Centre and the Technical Safety Support Manager to agree a methodology for the overall control of documentation. This will be divided into three methods of control, namely Controlled Copies, Uncontrolled and Information.

The standards and expectations requirements for both Controlled, Uncontrolled, Informational copies will be given to all staff through Team Brief messages and these arrangements will be clarified and described by amending the SZB Local Document Control Procedure (SZB/MCP/003V).

A plan of audits has been developed to review the control of Emergency Preparedness, Operational and Radiation Protection documents. This will examine the status of the documents in each of the areas and confirm compliance with the revised local arrangements.

IAEA comments:

The station has reviewed the suggestion related to document management and control process via a gap analysis method and identified an apparent cause that involves clarification of station policy statements and procedures in the area of documentation control. An action plan has been developed and implemented to remedy the situation by fixing those contributors to the identified problem. The station has removed all the uncontrolled copies identified by the OSART team from the respective locations and a revision control process is in place. The

station has made arrangements with the corporate organization to establish clear accountability and monitoring for the revision of corporate documents applying at the station. The revision status of corporate procedures is available for the station at all times. Of the 71 outdated corporate procedures applying to the station that were identified during the original mission, only five are still pending revision. The station has made changes to the procedure for documentation revision management and control and has also provided intensive personnel awareness team briefs throughout the station departments and groups on the change. In addition 2 monthly audits are planned and conducted by the station quality assurance group to monitor the station documentation status. Additionally an annual QA audit has been planned on the Subject of Document Management and Control. The station has demonstrated significant improvements in the area of documentation management and revision control. Recent evaluations show that minor deviations in this area have been noted.

However the station policy and process for revising POIs (Plant operating instructions), SOIs (Station operating instructions), and STOs (Surveillance operating instructions) is still not clear. Corporate and station document control procedures state that POIs, SOIs and STOs are not subject to periodic review. However, some procedures occasionally may be identified as “need to be reviewed” during the shift staff training at the simulator and /or prior to the use at the point of work. There is formal station guidance (issued in April 2015) for reviewing the operational and maintenance procedures that defines an extensive set of criteria to be used when reviewing such procedures. However there is no evidence and record that those criteria are used by reviewers when carrying out reviews. The station would find it beneficial to apply this guidance systematically to the review process, and this should be based on the station graded approach.

Conclusion: Satisfactory progress to date

1.9. SAFETY CULTURE

1.9(a) Good practice: Daily Safety Message and Station Status Brief

All work groups, including contractors, start the day with a common brief, to ensure fitness for duty and an understanding of station status and priorities. A common daily safety message is also discussed.

This is a two or three stage process. The station management team hold their brief, using information from the Operations Shift Manager's log. The brief includes station status and also the operational priorities set by the Shift Manger. Daily condition reports and other new OPEX are considered. There is discussion of the daily safety message, which is used at all locations (power stations and headquarters) in the Nuclear Generation organisation. The managers then cascade this brief to all their workers in one or two further stages. These briefings also include a check that everyone is fit for work.

Once this has been completed each supervisor continues with setting his team member(s) to work (Setting to Work) by ensuring they are SQEP (Suitably Qualified and Experienced), that they have the correct documentation, and that they have received an appropriate Pre-Job Brief.

The Pre-Job Brief is specific to the task, where the supervisor and team members discuss error likely situations, safety concerns, critical steps, previous operating experience, and the use of error prevention tools to control any identified issues.

Because of the daily safety message, staff has a good awareness of a wide range of safety requirements. The start of day brief also allows workers to mention any concerns they have regarding their fitness for their work. The use of the station log and condition reports allows all workers to know the state of the station, the key priorities all work groups must respect and any immediate OPEX.

2. TRAINING AND QUALIFICATION

2.2. QUALIFICATION AND TRAINING OF PERSONNEL

The station has included Nuclear Safety Engineers as Subject Matter Experts in Training sessions for Operations Main Control Room (MCR) staff, when applicable. The benefit of including Nuclear Safety Engineers as subject matter experts is to improve the MCR staff understanding of fault progression, and to act as the station safety case expert. The team has identified this as good performance.

A Desktop Simulator written in Visual Basic for Microsoft Excel is available for all Station personnel. The key use for the package is in familiarizing new starters/graduates with the main station systems and behaviour of the station in both automatic and manual modes. The team has identified this desktop simulator and its application as a good practice.

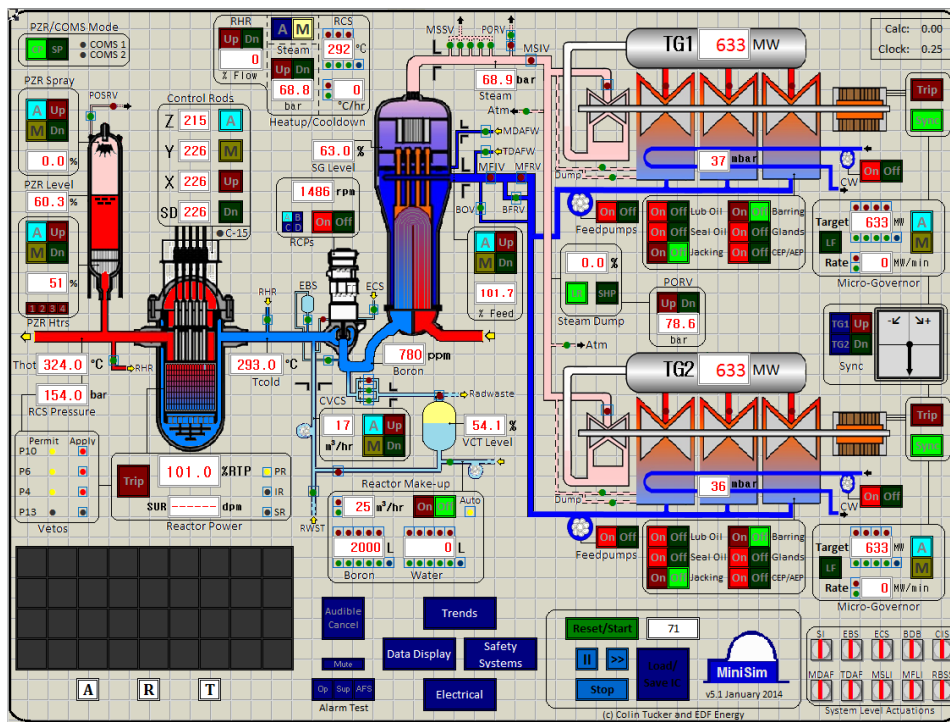
The training facilities at the station reflect a strong commitment to high quality training. The station uses an off-site “Excellence Centre” Training facility that allows staff to be trained and then assessed in a safe, yet realistic station-like training environment. The learning environment of this facility has enabled learners to walk away from their training session with new and/or reinforced skills, knowledge and behaviours which they can transfer to their station work environment. The team recognizes the learning methods utilized at this facility as a good performance.

DETAILED TRAINING AND QUALIFICATION FINDINGS

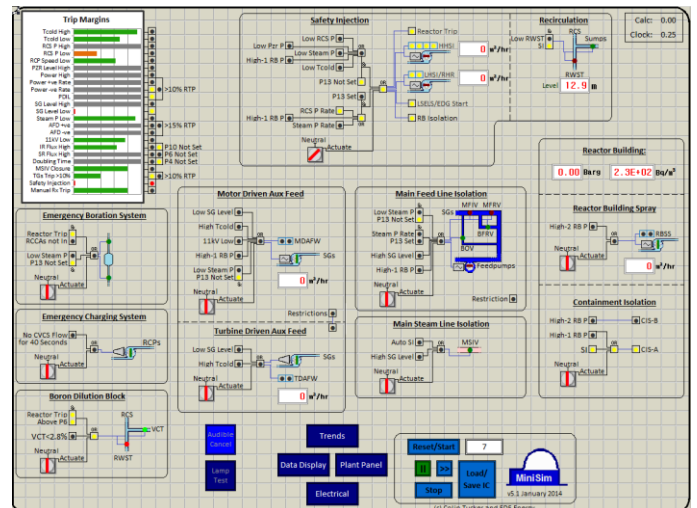
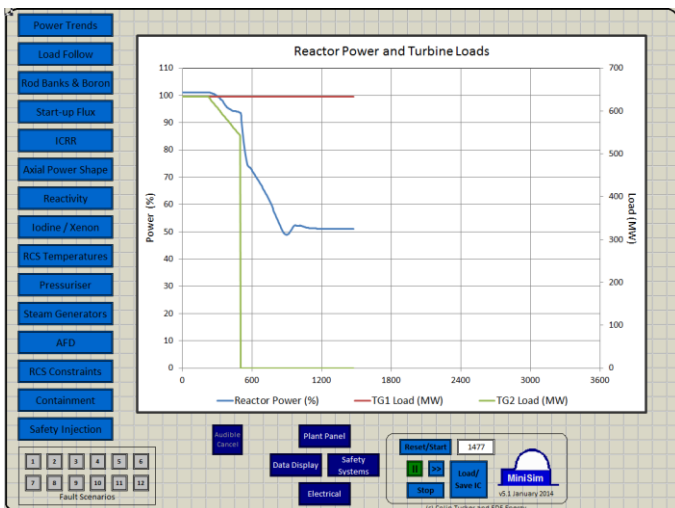
2.2. QUALIFICATION AND TRAINING OF PERSONNEL

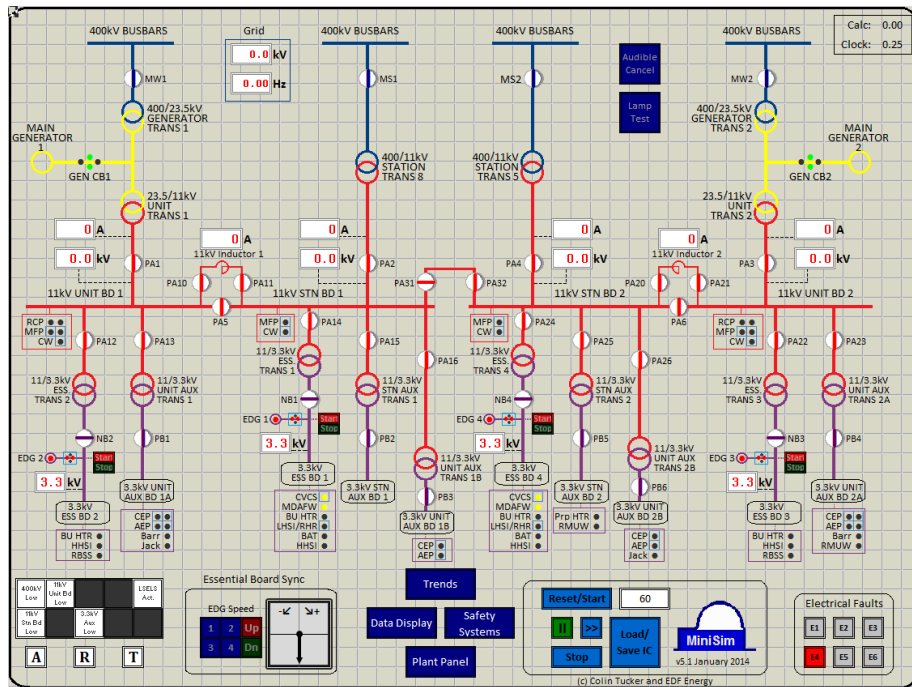
2.2(a) Good Practice: Desktop Simulator written in Visual Basic for Microsoft Excel is available for all Station personnel.

MiniSim provides a *Sizewell-specific desktop simulator* for use in introducing the principles of PWR operations. Unlike other such packages, it is written in *Visual Basic for Microsoft Excel* and so can be easily copied and run on any computer at work or at home.



It has developed in response to requests from trainers and it can be easily adapted as future requests or training needs arise. Detailed instructions are included, together with Station Operating Instructions for station start-up and power-raising, station cool-down/heat-up, post-trip actions load-follow operations.





The key use for the package is in introducing new starters/graduates to the main station systems and to the behaviour of the station in both automatic and manual modes. The package includes modelling of Safety and Electrical Systems and covers a range of fault scenarios (e.g. station blackout, small LOCAs etc.) in addition to normal station operations.

Its use is formally included within the Mentor Guides for Nuclear Safety Group Graduate Attachments.

A second 'Generic' version of MiniSim (a single Turbine model, which can be run in French or English) has been cleared for wider distribution and is in use at a number of UK universities.

3. OPERATIONS

3.3. OPERATING RULES AND PROCEDURES

Team observed that periodic review of control room and field operator procedures for the Station Operating Instructions (SOI) and Plant Operating Instructions (POI) categories is not required by the station policy. The team has found some procedures that have not been reviewed for several years. In addition, some operator aids, throughout the station, are not controlled. The use of uncontrolled operator procedures and aids may compromise station safety. The team made a recommendation in this area.

3.4. CONDUCT OF OPERATIONS

Routine field operator rounds do not always provide for consistent, timely identification and reporting of deficiencies to ensure they can be effectively addressed in a timely manner. The station has an action plan to improve operator rounds, however the effectiveness of this plan is not yet demonstrated and therefore the team suggests reinforcing station expectations in respect of field operator rounds.

3.5. WORK CONTROL

The station developed a system of colour coded symbols for identifying electrical panels on switchboards for each circuit. The use of this system provides a good and simple human error preventive tool and the team considers it as a good practice.

The team also identified good performance in the usage of different coloured defect tags for each fuel cycle so the defects from previous fuel cycles can be easily identified.

3.6. FIRE PREVENTION AND PROTECTION PROGRAMME

The station has in place a system for ensuring fire safety. However, the team observed weakness in fire protection equipment reliability, control of combustible materials and fire team drills. The team suggested that the station consider improving its arrangements for ensuring fire safety.

3.7. CONTROL OF PLANT CONFIGURATION

The team observed some deviations from configuration control policy.

The team encourages the station to assess these deviations to fully understand the potential consequences to safety and to improve station configuration control practices.

DETAILED OPERATIONS FINDINGS

3.3. OPERATING RULES AND PROCEDURES

3.3(1) Issue: 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.

The following observations were made.

Procedures:

- A review of the list of procedures updated within the last 30 days showed that many hardcopy procedures in the Main Control Room had not been updated in a timely fashion.
- The Auxiliary Shutdown Room Procedure SOI-7-4-1 references Procedure SOI-8-8. However, there was no paper copy of Procedure SOI-8-8 available in the Auxiliary Shutdown Room.
- Operating instructions on Panel 1AE-PNL-0061 are not controlled as required by the station's policies.
- Procedure SOI 7.1 was added to the procedures SOI 8.1 and SOI 8.2 folder in 2008; however, this inclusion was marked just by a yellow sticker on the folder. There is no clear indication as to why SOI 7.1 was placed in the SOI 8.1 and SOI 8.2 folder.
- Procedures listed below had not been updated to the current version in the Operator Plant Office:
 - Turbine Trip actions – SOI 5.4.1 rev. 028. The newest version is rev. 030.
 - Loss of Ultimate Heat Sink – SOI 5.4.3 rev. 015. The newest version is rev. 017.
 - Loss of grid 11KV – SOI 6.6 rev. 017. The newest version is rev. 019.
- Folder with “Conduct of Operations” procedures is not under the document control system and does not get updated. All procedures in the folder are from the time of British Energy. These are uncontrolled copies.
- A section of STO RL 008 Procedure rev. 8 used for training was found on a cork board in the Full Scope Simulator room. The newest version is rev. 18.
- Procedures at the Full Scope Simulator (and in the Main Control Room as well) are in disorder, have different folders and font sizes. The whole arrangement is not optimized for human performance.

Operator aids:

- In Main Feed Water Room East (R1412) there is an unauthorized operator aid (uncontrolled handwritten information) on valve 1AB-HV0290.
- In the field operators' office in the Turbine Hall, there is a Contingency Plan sheet for handling a red phase leak on the General Transformer. This sheet has unauthorized hand-written advice. The MCR staff has not been aware on how to deal with that written advice. A drawing dating back to 1988 was found on the wall of the field operator's office in the Turbine Hall. There was no evidence that it was approved, controlled, current, and valid for operations. This drawing is

available in the computer system. Two operators stated that if this version of the drawing is available in the computer system, it means it is valid.

- In staircase 4104 of the Auxiliary Building, the three floor plan drawings show no evidence of revision and are not controlled copies.
- In the Pump House, at ground level, eight uncontrolled floor plan drawings dating back to “British Energy” are hung below waist level and are not easy to read.
- At the entrance of the Radiation Controlled Area, in corridor 1560, three large floor plan drawings have no stamps or other evidence of being controlled.
- Drawing SZB-AP-S38101/11 in the Main Control Room was not controlled or updated.
- Operator aid number 98/63/AD was dated from 10/11/98.
- On the wall of the field operator office, a RCS/SIS drawing dated from 25/11/1993 was found. There is a stamp on it saying that it is an uncontrolled copy and “VALID ONLY AT TIME OF ISSUE”.
- Operator aid (a label of recommended set points) not controlled was found on panel 1AC-PNL 3382.

Other (procedures and aids application):

- Shift technician used a Return to Service Sheet printed from the computer system as a reference. It contains verification steps (Y/N), dates, signature spaces which were not filled in.
- Five Return to Service Forms were randomly checked by the team. There are no common requirements on how to fill them in and apply them. Inconsistencies were observed in how the forms were filled.
- The Main Feed Water Pump 2B panel 1AE-PNL 0030 has a paper copy of uncontrolled documents attached to it.
- The station has experienced significant events caused by inadequate operating procedures in the past.

The use of uncontrolled operator procedures and operator aids compromises station safety as these items are not subject to document control and can thus result in human errors.

Recommendation: The station should enhance its policy and practices with regard to handling and use of operating procedures and operator aids to ensure that current and correct documents are used by operators.

IAEA Bases:

SSR-2/2

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.”

7.6. “A clear operating policy shall be maintained to minimize the use of, and reliance on, temporary operator aids. Where appropriate, temporary operator aids shall be made into permanent plant features or shall be incorporated into plant procedures.”

NS-G-2.14

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

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

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

- The types of operator aid that may be in use at the plant;
- The competent authority for reviewing and approving operator aids prior to their use;
- Verification that operator aids include the latest valid information.”

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

- An audit of plant and control rooms has been performed to remove uncontrolled documents and un-authorized operator aids.
- The specific observations have been walked down and resolved.
- A yearly routine has been established to audit the plant and control rooms for uncontrolled documents and un-authorized operator aids.
- The quarterly routine to audit existing operator aids as per BEG/SPEC/OPS/049 has been confirmed as active.
- A common standard for completing return to service sheets has been established.
- Standards and expectations for filing new controlled documents have been reinforced.
- Establish colour coded SOI files in the MCR and simulator, this action is ongoing.

C - Action plan effectiveness review

The action plan has addressed the shortfalls identified by removing un-authorized operator aids, validating authorized ones, removing un-controlled documents and setting standards and expectations for the management of controlled documents. This has been done via a combination of coaching discussion and material at the weekly leaders brief.

Substandard operating conditions have been challenged aggressively via the shift managers log to drive down the number of operator distractions (Control Room Alarms and Defects). Often these defects include operational aids or defect tags on plant to instruct of the defect and necessitate alternative actions. Excellent ownership of these areas has been demonstrated by maintenance teams to ensure reduction.

A review of the current plant state has been conducted and some low level issues have been identified. In each case these have been addressed with area owners to re-inforce correct standards.

The new AMS routine will audit the required standards, insufficient evidence is available to assess the effectiveness of this area.

The return to service process has been enhanced and included in the WEC/Safety Document office start of shift brief.

The new routine will provide the basis to demonstrate the effectiveness of the actions placed.

IAEA comments:

The station has analysed an issue related to standards and expectations for compliance with company procedures and developed an action plan focused primarily on the station personnel behaviours. These actions involve the following:

- A yearly routine to audit the station and control rooms for uncontrolled documents and un-authorized operator aids
- The station tours expectations training has been delivered to all operations staff
- Directed reading issued (8/3/17) to set out the standards and expectation for management of Operator Aids and uncontrolled document to all Operations staff.

- Colour coded SOI / POI files established in the MCR to enhance the material condition and improve the human factors interface.
- Formal Operations Lead Team meetings have been established on a quarterly basis (3 held to date) to align the shift teams to drive the standards and expectations and department improvements.

All those arrangements have resulted in reduction of the number of un-authorized Operator aids and un-controlled documents at the station. The operational document review process resulted in 240 Operations documents being updated in 2017 to date, 917 documents in 2016 compared with 124 documents in 2015.

However during the tours at the station the team has found some shortfalls related to procedures management and handling. These are as follows:

- An out of date non-operational company document specifying report writing was found in the Team Leader's office for information use only. The expectation when using or making reference to procedures is the user will check the electronic document control system that the document revision remains valid or print off a new document. Procedures should be destroyed after use.
- A closed Operator Aid was hand amended with the Work Order Card number that closed the issue, the completed Operator Aid was not removed from the active section. Closed operator aid was not removed from the file.
- AN-PNL0001 unauthorised hand written information on panel (lamp bulb sizes). Information has now been removed.
- In the field operators room folder #21 contains POIGT04 procedure. It was 'gold' copy and all pages should be yellow, however there is a white page – with unstamped validation list dated 1997.
- The drawing in the Fire Fighting Pump House on the wall was not a part of document suite '337' Fire Risk Assessment Drawings (FRAD). It was SXB system drawing from construction. After discovering during the Follow-up mission it was replaced with on a new one by the responsible owner.

Conclusion: Satisfactory progress to date.

3.4. CONDUCT OF OPERATIONS

3.4(1) Issue: The station operational practices do not always provide a consistent approach to identifying and reporting deficiencies in the field in a timely manner.

The following observations were made.

Control Room operations:

- The deficiency tag on a disconnecter (WOC 08471145) on the MCR electrical panel was hung in 2007 with a projected resolution in 2017.
- The Control Room Alarms (CRA)/Control Room Defects (CRD) tracking sheet lists 11 MCR defects. However, there are 19 defect tags on the panel: 4 are marked as CRD, 3 as CRA and 11 not marked as either.

Shift routines and operating practices:

- There is a 15cm by 15 cm oil spot on the Emergency Charging pump 1FC-K03B. Contractor cleaners noted the leak 3 weeks ago but field operators have not identified or hung a deficiency tag.
- On the Motor Driven Auxiliary pump, a local indicator of motor end bearing oil temperature indicates “0”. However, the digital panel displays 27o C. This deficiency has not been tagged.
- There is a 30 cm² oil spot under HHSI pump 1EM-D-P01C. No deficiency tag issued. A field operator toured the area the night before.
- Six oil pressure meters (gauges) on the Safety Injection Pump have unauthorized hand- written values. The escorting manager stated that this marked information is not correct. However the marking has not been removed.
- On TG-1 1AF-T01-1 is a small oil leak not identified or reported.
- The gauge “Condenser extraction pump 2B water seal” is defective, but has no tag. After the team alerted station management, operators were told to identify the deficiency and hang a tag.
- There is a 4cm x 4cm oil leak beneath the bearing of component Cooling Water Pump “A”. The leak was not tagged and reported.
- A deficiency tag dated April 2009, indicated a transmitter deficiency with replacement required. Work order 10003524158. A field operator was coaching a new operator while performing a detailed tour. He did not notice several deficiencies: scaffolds in the Room 3720 not installed on metal toes, more than 10 lighting bulbs blown, storage of combustible packages and wooden bricks in Room 3723, and pipe metal separators after repair of the equipment.
- Numerous penetrations (over 10) still have temporary labels dating back to the construction phase (one is dated 1991). These are not addressed by operators as deficiencies.
- One “green” bulb is blown on the Pump House electrical panel 1EA-PNL0009.
- Pump House (ground level) local control panels 1DC-PNL0011 and 1DC-PNL0003 have actuated alarm lights. That signal to 1DC-PNL0003 is initiated by trace heating 1Q-PNL0043 and then goes to the Control Room. The deficiency is in the database, but neither a Work Request nor a deficiency tag has been issued.

Failure to identify and report deficiencies in a timely manner may result in equipment inoperability.

Suggestion: The station should consider enhancing operating practices to ensure that deficiencies in the field are identified and reported in a timely manner.

IAEA Bases:

NS-G-2.14

4.34. "Rounds should be conducted regularly by the operators to identify actual and potential equipment problems and conditions that could affect the functioning of the equipment. The frequency of equipment inspections should be determined on the basis of the safety significance of the possible failure of the item of equipment, and it should be adjusted when operating conditions or maintenance conditions change. Particular attention should be given to remote areas of the plant and items of equipment that are difficult to access."

4.35. "Personnel assigned the task of carrying out rounds should be made responsible for verifying that operating equipment and standby equipment operate within normal parameters. They should take note of equipment that is deteriorating and of factors affecting environmental conditions, such as water and oil leaks, burned out light bulbs and changes in building temperature or the cleanness of the air. Any problems noted with equipment should be promptly communicated to the control room personnel and corrective action should be initiated."

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;
- The operability and calibration status of measurement and recording devices and alarms on local panels throughout the plant, and their readiness for actuating or recording;
- The proper authorization for, and the condition and labelling of, temporary modifications in the field (e.g. the presence of blind flanges⁹, temporary hoses, jumpers and lifted leads in the back panels);
- Indications of deviations from good housekeeping, for example the condition of components, sumps, thermal insulation and painting, obstructions, posting of signs and directions in rooms, posting of routes and lighting, and posting and status of doors;
- Deviations from the rules for working in safety related areas such as those relating to welding, the wearing of individual means of protection, radiation work permits or other matters of radiation safety or industrial safety;
- 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 fluid¹⁰, hazardous equipment and trip hazards;
- Deviations in other installed safety protection devices, such as flooding protection, seismic constraints and unsecured components that might be inadvertently moved."

4.37. "Operators should assume that instrument readings are accurate unless proven otherwise. Ignoring an unusual reading can lead to abnormal conditions going undetected."

4.42. “The shift supervisor and control room operators, when properly relieved or not on shift, should spend some time walking through the plant and observing field operators carrying out their activities. These observations should be appropriately documented and, when necessary, corrective actions should be developed, prioritized and tracked. Best practices include documenting minimum requirements as a basis for written field observations.”

7.34. “The shift supervisor and the operations manager should conduct periodic walkdowns in the plant to observe the tagging process and the process for bringing equipment back into service, and in particular the process for filling and venting a drained system or component in a manner that ensures the industrial safety of field operators. If supervisors detect any non-compliance with the relevant industrial safety standards, it should be corrected immediately and communicated in accordance with established procedure for the feedback of operational experience.”

NS-G-2.4

6.33. “The shift crew should perform regular rounds through the plant. The shift supervisor or authorized staff should also walk through the plant periodically

Plant Response/Action:

A – Apparent Cause of Suggestion

The station operational practices do not always provide a consistent approach to identifying and reporting deficiencies in the field in a timely manner.

- Plant tours operational standards are not clear
- Operators have become tolerant to poor material conditions on the plant
- Plant tours procedures do not provide the required level of detail to support best practice plant tours
- Operations and station supervisory oversight of the plant tours does not identify and correct poor operational practices

Operator Filed Tour procedures did not contain the Standards expected of Field Operators whilst performing Plant Tours.

Causal Code - **MS1a** - Management Systems, Standards, Policies, or Admin Control (SPAC), No SPAC

Operators performing field Operator Tours are unaware of the ‘Standards and Expectations’ required to perform the tour with the correct level of detail.

Causal Code – **WD1c** - Work Direction, Preparation, Pre-job briefing

Field Operators performing the area tours were not being observed by Operations Leaders to ensure that tours were being completed to the correct standard.

Causal Code – **WD3a** - Work Direction, Supervision during work, No Supervision

B – Summary of action plan

1. Operational standards for plant tours has been clarified

2. Training to operations personnel on plant tours standards and expectations has been provided
3. The priority and importance given to plant tours has been improved
4. The supervisory oversight of plant tours is being enhanced.
5. The plant tour procedures are being enhanced and re-issued.
6. A cross-site plant tours working group has been set up with Operations input.
7. The logging and reporting of the findings from plant tours has been improved.

The above actions have rectified this suggestion. We are also implementing the following further improvements to meet the world standard of excellence.

8. Auto tour with handheld computers are being implemented.

C - Action plan effectiveness review

1. A new departmental instruction has been issued to bring together the standards and expectations for plant tours SZB/PDDI/047
2. All operations staff have been given training on the importance of plant tours and the priority that shall be given to them as part of continuing training. This is to be included in future continuing training to ensure it remains embedded.
3. The high priority given to tours is being consistently set at the start of each duty shift. The 'golden time' concept for plant tours has become embedded.
4. Plant tours observations are being actively monitored and reported by the department lead team. This has supported a general increase in the plant tours observations carried out. The departmental instruction for plant tours now includes guidance on the conduct of observations on plant tours.
5. Of the four main operational plant area tours procedures one has been revised and re-issued to the enhanced standard and one has been revised and is currently on review prior to issue. The remaining two plant tour procedures are in the process of being reviewed with a planned completion in accordance with the station improvement plan. The responsibility for the revision of the plant tours procedures has been spread across four of the shift teams to optimise the completion of the enhancements.
6. The plant tours working group is now in place with the station actively participating in this process. The station is seeking a lead role in the deployment of new hardware and software for auto-tour completion.
7. The findings of plant tours have been incorporated into the formal station log and are reviewed each shift. This has led to greater reporting of finding from the plant tour and supports greater focus on the completion and supervision of the plant tours.
8. Hand held computers are now used for all detailed plant tours, primarily to provide the operators with up to date information on active work requests and defects. One of the four major plant tours has been transferred onto Autotour, which provides the plant tour procedure and all the required technical information to allow the operator to confirm operational plant status from the plant. The further deployment of electronic

plant tours is part of the station improvement plan. The station is actively seeking to acquire the latest supported hand held computers and software to allow further deployment of Autotour.

IAEA comments:

In response to the recommendation made by the OSART team during the original mission, the station has made efforts to identify causes of the issue. Causal factors identified by the station include some gaps in Management System, Station standards, policies and performance. Operational practices for identifying and resolving deficiencies have not provided a consistent approach to identifying and reporting deficiencies in the field in a timely manner. Operators performing field operator tours were unaware of the 'Standards and Expectations' required performing the tour with the correct level of detail. The station has adopted a strategy and a method for resolving the issue and imposed an action plan that was routinely monitored and regularly evaluated:

- A new departmental instruction has been issued to bring together the standards and expectations for plant tours. It includes guidance on the conduct of observations on plant tours.
- The high priority given to the tours is being consistently set at the start of each duty shift.
- Station tours observations are being actively monitored and reported by the department lead team. This has supported a general increase in the station tours observations carried out.
- Findings of the station tours have been incorporated into the formal station log and are reviewed each shift. This has led to greater reporting rate of findings from the station tours and supports better focus on the completion and supervision of the station tours.

However, some of the activities are not finished yet. The importance of the station tours and the priority that shall be given to this activity as part of operations staff continuing training is to be included in future continuing training.

Several operational station area tours procedures need to be revised and/or re-issued to the enhanced standard.

Additionally several deficiencies in the field were noticed during the station tour:

- Vertical ladder in the cooling water pump house was damaged and had no deficiency tag on the damaged step
- A vibration sensor on a Main Feed Water Pump was damaged but not identified by a deficiency tag.
- Control valve 1AE-FCV2864 near the Main Feed Water Pump was leaking. It has not been identified with a deficiency tag. An escorting operations manager issued a tag and fixed it to the valve.
- In the feed pump bay (level – 1m) under a Main Feed Water Pump there was an oil spot of about 500 cm². The deficiency was not identified by a deficiency tag. The escorting operations manager fixed a tag. In an interview the manager stated that field operators were expected to clean the equipment but there are no specific criteria related to leakage size to be reported.

Conclusion: Satisfactory progress to date

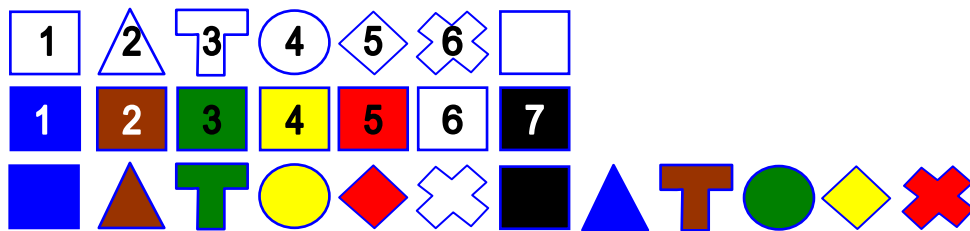
3.5. WORK CONTROL

3.5(a) Good Practice: Colour coded symbols for identifying electrical panels on switchboards.

A system for identifying electrical panels on switch boards uses a shape/colour recognition symbol for each circuit. All the related doors and covers for each circuit are given a symbol that is different from neighbouring circuits. There are six shapes that are repeated in order. There are also seven colours that are repeated in order so that the first circuit is a blue square, on the seventh circuit the square is repeated but the colour is black. The next time the square is repeated it is a white square. Using this system the blue square is repeated every forty two circuits. Most switch boards have less than forty-two circuits. On the few occasions where are more than forty-two circuits, they will be so far apart that it should be obvious that they are different circuits. The colour shape recognition symbols use six shapes and seven colours to produce 42 different symbols.

These coloured shapes are used in secured communication, especially when people are working at the front and the back of the cubicle at the same time, insuring they are working on the same components, avoiding a mismatch.

Picture of colour coded symbols





3.6. FIRE PREVENTION AND PROTECTION PROGRAMME

3.6(1) Issue: The station arrangements for fire protection are not robust enough to always ensure the reliability of fire protection equipment, control of combustible materials and adequate fire team drills.

The following observations were made.

Fire protection equipment:

- Valve lock devices are not properly applied. Deluge valves can be closed without opening the lockers or breaking seals. The following areas were verified with deficiencies:
 - Essential Diesel Generator 2
 - Main transformer 1;
 - Essential Transformer 4;
 - Turbine building -0.20m;
 - Aux. Transformer 1A;
 - Aux. Transformer 1B;
- TG-1 extinguisher DP 258 had been tested (confirmed by the station documentation) but the signature on the extinguisher itself had been omitted.
- Fire door 1005 electric drive mechanism was found deficient and without a defect tag.
- Fire door D1341/42 has required a new ram seal since 12/11/2014, and had a defect tag dating back to 07/08/2015. Fire door 6103 (Fuel pond heat exchange room) was found open.
- Damaged fire system air release nozzles on TG-2, TG-1 and main feedwater pump 2B.
- Fire door 4557/4146 lock was broken. There was no defect tag. The door is located in front of Operations Plant Office (room 4573).
- Fire door 1019 (Safety Injection Pump C) DT 11105100417 dated from 28/11/2014. Oil leak on hydraulic cylinder that closes the door.
- Fire door 1020 (Containment Spray Pump B) DT 11105002029 dated from 04/06/2014. Local alarm not working.
- Fire pump 1 deficiency on oil system identified on 7th of October was repaired. Return to service test identified excessive gland seal leakage on 11th of October (WO01735737) compromising reliability.

Combustible material storage:

- An “Authorization for use of site/plant areas for storage/accommodation” number 241 dated from 02/07/2009 was found in turbine building at access door to turbine oil tank. The form is not updated according to the current procedure.
- Turbine building - Room 4194 elev. -0,20m: 4 containers (6x3x2,5m each) are stored below electrical cable rails containing class A fire materials (cleaning materials, hoses, solvent, paper box, plastic reservoirs, wood).

Firefighting drills:

- Fire exercise drill has not been performed since 2012 with the external fire brigade, and records are not available for this exercise.
- In the last ten years fire exercises involving External Brigade were performed in 2006, 2007, 2011 and 2012. However, records are not available to support effective evaluation of the results and overall adequacy of the firefighting exercises.

The station has experienced several events in the past:

- An event involving fire protection equipment that resulted in a loss of automatic fire suppression in two areas.
- An event that resulted in fire in a temporary sampling installation at the cooling water forebay.

Without appropriate arrangements related to fire prevention and protection the station safety may be compromised.

Suggestion: The station should consider enhancing its arrangements in respect of fire protection equipment, control of combustible materials and adequate fire team drills.

IAEA Bases:

SSR-2/2

5.21. “The arrangements for ensuring fire safety made by the operating organization shall cover the following: adequate management for fire safety; preventing fires from starting; detecting and extinguishing quickly any fires that do start; preventing the spread of those fires that have not been extinguished...”

5.24. “The operating organization shall be responsible for ensuring that appropriate procedures are in place for effectively coordinating and cooperating with all firefighting services involved. Periodic joint fire drills and exercises shall be conducted to assess the effectiveness of the fire response capability.”

NS-G-2.1

2.20. “Regular fire exercises should be held to ensure that staff have a proper understanding of their responsibilities in the event of a fire. Records should be maintained of all exercises and of the lessons to be learned from them. Full consultation and liaison should be maintained with any off-site organizations that have responsibilities in relation to fire fighting.”

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

6.3. “The total fire load due to combustible materials in each area identified as important to safety should be maintained as low as reasonably practicable...”

6.6. “Administrative procedures should be established and implemented to provide effective control of temporary fire loads in areas identified as important to safety during maintenance and modification activities...”

7.1. “A comprehensive programme should be established and implemented to perform appropriate inspection, maintenance and testing of all fire protection measures (passive and

active, including manual firefighting equipment) specified as important to safety...”

7.2. “The inspection, maintenance and testing programme should cover the following fire protection measures: passive fire rated compartment barriers and structural components of buildings, including the seals of barrier penetrations; fire barrier closures such as fire doors and fire dampers...”

10.1. “Fire protection features are not generally classified as safety systems and thus they may not be subject to the rigorous qualification requirements and the associated quality assurance programme applied to safety systems. However, fire has the potential to give rise to common cause failure and thus to pose a threat to safety, and therefore the installed active and passive fire protection measures should be considered safety related. An appropriate level of quality assurance should therefore be applied to fire protection features.”

NS-G-2.6

8.33. “Plant management should make administrative arrangements to ensure that the storage facility is operated in a manner that preserves the proper environmental conditions, guards against fire hazards and prevents unauthorized access to stored items...”

8.34. “The administrative arrangements should include written procedures assigning the responsibility for regularly examining stored items and auditing the administration of stores in order to detect any deterioration or any unauthorized or unrecorded use of stored items. Particular attention should be paid to retention of the original identification of items during storage.”

NS-G-2.8

4.28. “All personnel who have specific duties in an emergency should be given continuing training in the performance of these duties. Firefighting drills should be included in the continuing training programme for plant personnel who are assigned responsibilities for firefighting.

Plant Response/Action:

A – Apparent Cause of Suggestion

The apparent cause of the recommendation was threefold:

1. An accumulation of identified defects, some of which were longstanding

Causal Code - **WD1e** - Work Direction, Preparation, Scheduling needs improvement.

2. Examples of storage not complying with current station arrangements.

Causal Code – **HE2a** - Human Engineering, Work Environment, Housekeeping.

3. A lack of clarity from EDF Energy regarding standards and frequency of training for site fire teams.

Causal Code – **TR1a** - Training, No Training, Task not analyzed

B – Summary of action plan

1.
 - Fire system valve locking arrangements have been reviewed to ensure that no valves can be opened without either removing the lock or breaking the plastic

chain.

- MFP suppression air release valves have been inspected to ensure that the frangible bulb assemblies are undamaged and installed as expected.
- 2.
- A site excellence lead has been appointed.
 - Area owners for all plant areas have been appointed.
- 3.
- A simple fire team exercise assessment template for use during exercises has been produced and issued.
 - Company fire team arrangements are being reviewed to establish the minimum standards required – An external body is undertaking a review of SZB and fleet fire team requirements. The outcome of their report is due in March 2017. Fire team training arrangements will then be reviewed to ensure that we are training and exercising all site fire teams in line with expected standards.

C - Action plan effectiveness review

- 1.
- All site fire skid valves that are required to be locked shut have been checked and signed off by Operations to ensure that they are in the correct configuration as per station SOI-15.6. No further issues identified.
 - The fire system engineer has undertaken a random 10% sample of all site fire suppression system frangible bulbs and found no issues.
- 2.
- 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 Planned general Inspections (PGI's)
- 3.
- Fire team evaluation sheet produced, approved and being used to assess fire team drills.
 - Review of site fire team arrangements underway. The success of this action will become clear in due course.

In addition to the above evidence of effectiveness of actions placed the condition of the site is supported by feedback from the December 2016 WANO follow up review. Improvements in arrangements involving storage of combustible materials, laydown control and defect backlog totals were all positive.

The fire safety focus index has continued to steadily improve since the Oct '16 review. The total at the end of Sept 2016 was 71% and is currently (end of Feb '17) at 76% showing an improvement of 5%.

The number of reported issues regarding plant storage has continued to trend steadily upwards and the level of tolerance to issues has decreased, indicating that personnel are thinking about fire safety, and the reporting culture on site is healthy. At the time of the initial

review the number of reported fire related issues from general staff was 52. In Q3 2016 this figure was 55 indicating a steady increase in reporting.

The number of oil leaks has reduced by 13 from 61 to 48 and the station now fire risk assess 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.

Rectification of an issue with obsolescence of fire door closers has eliminated the longstanding issue with power operated closers. EC no: 350024 rectified obsolescence issue with power operated door rams.

33 fire pre-plans have been issued and approved to support fire teams in dealing with a fire event in non-nuclear significant areas of high risk. These plans have been reviewed by site fire teams and Suffolk fire and rescue service who are supportive and see them as a good practice.

IAEA comments:

In response to the suggestion made by the OSART team during the original mission, the plant has made efforts to identify causes of the issue and developed corrective actions plan that is routinely monitored and regularly evaluated for efficiency. This resulted in the following improvements:

- All site fire skid valves that are required to be locked shut have been checked and signed off by Operations to ensure that they are in the correct configuration as per station SOI-15.6. No further issues identified.
- A Site excellence lead has been appointed and drives improvements across site.
- Area owners have been identified for all areas and are held accountable for findings in their areas.
- Fire team evaluation sheet was produced, approved and is being used to assess fire team drills. Fire team exercises are conducted on regular basis.
- Rectification of an issue with obsolescence of fire door closers has eliminated the longstanding issue with power operated fire doors.
- 33 fire pre-plans have been issued and approved to support fire teams in dealing with a fire event in non-nuclear significant high risk areas.
- The fire safety focus index has continued to steadily improve since the Oct '16 review. The total at the end of Sept 2016 was 71% and is currently (end of March '17) showing an improvement of 5%.

It should be noted that some actions have not been finished yet and are still being implemented. These are as follows:

- The review of site fire team arrangements is underway. The success of this action will become clear in due course.
- The number of oil leaks has reduced by 13 from 61 to 48 and the station now 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.
- The number of reported issues regarding plant storage has continued to trend steadily

upwards and the level of tolerance to issues has decreased, indicating that personnel are thinking about fire safety, and the reporting culture on site is healthy. At the time of the initial review the number of reported fire related issues from general staff was 52. In Q3 2016 this figure was 55 indicating a steady increase in reporting.

Conclusion: Satisfactory progress to date

4. MAINTENANCE

4.2. MAINTENANCE FACILITIES AND EQUIPMENT

The station adopted a scheme of mechanical key interlocks to prevent unauthorized access to Reactor Protection System (RPS). All cubicles and transmitter racks related to the RPS are accessed via hinged doors fitted with a mechanical lock and key system, which allow authorized access at power, to only one train per system at a time for normal maintenance and testing. There have been no cases of unauthorized access to the RPS as a result of this mechanism. The team recognized this as a good practice.

The station has adopted an effective way of locating condenser tube leaks. By coating the entire tube plate of the leaking condenser in shaving foam, the leaking tube can be quickly identified, as the leaking tube is revealed by a depression in the foam coating over the end of the leaking tube. The method has proven to be effective, reliable, environmental friendly, and has reduced the downtime of condenser. The team identifies this as good performance.

4.5. CONDUCT OF MAINTENANCE WORK

The team observed that station maintenance activities were not always prepared, controlled and implemented in a manner to ensure equipment and personnel safety. Worksites are not always properly prepared and controlled, human error prevention tools are not always used or used effectively, and torque settings are not always specified in working instructions. The team made a suggestion in this area.

4.6. MATERIAL CONDITION

The team identified that the Foreign Material Exclusion (FME) Programme is not strictly implemented at the station. Barriers around the spent fuel pool were inadequate, logs were not filled out per the station expectation, and some FME areas are not fenced off. There were several FME events and near-miss events in 2015. The team made a recommendation in this area.

Although the total number of leaks has been reduced in the recent past, the team observed that the station still has a relatively large number of leaks. The team encourages the station to continue its effort in reducing the number of leaks.

4.7. WORK CONTROL

The station has used the risk-monitor process extensively to plan its on-power and outage maintenance activities. A case in point is that the risk profile for outage R13 has demonstrated risk-informed activity planning. The team recognized this as good performance.

The team observed that there are 18 compliance related preventative maintenance (PM) activities overdue at this moment in the station, and 12 out of 18 are on the systems related to the Heating, Ventilation, and Air-Conditioning System (HVAC). The team encourages the station to make further efforts to reduce overdue PMs.

DETAILED MAINTENANCE FINDINGS

4.2. MAINTENANCE FACILITIES AND EQUIPMENT

4.2(a) Good practice: Use of a mechanical key interlock scheme to prevent unauthorized access to the Reactor Protection System and other safety related equipment.

The station Reactor Protection System (RPS) comprises of 2-off diverse 4-train independent protection systems. The Primary Protection System (PPS) and the Secondary Protection System [SPS] provide both diverse Reactor Trip (Scram) and post-trip Engineered Safeguards Features (ESF).

Both systems are designed to allow authorized access at power to only one train per system at a time for normal maintenance and testing. All cubicles and transmitter racks are accessed via hinged doors fitted with a mechanical lock and key system.

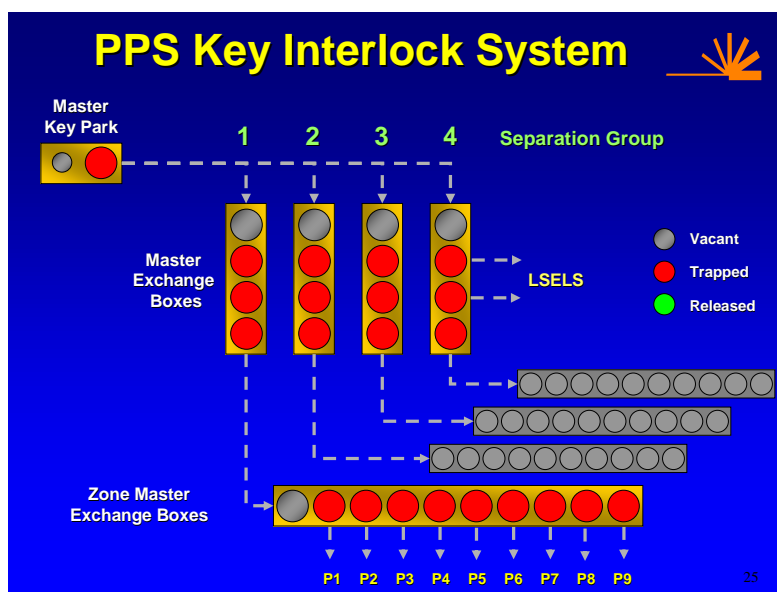
The master key (one per system) gives access to a Separation Group (Train) Master key box that releases keys in cascading order to further key exchange boxes, located in the Plant adjacent to the related cubicles and transmitter racks. Keys from the slave boxes are then released to open the doors to the cubicles for testing and maintenance.

Each key is unique, and the release of a key from the master box prevents the release of a key from another Separation Group until the first released key is returned. The slave boxes also retain their sub-master key which can only be released when all of the individual door keys are returned.

Thus the key system allows maximum access for testing and maintenance while preventing inadvertent trip or actuation due to testing or maintenance activities.

This supplements Human Performance and administrative controls to give an additional layer of defense during Nuclear Safety related equipment work.

There have been no cases of unauthorized access to the Reactor Protection System as a result of this interlock scheme.



4.5. CONDUCT OF MAINTENANCE WORK

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

The team noted the following:

- Work on valve (1EM-V3109) for the lube oil filter for high head injection pump C:
 - A torque wrench was not used to torque the valve packing to the recommended value as specified on the drawing during the maintenance work on valve (1EM-V3109) for the lube oil filter for high head injection pump C. The maintenance procedure did not require the use of a torque wrench during this step.
 - A torque wrench was not used to torque the valve body into place. The maintenance procedure did not require the use of a torque wrench during this step.
 - Maintenance tools were not placed in the laydown area in an orderly manner during the maintenance on the valve (1EM-V3109). Some tools were placed on nearby equipment, and others were placed on the pump C bed plate.
- Work on Essential Service Water (ESW) pump C outlet venting Valve (1EF-V0054):
 - Floor grates at the worksite were not protected to prevent small items from falling through to the floor below.
 - Wrenches, spanner, bolts and nuts in plastic bags and lubricants for bolts were placed on the Pump inlet pipe with the potential to slip off.
 - The plastic bag containing bolts and nuts was broken during the work, and the bolts and nuts fell through the floor grates down to the floor below.
 - A soft Foreign Material Exclusion (FME) cover was used as bag for used bolts and nuts.
 - The worksite was not fenced off.
 - The above situations were not challenged by the three workers within the group.
- The worksite for ESW Pump C maintenance area was not completely fenced off while work was in progress.
- The work sites were not fenced off during maintenance work on the ESW Strainer (1EF-F01C).
- Several white paint traces were identified on the driven-end bearing seal surface of the motor driven auxiliary feed water pump B after its disassembly. The paint traces were left from a previous disassembly of the pump, and were not cleaned prior to assembly.
- The pre-job brief for the test of the Load Shedding Sequencer logic check for 3.3kV essential electrical board 3 was not conducted in a structured manner as outlined in the Green Card Brief. Although most of the elements were covered, key points were not emphasized in a concise manner.

- Three way communication was not used as intended during the test of Load Shedding Sequencer logic check for the 3.3kV essential electrical board 3. The worker and the team lead did not challenge each other for not using three way communication.
- On 16 September 2015 during leak testing on the condensate system, the test equipment used for this activity was connected to the incorrect Condenser Extraction Pump (CEP). Not using human error prevention tools (such as pre-job briefing, point touch verbalize, peer check, and three way communication) has been identified as the main cause.
- On 4 August 2014, when working on the controller (1AB-PC0277) for the loop 2 steam generator Power Operated Relief Valve (PORV) (1AB-PV0277), an unauthorized parameter setting was used. This caused the manual close button to open the PORV and the open button to close the PORV. This condition was not identified from 4 August to 26 September 2014 as the automatic control worked correctly.

Inadequate preparation and control of maintenance activities may increase the risk of equipment damage and personnel injuries.

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

IAEA Bases:

SSR-2/2

4.29. Aspects of the working environment that influence human performance factors (such as work load or fatigue) and the effectiveness and fitness of personnel for duty shall be identified and controlled. Tools for enhancing human performance shall be used as appropriate to support the responses of operating personnel.

8.3. The operating organization shall develop procedures for all maintenance, testing, surveillance and inspection tasks. These procedures shall be prepared, reviewed, modified when required, validated, approved and distributed in accordance with procedures established under the management system.

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

8.9. An adequate work control system shall be established for the protection and safety of personnel and for the protection of equipment during maintenance, testing, surveillance and inspection. Pertinent information shall be transferred at shift turnovers and at pre-job and post-job briefings on maintenance, testing, surveillance and inspection.

GS-G-3.1

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

NS-G-2.14

4.27. Pre-job briefings should be used as a means of avoiding personnel errors, difficulties in communication and misunderstandings.

4.45. In communications, the full description of any plant item should be given and the phonetic alphabet should be used where appropriate. To reduce the likelihood of error in verbal communication, both in the plant and in control rooms, training should be provided in the use of three way communications between the sender and recipient and this method should be used as widely as practicable, especially in abnormal situations.

NS-G-2.6

5.2. The operating organization should require the plant management to prepare procedures that provide the detailed instructions and controls necessary for carrying out MS&I activities.

5.7. In the process of preparing procedures, in particular in determining their technical content, reference documents should be used. These reference documents should include appropriate drawings, codes, standards, instruction books and manuals, as provided by the design organization, construction organization, equipment suppliers and operating organization.

Plant Response/Action:

A – Apparent Cause of Suggestion

A structured approach to observations in the field was not in place, this did not provide the opportunities for leaders to fully implement high standards and reinforce expectations or the ability to provide support as appropriate.

Causal Code – **MS2e** - Management Systems, Standards, Policies, or Admin Controls needs improvement, Accountability

Facilities, tooling and equipment was not always available to support the fundamentals and expectations expected of the teams.

Causal Code – **HE1h** - Human Engineering, Human Machine Interface, Tools/Instruments needs improvement

Procedures and work instructions did not always provide all appropriate information.

Causal Code – **PR1b & PR1c** - Procedures, Not Used/Not Followed, Procedure not available or inconvenient for use & Procedure difficult to use.

B – Summary of action plan

Standards and expectations for maintenance fundamentals have been re-branded and designed to provide clarity in the body of information; this is being rolled out to the Maintenance Department staff and long-term contract partners during 2017. The roll-out includes manager briefings and information campaigns.

Leadership time in the field has increased with specific focus on setting to work and delivery of the standards into the workplace.

All work specifiers have completed an improved package of refresher training, guidance and tool box talks have targeted the maintenance teams and embedded contract partners emphasising procedure changes and improving standards and quality. BEG/SPEC/WM/A2/101 has been updated to reflect a common approach and standards for work specification. This has provided an increase in document change requests for old and existing procedures and improved output of quality and standardization specified work order cards. Benchmarking has also been completed supporting improvements and controls in leak management.

Human performance as found condition training has been conducted using the maintenance flow loop simulator, providing a realistic work place environment. Tutorial and practical training has been completed on small bore pipework and flange tightening, and training has been delivered to all work specifiers to ensure that the same standard is applied in all areas, this has been aligned to a recent issue of BEG/SPEC/WM/A2/101, tool box talks have been conducted with the maintenance teams and contract partners on improving procedure quality and work efficiency.

Trend analysis has been completed on targeted areas associated with Maintenance practices, from the Station rework review board and Maintenance Trend reviews.

Additional tooling and work place tool storage has been provided to support enhanced FME and housekeeping controls. Additional barriers have been provided and are stores stocked item and high quality transportation bags have been provided as a stock item, to aid with the storage and transportation of small items. Improvements to mechanical joint sealing have involved benchmarking, improvements to procedures, improved guidance on gasket sealing and material selection, training, availability and storage of pre-cut gaskets.

C - Action plan effectiveness review

Maintenance fundamentals rollout to the teams has been completed including maintenance contract partners.

An improved structured approach to observations is in place targeting appropriate areas to support safety and work quality. Within a snap shot of a 14 month period it has delivered 300 formal observations and provided 500 hours of leadership time in the field. The formal observation has provided details of targeted areas of correct tooling, tools used in a safe manor, good housekeeping, FME Observations, 3 way coms, and STAR and self-checking.

Station Rework Levels have remained consistent over a 2 cycle period; the levels of rework are low. In the last 12 months sufficient data has been collected to enable investigations to be completed in 2 areas of rework Equipment Reliability (AR964356) and Knowledge based human performance (AR964360). Equipment reliability summary review determined that over an 11 month period the failures associated with particular systems and components do not represent a downward or identified trend that require any specific action that has not already been taken.

Knowledge based human performance summary review has considered a considerable period of time and a wide band of disciplines, EDF and contract partners. There has been no specific finding from this review and in consideration to the number of tasks performed throughout the year and during outages the percentages remain low. Therefore it is considered that no further action is required at this stage.

Maintenance have conducted the following reviews and assessments based on GAP analysis at maintenance trend review.

Adverse trend identified - There has been a sharp increase during Q1 2016 of ME7 coded CRs. Which in turn, along with the increase in ME5 coded CRs has had a causal effect of pushing up the ME Group of ME1-ME8 (Maintenance Standards & Expectations) from an average of 4.50 in Q4 2015 to 7.12 in Q1 2016.

Positive trending (AR964851) Completed Self-Assessment 963690 on WANO findings regarding the quality of procedures. The preliminary findings of the Self-Assessment reflect the downward trend in the number of CRs raised against documentation and coded ME19. The Self-Assessment reflects a positive trend in behaviours towards procedure changes; this was established through a series of interviews and statistical data collection.

Self-assessment completed (AR963690) summary of findings that an improvement has clearly been observed in many work groups and many areas associated with the creation, distribution, control and update of procedures this is identifiable by collected data and observation of a change in behaviours. This is to the standards applied and guidance being followed within BEG/SPEC/WM/A2/101, and the roll out of specifier training (WMWOSPGEN).

The introduction of the post job procedure checklist has resulted in changed behaviours within the targeted area of MTB. The post job procedure checklist has been briefed to the WPS teams and is currently being rolled out within with positive acceptance of its worth from within the team.

Within a 14 month period it has delivered 300 formal observations and provided 500 hours of leadership time in the field. The targeted observations using the plant observation area have targeted the gaps in performance, with 35 observations in the previous 12 months compared with 121 over the next 14months.

Leaks are being tracked by the Operational Plant Delivery Team and reported to the Station Performance Review Meeting. Water, chemical and high priority oil leaks are tracked via the Operational Focus Indicator. A strong performance was achieved in this area, meeting or exceeding 2016 end of year targets for chemical and high priority oil leaks and marginally below target for water leaks. There is currently no medium or high fire risk arising from oil leaks.

IAEA comments:

The station worked mainly on two areas in order to address the issue:

- First the process to make observations in the field has been reinforced in a consistent manner. Now two full plant observations are provided by each maintenance manager each month. That represents about 25 observations per month covering all the aspect of tasks i.e. preparation, safety, RP, risks analysis, execution. Positive observations (Met Expectations -ME) are reported as well as negative one (Opportunities for improvement – OFI). Data from the observations are analysed and discussed at the maintenance leadership coaching review (LCR) held twice per month. From the data and reports from the observations feed back to the whole maintenance team is provided via a presentation that reports any theme for the following observations, Positives and recognitions and Opportunities for improvement.

No data were collected before the OSART since, within 12-month data period, the following trends have been observed and tracked.

- Correct use of Barriers: 119 ME / 13 OFI
- Correct Tools: 146 ME / 20 OFI

- Housekeeping: 144 ME / 13 OFI
- Tools used in a safe Manner: 152 ME / 09 OFI
- Point Touch Verbalise: 413 ME / 13 OFI

The second aspect is related to the improvement of procedures and tools to facilitate the staff's work. For example, some safety related procedures involving complex tasks have been enhanced with clear pictures and drawing. More precisely the action plan had encompassed improvement to: specification of work instructions, improvement of the training package for specifiers, improvement and feedback required from end user, Quality Control enhancements to work packages. In the same way, dedicated tools boxes are made available for important work tasks: workers can find easily all the dedicated tools they need for their job preventing the use of forbidden tools like adjustable wrenches. During the FU OSART, some fieldworks were observed i.e. modification of instrument compressor, auxiliary boilers, essential diesel generator 2, secondary protection system and telecoms distributed batteries. In most of these workplaces signs of new equipment were seen.

Conclusion: Issue resolved.

4.6. MATERIAL CONDITION

4.6(1) Issue: The Foreign Material Exclusion (FME) programme is not strictly implemented to prevent foreign material from entering station systems and components.

The team noted the following:

In the Fuel Building:

- A two (2) meters wide opening in the FME barrier around the spent fuel pond was not restored. There was no work in progress and no staff present at the time the opening was identified.
- The records in the FME Area Control Log Form for the spent fuel pool were found not legible, stroked out, corrected, not completed, or not verified.
- A thin layer of dust, insects and other light objects (potentially from intake air) were on the surface of the flask fill bay water, with the potential to connect to the spent fuel pond.
- An unattended power cord was left in the spent fuel pond FME area.

In other areas:

- The worksite barrier was not in place during the lube oil cooler 2A maintenance work (a FME standard work). No worker was present at the worksite at that time.
- A large piece (60cm x 60 cm) of clear plastic was found in the radioactive waste building.
- A large number of defective FME covers (soft or plastic, more than 30) were found in the maintenance workshop, the pump house and the Radiological Controlled Area (RCA) tool shop reception areas:
 - having foreign material inside, such as sand and debris,
 - degraded with inside lining detaching
 - broken
- A FME cover was missing on a flange to a steam generator drainage pump. (BMV 0309, Room 1161)
- No FME cover was on the open fire hydrant open pipe for Hydrant 1 KC V0369.

Station events:

- On 11 October 2015, during a forced helium dehydration function testing, a pressure relief disc burst on the dummy heat load cask with the system pressurized with helium. The heat lagging insulation covering the pressure relief disc was dispersed and a small amount of the lagging debris and dust was found on the spent fuel pond surface.
- On 6 October 2015, a head torch got loose from the elastic strap and fell into the Essential Service Water Pump suction header.
- On 4 October 2015, a broken fluorescent luminaire diffuser was found near the spent fuel storage pond.
- On 3 March 2015, a gas meter was found just inside the crank case door B5 of Emergency Diesel Generator (EDG 3) (1KJ-K02-3 EDG3)

- During Refuelling outage 13 (24 December 2014), a significant amount of foreign material was recovered from the shroud of Reactor Pressure Vessel head in the laydown area.
- On 8 June 2015, debris, such as small plastic bags, bits of hard plastic, small amounts of metallic fragments and a fabric type of material, were found inside a lubricating oil cooler.

Lack of rigorous implementation of the FME programme could challenge fuel integrity and equipment reliability.

Recommendation: The station should improve the implementation of its FME programme.

IAEA Bases:

SSR-2/2

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

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

Plant Response/Action:

A – Apparent Cause of Recommendation

Whilst a comprehensive Foreign Material Exclusion specification [BEG/SPEC/MNT/003 Company Specification – Foreign Materials Exclusion] and local guidance document [SZB/TSTS/011 Technical Standard – Foreign Material Exclusion] were in force at the time of the inspection, awareness of the required standards, and subsequent enforcement, was not consistently implemented in the field.

Causal Code – **PR1c** - Procedures, Not Used/Not Followed, Procedure difficult to use

A structured approach to observations in the field was not in place, this did not provide the opportunities for leaders to fully implement high standards of Foreign Material Exclusion and reinforce expectations in this area.

Causal Code - **MS2c** - Standards Procedures or Admin Controls [SPAC] Enforcement Needs Improvement.

Foreign Materials Exclusion specific tooling and equipment was not always available to support the fundamentals expected of the teams.

Causal Code – **HE1h** - Human Engineering, Human Machine Interface, Tools/Instruments needs improvement.

Causal Code - **QC2c** - Quality Control, QC Needs Improvement, Foreign Material Exclusion during Work Needs Improvement.

B – Summary of action plan

Using the Station Improvement Plan [SIP] action tracking and planning tool, the responses to OSART Recommendation 4.6 were integrated into the Sizewell B Business Plan.

The following sub-sections represent the Station's response to the recommendation:

Via the 2016 Quarter 3 [Q3] Maintenance Trend Review, targeted monitoring of the FME event rate and severity was carried out. FME events have been tracked from January 2016 to present [28/2/17]. Following a peak of events in outage RO14, events have been reduced to 3 low-severity findings per month.

Targeting of leadership field observations of Plant work to FME-related activities began in October 2016 and has continued to date [2/3/17] via the Maintenance Department Leadership Coaching Review [LCR] meeting meetings being held every 2 weeks.

To enhance Site collaborative working, an FME Working Group comprising of members from Maintenance, Investment Delivery and primary contractors Areva, GE and Doosan has been established. The group meets every 2 weeks and is a forum for exchanging operating experience and good practice regarding FME. 7 meetings have held to date [15/3/17].

Standards and expectations for maintenance fundamentals, including FME control, have been re-branded and designed to provide clarity in the body of information; this is being rolled out to the Maintenance Department staff and long-term contract partners during 2017. The roll-out includes manager briefings and information campaigns.

The Corporate FME Procedure [BEG/SPEC/MNT/003] is currently in the process of revision. Following discussion with the corporate document owners, the Sizewell B specific requirements will continue to reside in the local instruction SZB/TSTS/011. The Fleet procedure has been reviewed by the Sizewell B FME Working Group and feedback provided for incorporation into next revision [Rev. 008]. The re-issue of this procedure, with feedback from all Stations included, is scheduled for Q3 2017 and the Maintenance Accredited Training Programme will then be updated with any changes in Q4 2017.

In response to specific operating experience during outage RO14, a trial of hard-hat lanyards has been carried out to reduce the risk of dropped personal protective equipment. The trial was successful and lanyards will now be used in areas where the dropped hat risk demands such precautions. In addition, key work groups represented on the FME Working Group will be involved in any pre-outage training and OPEX sharing. For visiting outage contractors, a Dynamic Learning Activity [DLA] process has been incorporated into the Site Induction. DLA occurs in the weeks preceding an outage to cover multiple practical aspects of working at Sizewell B and already contains FME sections. The FME Coordinator will advise Training Department of any revisions required to the standard training package prior to RO15 in-processing as a result of the revised guidance documents.

In the area of work specification, 'aggressive work' leading to a potential FME challenge from particulate generation, has been recognised as an area for attention. The Work Engineering Group Team Leader has produced a learning brief which is now delivered to the WEG Engineers as part of their training.

For Investment Delivery activities, the Pre-Construction Check sheet has been amended to include for FME controls and Specification Authors trained in recognising FME risks in new article procurement from vendors.

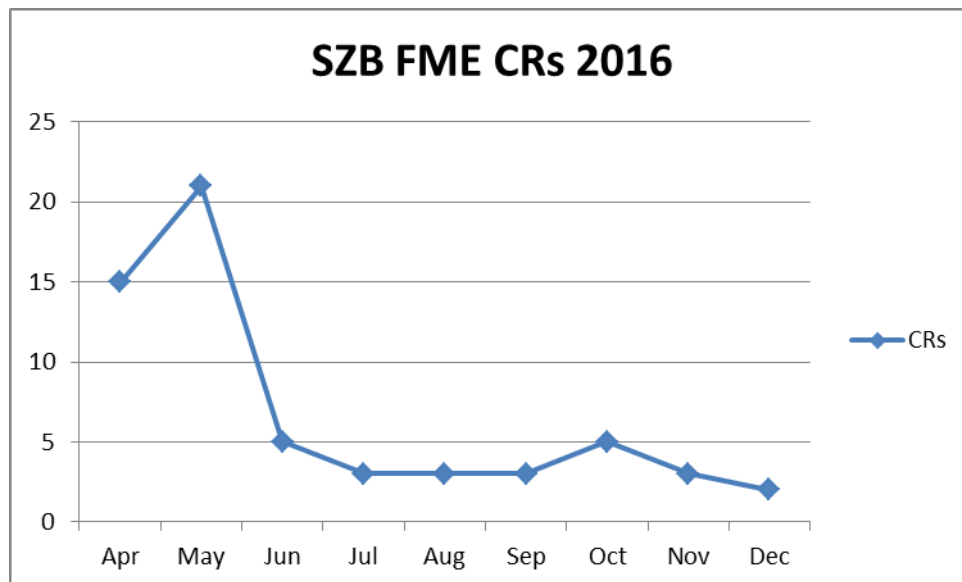
In response to the FME control failure event at Paks NPP where a lead shielding blanket was left in a Steam Generator, a mandatory assessment was performed on the potential lessons-learned at Sizewell B. This assessment has been completed and results presented to the Sizewell B Corrective Action Review Board [CARB] on 3/3/17.

To gain a broader perspective on FME controls, a benchmarking visit to Blayais NPP is scheduled for May 2017.

C - Action plan effectiveness review

FME events are being tracked and trended as part of the work of the FME Working Group. FME-related CRs are reviewed and non-genuine records stripped-out [e.g. FME training requests, positive findings etc.] leaving genuine FME transgressions to be trended.

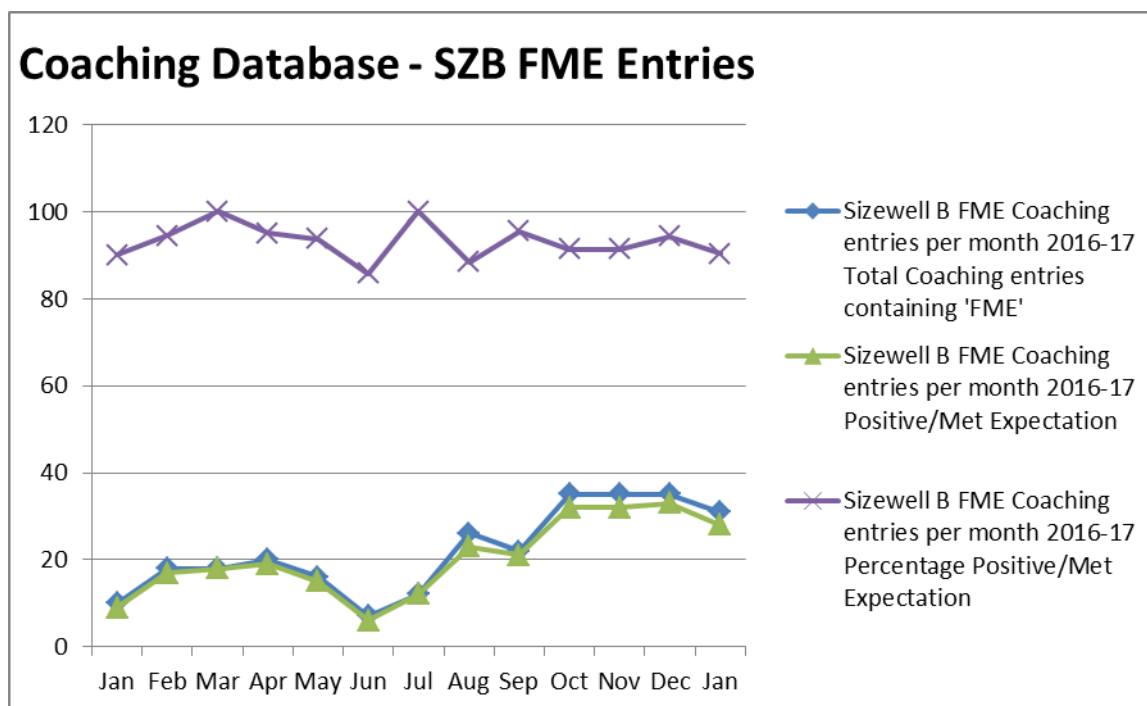
The trend from April 2016 is as follows:



Following the peak in RO14, FME-related CRs are now averaging 3 low-severity events per month.

Targeted observations have been carried out through Cycle 15 on the effectiveness of FME Controls. Over this period since enhanced observation commenced in October 2016, FME-related observations have increased from 20 per month to 35 per month on average. Overall, 'met or exceeded expectation' responses are now averaging 93% of reported findings.

The trend since January 2016 is as follows:



Reporting and effectiveness of the targeted observations have been monitored via the Leadership Coaching Review [LCR]. Fortnightly LCR meetings are being held and coaching observations discussed at this meeting with the Maintenance Team Leaders and Group Heads.

Findings on progress with FME observations to date were presented to the LCR in February by the Chair of the FME Working Group.

FME control procedures BEG/SPEC/MNT/003 and local procedure SZB/TSTS/011 have been reviewed by the FME Working Group. Comments have been supplied on the corporate procedure and these are in the process [2/3/17] of being collated with responses from the other Stations in the EDF Energy fleet prior to re-issue of the document at Rev. 008. The local document has been amended to take into account the proposed changes in BEG/SPEC/MNT/008 and improved automation in tool accounting at Sizewell B.

For work activities in specific FME High areas, Sizewell B is trialling enhanced tooling control. 3-off Snap-On[®] tool cabinets with automated tool issue and logging software have been purchased. These cabinets log all tools issued to a card holder ID and provide instant inventory control reporting to ease FME High area tool log reconciliation. 1 cabinet is allocated to the Fuel Route ONL team the remaining 2 are for Maintenance MTB team use. If successful, the cabinet use will be extended to all suitable FME High activities. The results of the trial will be shared via the FME Working Group to other workgroups and contract partners on site.

Future enhancements include:

Training material has been reviewed and enhanced training will be targeted at key work groups prior to RO15 outage. Fuel Route and Reactor Systems areas will be the primary focus. Engineering Support Personnel who will be undertaking RO15 Outage Project roles will be receiving FME awareness refresher training in the March 2017 Continuing Engineering Training sessions presented by the FME Working Group Chair.

Maintenance fundamentals roll-out is planned for 2017 and FME will be part of this package.

IAEA comments:

The analysis developed by the station in response to this recommendation has shown the main weaknesses regarding FME were as follows: procedures were not specific enough and/or difficult to use; there was not a strong process in place to make relevant observations and to reinforce expectations in the field and FME specific tooling and equipment were not always available or stored in a correct manner.

To address the issue the station has defined a detailed action plan including the following three priority focus areas:

- Reinforcement of observations in the field. This was conducted to increase the number of FME-related observations recorded. Observations increased by 75% from typically 20 to 35 per month. In parallel it is observed that the reporting threshold of 'Opportunity For Improvement' (OFI) concerning FME is decreasing: since the action plan, no major event has occurred in the FME 'High' areas.
- The fleet procedure was reviewed and Sizewell B comments were discussed for inclusion. To cover the PWR technology differences from the UK Advanced Gas-Cooled Reactor fleet, a Sizewell B specific supplemental FME procedure for the station was developed encompassing details of the main permanent FME areas. Also, according to this procedure, a Pre-Job Brief is mandatory before entering such areas i.e. Fuel Building. Procedures for 'Clear Bore Inspection' have also been developed in conjunction with key suppliers to ensure new equipment delivered is clean before being put into service at the station.
- Investment has been made to provide more tooling and FME equipment. Three electronic tool cupboards are available to be used in FME High areas; when issued, the tools are electronically associated with the badge of the person who receives them. During the tour made on the station a number of FME cabinets were observed clean, in order and with dedicated tooling. A routine exists to check these cabinets every month.

It was also noted that the station has provided more training in FME matters showing actual cases encountered in the field e.g. all the engineers were trained by March 2017 and a refresher is in place every three years. FME training will also be included in the pre-outage training in 2017 utilising recent operating experience.

Addressing the issue, the station has created a dynamic that now puts the FME control in line with the organization involving good support from contractors via the regular FME Working Group. The station has also recently received solicitations from other utilities (French fleet, AREVA) for benchmarking.

During the station tour made by the OSART Follow-up team no FME related deviation were observed.

Conclusion: Issue resolved.

5. TECHNICAL SUPPORT

5.1. ORGANIZATION AND FUNCTIONS

The training programme for technical support personnel was developed using a systematic approach to training. The programme is accredited by an independent organization using industry recognized standards. This allows technical support staff to be trained on and be formally qualified for tasks they perform, and supports efficient qualification tracking. The team recognized this as good performance.

5.2. PERIODIC SAFETY REVIEW

The station's second Periodic Safety Review (PSR) process and scope were developed based on IAEA and other methodologies. A comprehensive process was used to organize the results of the PSR, and formal corrective actions were developed and are being formally tracked to completion. The station's safety case was updated in response to the PSR. The team recognized the station's PSR process as a good practice.

5.5. USE OF PSA

The station's Probabilistic Safety Analysis (PSA) is maintained by station staff as a "Living PSA" in that it is updated as needed to reflect station design and operation, and at least every 3 years. PSA is used extensively to inform both near-term and long-term operational and configuration decisions, and is reflected in the station's approach to online and outage risk assessment and management. The team recognized this as good performance.

5.7. PLANT MODIFICATION SYSTEM

The station has implemented an efficient yet thorough modification tracking and control process that makes effective use of the stations integrated computer system to ensure all modification related requirements are met. The system electronically links all items associated with a modification package including documents, work instructions, materials catalogue, tests, handovers, training requirements, maintenance strategy, and references. Milestone tracking, used throughout the modification planning and implementation, is clearly presented such that review and approval can be done online in a timely manner with transparency to all reviewers/approvers. The team recognized this as good performance.

Some examples of not controlling portable equipment related to heating and ventilation were observed by the team and resulted in a team suggestion to consider improving the application of existing station processes to control the use of portable equipment.

5.8. REACTOR CORE MANAGEMENT (REACTOR ENGINEERING)

A utility-developed neutronic and thermal-hydraulic code (PANTHER) is used to provide diverse checks on the output of industry standard software used for core design and operational support, and the team recognized this as good performance.

Reactor core management and overall station operations are supported by consistently high availability of computer systems. The station has maintained a dedicated Process Computing Group (PCG) from 1992; well before station start-up. This group is tasked with ensuring that a consistent, comprehensive approach is used to support engineering and maintenance of the station's important computer-based systems. This was particularly important because the station's design incorporated unprecedented use of computer-based monitoring and control systems. The continued use of a dedicated group has resulted in very high level of product

quality as reflected by the number of issues not found prior to installation being almost zero. The team recognized this as good performance.

DETAILED TECHNICAL SUPPORT FINDINGS

5.2. PERIODIC SAFETY REVIEW

5.2(a) Good practice: The station's Periodic Safety Review (PSR2) process is comprehensive and rigorous.

In the scope of its second Periodic Safety Review (PSR2) the station benchmarked its documented safety case against high level principles and requirements that are representative of international modern safety standards. The safety standards selected for the comparison comprise of three top tier IAEA safety standards identified as representing international best practice and consensus (Safety Fundamentals No. SF-1; Specific Safety Requirements No. SSR-2/1; Specific Safety Requirements No. SSR-2/2). In addition, the WENRA Reference Levels and the WENRA Statement on Safety Objectives for New Nuclear Power Plants were explicitly considered. Furthermore, review of lower level modern industry codes and standards was undertaken in each relevant technical discipline.

In order to ensure that the station's PSR2 has been conducted in line with world best practice, alignment with the IAEA Safety Factors presented in Specific Safety Guide No. SSG-25 was demonstrated using a tried and tested safety case methodology of Claims, Arguments and Evidence. A route map of the PSR2 alignment with the IAEA Safety Factors is documented in the PSR2 Head Document 'Adequacy of the Nuclear Safety Case Statement' which also presents a discussion of how the PSR2 process is aligned with the general objectives of the IAEA Global Assessment outlined in SSG-25. PSR3 will consider two additional Safety Factors covering the areas of radiological protection and decommissioning.

This thorough process for review of station performance against modern standards has resulted in a very comprehensive and well documented PSR supporting station continuous operation for next 10 years.

5.7. PLANT MODIFICATION SYSTEM

5.7(1) Issue: The station local instruction, “Additional Requirements at Sizewell B for Engineering Change Process”, is not properly applied to the installation and control of some portable equipment used to augment station heating, ventilation, and air conditioning (HVAC).

The team noted the following:

- Two portable heaters in operation in the radiological chemistry laboratory were not installed under the station’s portable equipment process. As a result, the heaters were not on the station’s temporary equipment register. The heaters have been in place for several months and were installed to augment the room’s HVAC system which was unable to maintain proper room temperature for the laboratory equipment in the room.
- Two portable cooling units in operation in the turbine building process sampling lab were not installed under the station’s portable equipment or temporary modification processes. As a result, the coolers were not on the station’s temporary equipment register. The coolers have been in place for about two years and were installed to provide room cooling pending upgrade of the room’s HVAC system.
- Two portable heaters were installed in the hypo-chlorination transformer room to help reduce humidity when the transformers were not in operation. The heaters were not removed when the transformers were re-energized after the most recent transformer outage.

Installation of equipment outside required station controls or processes may have an adverse impact on equipment reliability or station operation.

Suggestion: The station should consider improving the application of existing station processes for use of portable equipment.

IAEA Bases:

SSR-2/2

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

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

NS-G-2.3

2.11 Plant modifications should be performed in accordance with established procedures, with due consideration being given to quality assurance provisions.

2.13 The modifications should at all times be under the control of the plant management and should be managed in accordance with established procedures.

Plant Response/Action:

A – Apparent Cause of Suggestion

The apparent cause of this suggestion is that although the process is adequate; there was a knowledge gap in some departments concerning the use and adherence of SZB/LI/021/101 “additional requirements at Sizewell B for engineering change process”.

Causal Code – **MS2a** - Management Systems, Standard Policies or Admin Controls, Communications of Standards policies or Admin Controls Needs Improvement.

B – Summary of action plan

Key groups were briefed in the process requirements. In addition further actions have been delivered via the department’s improvement plan.

- The Scope of Temporary Equipment control has been clarified via communication in the station leaders brief.
- The Temporary Equipment register has been amended to include reference to SZB/LI/021/101 which specifies criteria for inclusion.
- Temporary Equipment register format has been revised to include the laydown assessment reference rather than a simple YES/NO to encourage use of the process.
- The Register of Temporary Equipment has been reviewed. Of the 25 items initially on the register 7 items are confirmed as no longer required, have been removed from the plant and the register updated.
- Laydown assessments have been reviewed for the remaining portable equipment still required to support plant operation. The register has been updated with the Assessment references.

C - Action plan effectiveness review

Questioning individuals, randomly selected from the groups given briefings, confirms key personnel are aware of the requirements relating to use of temporary equipment on the plant.

The simple change to the register highlights the need for Laydown Assessments and provides a simple reference to the controlling procedure.

The Register review has identified a number of Laydown Assessments are no longer required and initiated the removal of the associated equipment. A number of electrical tests were also identified as being due; these have been completed.

Approval of the required Laydown Assessments remains in progress.

A routine WOC is to be generated to prompt a periodic review of the Register to ensure it remains up-to-date. PMRG A/R 01029340 raised 08/03/2017.

The plant has been systematically surveyed, as part of the Detailed Operations Plant Tours, to confirm that all temporary equipment installed has been registered.

A search of CRs raised since Jan 1st 2016 has identified 4 with a reference to temporary or portable equipment. None of these report an adverse condition relating to deployment on the plant. Similarly none of the CRs reporting Laydown control issues relate to temporary Equipment.

IAEA comments:

The station analyses on the identified gaps concluded that no programmatic changes were needed but rather reinforcement of management expectations as defined by SZB/LI/021/101 “additional requirements at Sizewell B for engineering change process” is required. In line with this the station amended its practices to require review of the Register for Temporary Equipment every 3 months, to remove the temporary equipment which is no longer required and to review the laydown assessments for all portable equipment which remains in the field as needed to support plant operation. The importance of temporary equipment utilisation control has been emphasised via communication in the station leaders briefs performed for Work Management, Chemistry and Contractor partners’ team. The records from the brief performed in July 2016 to 16 members of the Work Management team were reviewed during the follow-up mission.

During the follow-up mission the station demonstrated that the reinforcement measures have produced the expected results. 7 out of 25 portable equipment found in the field after the OSART mission were removed as no longer needed. The assessment of the laydown conditions and overdue portable appliance tests were performed for the rest of the equipment. Periodic laydown conditions updates and tests have been performed afterwards and were dully listed in the Register for Temporary Equipment. At the time of the mission 19 portable equipment items were controlled under the station Register for Temporary Equipment and no deficiency in the control process for this equipment was identified. Analysis of the operational experience databases since 2015 showed that there were no deficiencies reported on the deployment of temporary or portable equipment. The plant tour of the turbine hall, Essential Diesel Generator Building, turbine building process sampling lab, 23.5/400 kV circuit breakers Compressor room 0411/01 and Cooling Water Pumphouse Loading Bay completed during the follow-up mission did not reveal any deficiency concerning utilisation of portable equipment in the field.

Conclusion: Issue resolved

6. OPERATING EXPERIENCE FEEDBACK

6.1. ORGANIZATION AND FUNCTIONS

All permanent employees and contracted individuals are encouraged to identify and raise up issues within the condition reporting programme at Sizewell B. General station access training provides the knowledge and expectations of all employees, and they have sufficient access to computers, or can raise issues on a hard copy paper condition report, which will get entered into the Corrective Action Programme (CAP) and screened along with all of the other condition reports. In addition to general station access training on the CAP program, enhanced training is provided to team leaders, group heads, and CAP evaluators through the use of enhanced CAP Mentor Guides. Before they can perform their enhanced CAP duties, each individual must demonstrate understanding of the expectations of their enhanced CAP roles through a meeting with the site CAP Coordinator, or Deputy CAP Coordinator. The team considers this to be a good performance.

6.4. SCREENING OF OPERATING EXPERIENCE INFORMATION

Internal and external operating experience (OE) is screened by a dedicated site OE coordinator. This individual meets daily with their site counterparts through a series of regular conference calls. This collegial review ensures that operating experience that is important or pertinent to the station, the EDF-Energy fleet, or to the international community is identified and reported based on the significance of the issue. This is considered good performance in that this approach to OE screening improves the effectiveness, timeliness, and accuracy of the screening of relevant operating experience.

6.5. INVESTIGATION AND ANALYSIS

Although the station has demonstrated accuracy and proficiency at identifying organizational or programmatic causes for significant events, a weakness has been identified in the identification of the generic applicability of the issues or causes of those events. In some cases, the Extent of Condition is too narrowly focused, and the evaluation of the Extent of the Root Causes has not been properly performed. Failure to adequately identify the generic applicability of the events has the potential to delay rectifying organizational or programmatic issues that could contribute to or cause significant events. The team has made a suggestion in this area.

6.7. UTILIZATION AND DISSEMINATION OF OPERATING EXPERIENCE

The team has identified a good practice with regard to the utilization and dissemination of relevant operating experience at Sizewell. The station utilizes a valuable process and software known as the Organizational Learning Portal (OLP). The OLP is very effective at providing intuitive searching and sharing of pertinent operating experience to the station and the rest of the EDF-Energy fleet. This OLP is used in the daily pre-job briefs, engineering evaluations, training lesson plans and other processes at Sizewell. The team considered this to be a good practice.

6.8. TRENDING AND REVIEW OF OPERATING EXPERIENCE

The team noted some weaknesses in the trending of deficiencies, low level events, near misses and significant events at Sizewell B. This has resulted in the untimely correction of programmatic issues including some critical component failures on the emergency diesel

starting air system, and with preventive maintenance programme weaknesses that are resulting in important safety system failures. A review of the departmental trend review boards revealed that for more than 90 per cent of the trends identified, no condition report or formal corrective action was taken to address the identified trend. Failure to identify or correct adverse trends will reduce the effectiveness of the corrective action programme in preventing more significant self-revealing events. The team recommends that the station enhances its corrective action programme trending process so that adverse trends once identified corrected.

DETAILED OPERATING EXPERIENCE FEEDBACK FINDINGS

6.5. INVESTIGATION AND ANALYSIS

6.5(1) Issue: Root cause investigations and equipment failure investigations do not always adequately identify the generic applicability of significant events.

The following observations were made:

- Extent of Condition and Extent of Cause were not properly identified in many recent Root Cause investigation reports. In some Root Cause Investigations, the Extent of Cause was not reviewed at all, eg:
 - Extent of Cause was not evaluated in SACI 929590 Grouped Investigation of Recent Injuries
 - Extent of Cause was not evaluated in SACI 913666 Deluge of TG2 Operating Turbine
 - Extent of Cause was not evaluated in SACI 911865 Overflow of Hypochlorination Plant Hydrogen Disentrainment Tank and Bund
 - Extent of Cause was not evaluated in SACI 897343 Level 1 Safety Rules Event with Temporary Power Supply
 - Extent of Condition did not address the Root Cause in SACI 913666, in that the Root Cause was inadequate operating procedures that resulted in improper operation of the system, whereas the extent of condition discusses the uniqueness of the generator seals. The direct cause discusses the fact that the manual valve was shut.
- Although Equipment Failure Investigations (EFI) are performed for some significance level 3 critical component failures (CCF), current Corrective Action Programme (CAP) procedures do not require the identification of the generic applicability.
- Although Corrective Action Review Board (CARB) members receive initial training and a qualification prior to performing CARB duties, root cause investigation reports are approved by CARB without the proper identification of the extent of condition and extent of cause.
- Refresher training has not been performed with the Root Cause Investigators, or Corrective Action (CAP) coordinators.

Failure to properly identify the generic applicability of a significant event may prevent the adequate dissemination of the event, and may increase the potential of a recurrence of a similar event.

Suggestion: The station should consider enhancing its root cause analyses to ensure that generic applicability of significant events is always adequately identified.

IAEA Bases:

SSR-2/2

5.28 Events with safety implications shall be investigated in accordance with their actual or potential significance. Events with significant implications for safety shall be investigated to

identify their direct and root causes, including causes relating to equipment design, operation and maintenance, or to human and organizational factors.

NS-G-2.11

2.4 The investigation and reporting of events contribute to improvements in nuclear safety and have the following objectives:

- To assess the generic applicability of events
- To prevent the recurrence of similar events.

Appendix III.3 Training (both initial and refresher) should be provided for the staff who might take part in an investigation. This should include training in investigation techniques, documentation needs, witness interviews, conflict resolution and dealing with confidentiality issues.

Plant Response/Action:

At Sizewell the Generic Applicability section of investigations is referred to as Extent of Condition.

A – Apparent Cause of Suggestion

There are two apparent causes for this suggestion:

- Firstly that root cause investigations were approved by the Corrective Action Review Board (CARB) without the extent of condition section meeting the required standards.

Causal Code – **MS2c** - Management Systems, Standards, Policies or admin controls not used, Enforcement Needs Improvement.

- The underlying cause was that neither the lead investigators nor the CARB members were aware of what the correct standards entailed despite being previously trained.

Causal Code – **TR2** - Training, Understanding Needs Improvement

B – Summary of action plan

The SACI presentation format has been changed to present the root causes for approval prior to the rest of the report. This allows all parties to spend longer writing the additional sections so that the quality is improved. In addition all SACIs completed during 2016 have had the extent of condition section split into the two sections - extent of cause and extent of effect so that it is clear both parts are included.

As an interim action the CARB agenda was updated to record the formal approval of the extent of condition section. This action was put in place to improve the standards of the extent of condition until formal training was completed.

Following international benchmarking the extent of condition section of the SACI training has been updated, this has been rolled out to new SACI lead investigators, and a refresher session has been given to Sizewell SACI investigators and CARB members.

The Equipment Failure template has also been updated to include the requirement to review the extent of condition.

C - Action plan effectiveness review

Improvements have been made in the standard of the extent of condition section for root cause investigations. For SACIs completed during 2016 both of the required sections have been included within the report, which will help prevent repeat events.

Extent of Condition reviews are being completed for equipment failures, with 65% of EFIs completed during 1st January 2016 – 30th November 2016 having actions placed to resolve the extent of condition.

The above actions have rectified this suggestion.

Further improvements to meet the world standard of excellence are expected once sufficient time has been given to embed the new training into SACIs completed. One SACI has been completed since the new training has been rolled out. This has improved the extent of condition section further.

Further improvement is also required in clearly defining the extent of condition for equipment failure investigations, as although actions are being taken to prevent repeat events, this is not always clearly defined within the investigation report. The System Review Board agenda has been updated to include a reference to the extent of condition requirements; and this meeting is being used to improve the extent of condition review for all equipment failure investigations.

IAEA comments:

In order to resolve the recommendation, the plant has performed casual analyses and identified an action plan to improve Root Cause Analyses practices.

The Extent of Condition training has been updated following international benchmarking and rolled out to 10 Significant Adverse Condition Investigation (SACIs) authors and 14 CARB members via refresher training in January 2017.

Extent of Condition reviews have been completed for equipment failures, with 65% of EFIs completed between 1st January 2016 – 30th November 2016 and having actions placed to resolve the extent of condition.

The OSART review found inadequacies in the Extent of Condition (EoC) sections of the five SACIs completed September 2014 to March 2015. The four SACIs completed during 2016 had improved EoC sections which had both extent of effect and extent of cause explicitly included. The one SACI completed since the training in 2017 has a world standard EoC section which complies with the new training.

Conclusion: Issue resolved

6.7. UTILIZATION AND DISSEMINATION OF OPERATING EXPERIENCE

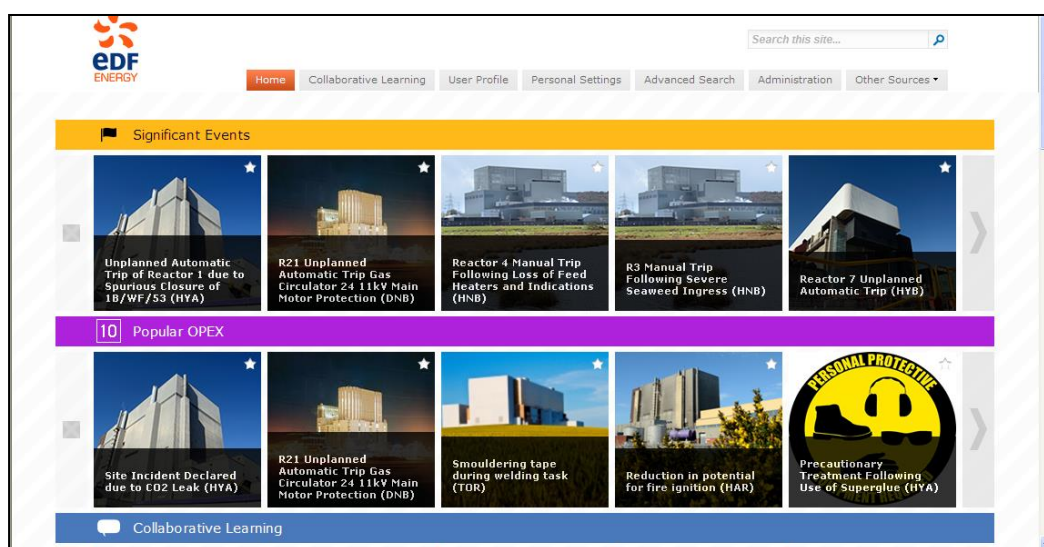
6.7(a) Good Practice: Organizational Learning Portal

The Organisational Learning Portal has been developed to enable all internal and external operating experience to be available in one system which can be reviewed by all personnel on-site.

The system enables rapid entry of events such as reactor trips which can then be commented on by all stations in the EDF-Energy nuclear fleet.

Individuals can set up favourite categories so that relevant events are sent directly to them by e-mail daily, weekly or monthly basis with hyperlinks to the OPEX report. They can also change their home page so that events are listed in the order of significance appropriate to each person.

The Organisational Learning Portal is a cross fleet operational experience database. Any one on site with computer access can access the database to view fleet, international and industry operating experience.



Results: During May 2015 the station saw more than 500 unique individuals accessing the database to review the Operating Experience.

6.8. TRENDING AND REVIEW OF OPERATING EXPERIENCE

6.8(1) Issue: Corrective action programme trending is not consistently performed across the station and some important adverse trends are not identified and corrected.

The following observations were made:

- An adverse trend in High Integrity Control System (HICS) events that resulted in unplanned LCO entries was identified within the past year. No condition report was written to document this trend and subsequently, no CAP investigation was performed to identify the causes of the adverse trend.
- An adverse trend of equipment failures caused by preventive maintenance issues was identified by the OSART team during the trending of important equipment failures, no condition report was initiated, and no CAP investigation was performed to address this trend (eg. demonstrated by CR 00913012; 00941784, 00901271).
- Three previous failures of related diesel starting solenoid valves caused by problems with the gaskets occurred prior to an event which placed the plant into an unplanned shutdown LCO (ref CR 959278). No CR was written to document any of the previous events, therefore trending of this common failure was not performed prior to this event. The gasket kit (Stock Code/CatID number 415057) for Emergency Diesel Starting Air System solenoid valve 1KJ-4723 had been issued out 4 times for the equivalent valve (Stock Code/CatID 412960) on the emergency diesel generators since the beginning of 2013, for similar failures. The system engineer had been aware of these failures, but he had not written CRs, only work orders until the station got placed into a 72 hour shutdown LCO and 24 hour action statement.
- Although Operations trending in 2015 identified configuration control events as a trend, no condition report was written and no CAP investigation was performed.
- Departmental trending does not result in Condition Reports (CR) or trend investigations for more than 90 per cent of all gaps identified at the site.
- A large number (17%) of causal factor codes are “Unknown”, “Other”, or “Not Coded”.
- Many departments have only started performing formal trend review boards within the past year.

Failure to adequately trend and analyse events will reduce the effectiveness of the corrective action programme at preventing more significant events.

Recommendation: The station should enhance its corrective action programme trending so that adverse trends are timely and consistently identified and corrected.

IAEA Bases:

SSR-2/2

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

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

NS-G-2.11

6.5 Trending should be used to analyse the performance of various work groups, to identify those factors that result in either less than desired or better than expected performance. Follow-up investigations should be performed to gain a better understanding of why an abnormal trend is occurring so as to determine the causal and contributing factors.

6.10 Once an abnormal trend has been identified it should be treated as an event, and the established deficiency reporting programme should be used to initiate an appropriate analysis and to determine whether the trend is identifying adverse performance. The level of the analysis should be based on the significance of the trend and its potential consequences. A thorough root cause investigation can be made so as to identify causal and contributing factors to explain why a trend is occurring. Corrective actions should be focused on addressing the causes and should be incorporated into the organization's process or programme for corrective actions. Subsequent follow-up actions should be taken to verify that the adverse trend has been corrected or to modify the original corrective actions.

6.11 The investigation should then be focused on these more frequent factors, thereby increasing the probability that the actual (root) cause(s) of the adverse trend will be identified.

Plant Response/Action:

The OSART observation has been split into three distinct sections.

A – Apparent Cause of Recommendation

1. The trends of “unknown”, “other” and “not coded” investigations; and equipment failures caused by preventative maintenance; were not identified. This was due to routine trending using smaller sets of data to identify changing trends; rather than looking at total numbers. When the data was re-written to show total numbers these trends became obvious.

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

2. Trends are identified at many forums across the station, there was no requirement to raise CRs or complete analysis on trends identified outside of the CAP Process.

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

3. The trending process was not seen as an improvement tool to identify and address the causes of technical issues such as equipment failures and rework. The link between equipment reliability; maintenance rework and the CAP process was not clear. Trending was mentioned in each of the processes; however it was not apparent at

Code – **MS1c** - Standards, Policies or admin controls (SPAC) Need Improvement, Confusing or incomplete.

B – Summary of action plan

The main action for this recommendation was for the Performance Improvement team to provide support to the station by initially facilitating the identification of trends and communicating the benefits of trending until the process became embedded within each department.

Actions to address the individual causes are detailed below:

1. Reports have been produced which show the total number of causal codes identified. These have been included within the quarterly trending presented at the Corrective Action Review Board (CARB). The initial total causal code trending identified “unknown, other or not coded” and “Equipment not appropriate for conditions” and “procedures not followed” as the top three codes. Adverse trend investigations into these events have been completed and further actions placed to rectify the common causes.
2. An initial workshop was held to identify a common way for trends to be identified and recorded within the CAP process. A process was implemented which required a minimum of a Condition Report and an Effectiveness Review (known as a FLUP) for all Trends. Complex trends also require a Gap Sheet to be produced. The new process was piloted through the Configuration Management Working Group, and is now being rolled out to all meetings throughout the station.
3. A Workshop was held with Engineering to determine how equipment trends will be captured within the CAP process. The Maintenance Strategy Review Template (MSRRs), and the System Review Board Agenda have both been updated to require a CR and FLUP to be raised for all trends. This method has been piloted for all trends identified during 2016. In addition three component related trends were identified and MSRRs have been completed for these.

C - Action plan effectiveness review

1. Total number trending is now being routinely used as part of the CAP trending. The six monthly station trend review reports are being taken to the Corrective Action Review Board and so this section of the observations has been rectified.
2. The new process of raising a Condition Report and FLUP for all trends is working successfully. The station has many routine meetings, and the current focus is on ensuring that the process is embedded in each meeting. The station has raised on average seven trend Condition reports a month compared with two a month prior to the OSART visit.
3. The Maintenance Strategy Review Report template has been updated to rectify the concerns in this area; this has yet to be used as a new template is produced each year. The piloting of the scheme on the 2016 data has proved effective; the focus is for this to become embedded within the engineering department through 2017.

IAEA comments:

In order to resolve the recommendation, the station has performed casual analyses and identified an action plan to improve the quality of its Corrective Action Programme Trending. The station has split the problem cause into three contributors, investigated and eliminated each of them.

Station has introduced the new CAP software improvement which has enabled more than 1 event code to be added to each Condition Report. Each 6 months the Trend Report is issued covering the previous 18 month period. Station has developed the Gap Sheet template and instruction for complex or cross-functional trends. This has allowed the cause of trends to be established, actions to be placed, and effectiveness to be reviewed during follow up. The Maintenance Strategy Review template has been used for component defect review to allow trends to be identified and rectified for PCBs, Power Supplies, and Relays.

Since the introduction of the new trending process the number of adverse trend Condition Reports (CRs) raised has increased significantly. During the 2016 calendar year 91 CRs were raised compared with 37 in 2015. So far during 2017 35 CRs have been raised. This is equivalent to an average number of adverse trend CRs raised pre-OSART of 2 per month compared with an average of 8 per month since the OSART review.

Trends were not being raised from Equipment Failure trends. CRs are now required to be raised from Plant Health Committee trends and from the Maintenance Strategy Reviews, Engineering have raised 10 CRs to record adverse trends.

Station level trend reports did not include the total number of CRs coded. The method used for the trend report has been improved and 5 trend reports which include this additional information have now been produced and presented at the Corrective Action Review Board.

Conclusion: Issue resolved

7. RADIATION PROTECTION

7.3 RADIATION WORK CONTROL

In general, activities in the Radiological Controlled Area (RCA) are performed in accordance with clear rules and the presence of a strong, well-qualified Radiological Protection (RP) staff. This delivers good radiological protection results in terms of contamination control. However the station's practices related to low source term activities does not always promote progress in improving contamination control. The team noted that certain practices in the field do not reflect the generally good standard of radiological protection. As an example, it is noted that the rate of contamination events was increasing throughout this year. The team made a suggestion in this area.

7.4 CONTROL OF OCCUPATIONAL EXPOSURE

At the station, all activities in the RCA are subject to radiological risk assessments to ensure that radiation doses are optimised. Since the beginning of operation, the station has typically achieved good results in terms of reducing radiation exposure; particularly during outages and other significant projects. However, the team noted that for medium risk activities when the station is at power, there was limited interaction between radiological protection staff and other work groups to establish challenging dose goals and to track progress of radiation exposure. In a small number of jobs, radiation doses exceeded the initial estimates made by the radiological protection staff. This was the case for the work done to address emergent defects associated with an RHR pump that occurred in the first half of this year. The team identified opportunities for improved planning and engagement between radiological protection and other work groups, and made a suggestion in this area.

DETAILED RADIATION PROTECTION FINDINGS

7.3. RADIATION WORK CONTROL

7.3(1) Issue: The station practices applied in the RCA are not rigorous enough to support continuous contamination control improvement.

The station has a very low threshold to control station contamination and has very good performance in this area. However during the mission, the team identified some gaps which may prevent the station making further improvements. Examples of such facts are:

- Currently, 31 low level contamination events have been recorded since the last outage (5/12/2014). The rate of those contamination events is increasing.
- In only 38.7 % of contamination events the contaminated persons had entered a Contamination Controlled Area (C2). The majority of contamination events occur in uncontaminated areas of the RCA.
- During an iodine filter replacement, the old iodine filter was placed with the rest of the RP Technician's equipment at the end of the job. Segregation of clean and potentially contaminated equipment was not adequate.
- The station has a breakdown of Personal Contamination Event rate by Department, however there is currently no action plan developed to drive the rate lower.
- Contamination was detected on a worker after using a contaminated FME cover on the roof of the Auxiliary Building. The root cause was not determined.
- An RP Technician was contaminated in the Radwaste Building although he had not entered a C2 Area (7/10/15). The root cause was not determined.
- Before released as conventional waste the content of the bags from 'non-radioactive material' (Green stream waste) is only checked externally. This check doesn't systematically ensure that prohibited materials (for example items with radioactive marking) are not inside the bag.
- Green stream waste sacks are checked for contamination directly on the floor. The work position is not very ergonomic and no protection is used in case the bag or contents are contaminated.
- Approximately 25% of the observed green stream sacks did not meet the release acceptance criteria and had to be classified as radioactive waste.
- At the RCA boundary a part of a refrigeration unit, 1GK-E14 was checked for contamination. The arrangements for the control of such materials brought to the RCA boundary assume that the materials to be released are not contaminated.

By not using rigorous practices in the RCA the station may reduce the opportunity to further improve contamination control performance.

Suggestion: The station should consider developing more rigorous practices in the RCA to support continuous contamination control improvement.

IAEA Bases:

RS-G-1.1

4.22. Experience with a particular situation sometimes indicates a need to review procedures and performance. This experience may be qualitative (e.g. the observation that the frequency of occurrence of minor contamination may have increased) or quantitative (e.g. a trend in the results of monitoring programmes). The use of quantitative experience can be assisted by the application of investigation levels to monitoring results for individuals and workplaces. Investigation levels are one type of reference level (see Section 2). They are to be used in a retrospective sense, and should not therefore be confused with dose constraints. If an investigation level is exceeded, then this should prompt a review of the situation to determine the causes. This review should have the objectives of extracting appropriate lessons for any future operations and determining whether additional measures are needed to improve the current protection arrangements.

4.23. Investigation levels should be seen as important tools for use by management and should therefore be defined by management at the planning stage of activities; they may be revised on the basis of operational experience. Regulatory authorities may also wish to establish generic investigation levels in terms of individual dose for regulatory purposes.

5.18. The BSS (Ref. [2], para. I.21) state that:

“Registrants and licensees shall designate as a controlled area any area in which specific protective measures or safety provisions are or could be required for:

- (a) controlling normal exposures or preventing the spread of contamination during normal working conditions; and
- (b) preventing or limiting the extent of potential exposures.”

5.23. The BSS (Ref. [2], para. I.23) state that “Registrants and licensees shall:

(h) periodically review conditions to determine the possible need to revise the protection measures or safety provisions, or the boundaries of controlled areas.

5.41. Thus, a programme of monitoring may be used for a number of specific purposes, depending on the nature and extent of the practice. These purposes may include:

- (a) Confirmation of good working practices (e.g. the adequacy of supervision and training) and engineering standards;
- (d) Evaluation and development of operating procedures from review of collected monitoring data for individuals and groups (such data may be used to identify both good and bad features of operating procedures and design characteristics, and thereby contribute to the development of safer radiation working practices);

5.60. The results and findings of workplace monitoring should be recorded (see para. 5.86), and made available to line management and employees (through their representatives if appropriate). This information should be used in support of pre- and post-job evaluations, job planning, contamination control and management of radiological control operations. Significant changes in monitoring results should be identified and trends analysed periodically. Corrective actions should be taken as necessary.

NS-G-2.7

3.13. Before items are removed from any contamination zone, and in any case before they are removed from controlled areas, they are required to be monitored as appropriate (Ref. [2], para. I.23) and suitable measures should be taken to avoid undue radiation hazards.

Plant Response/Action:

A – Apparent Cause of Suggestion

Workers' experience is that there is a low risk of contamination due to the low source term. As a consequence there is an assumption that plant areas, tools and equipment are clean which results in complacent practices.

There is still inadequate challenge of sub-standard practices in the RCA. Many supervisors and RP staff still do not know what "good" looks like so poor practices go unchallenged thus becoming institutionalized.

Causal Code - **TR 2** – Training, Understanding Needs Improvement

Contamination Events have been primarily investigated by the Radiological Protection team with little line management accountability for their workers performance.

Analysis of Contamination Events is frequently superficial so root causes are not identified or addressed.

Causal Code - **MS2e** - Standards; Policies; or Admin Controls not used; - Accountability Needs Improvements.

B – Summary of action plan

The following actions have been placed to address this suggestion:

RCA Dress out training (DUCCA Gen) Lesson Plan has been reviewed to include additional emphasis on contamination control risks and appropriate control measures.

The Personal Contamination Event (PCE) rate has been made a Tier 2 Metric to ensure greater management oversight and challenge of performance.

PCE performance has been included in the Departmental Manager accountability template.

PCE metrics by major work group are presented to the Station ALARP Committee.

PCE CRs are assigned to and investigated by the relevant Departments.

PCE Mitigation Plan to be produced for Refueling Outage 15 based upon industry benchmarks.

A detailed Coaching Guide will be produced for line supervisors to help them identify good and bad practices in terms of contamination control.

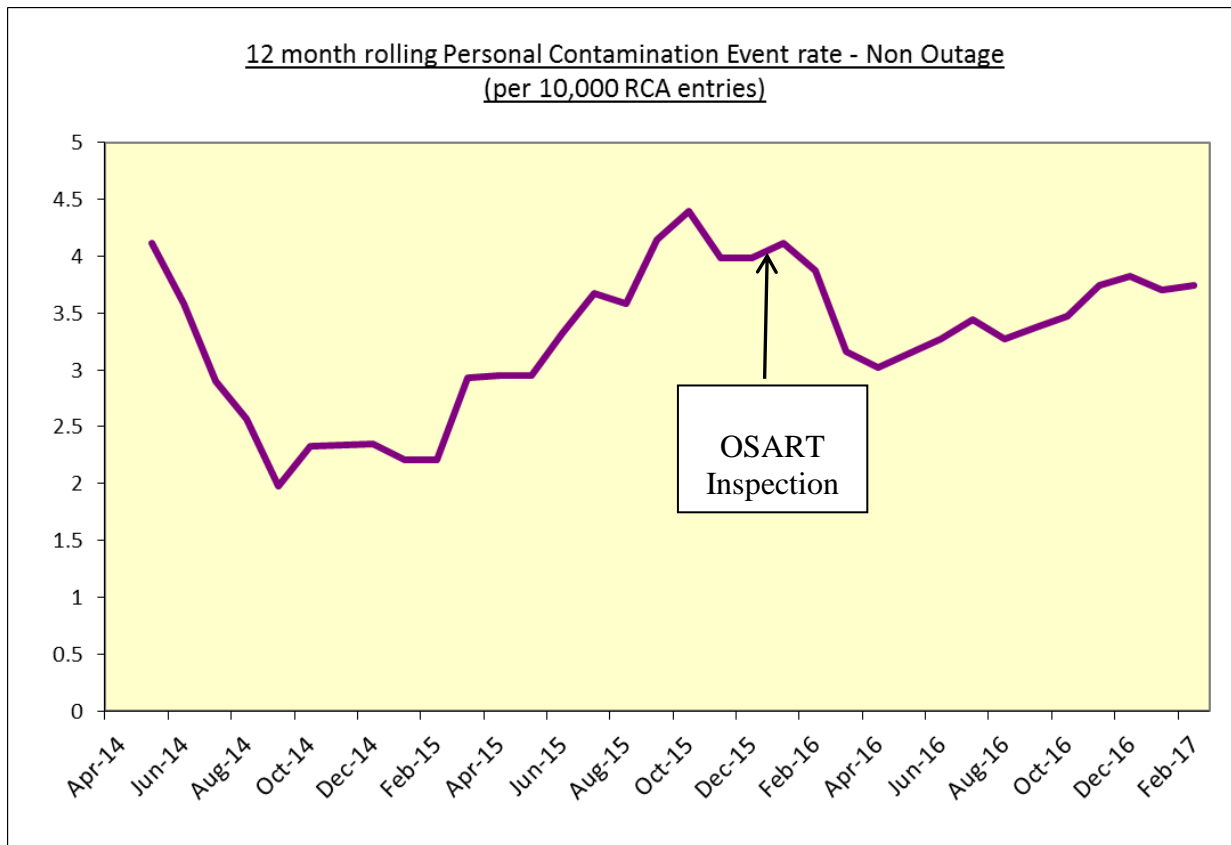
C - Action plan effectiveness review

As the original suggestion notes Sizewell's overall performance in terms of contamination control, when compared to industry peers, is good. For comparison the rate of Whole Body Contamination Monitor alarms at the RCA boundary at Sizewell is approx. 0.03% compared to 0.44% for EdF France, 0.04% for Spain, 0.25% for Belgium and 2% for Scandinavian plants. It also should be noted that the alarm set-point for the gamma detectors within the WBCMs at Sizewell is 400 Bq, compared to 600 – 800 Bq in Europe and 1000 Bq in the USA.

Dress out training has been reviewed and it has been concluded that this is NOT a contributory factor in terms of contamination control performance or worker behaviour. This judgement has been independently verified by an industry peer who has experience of the RCA Access training arrangements at Sizewell and US plants and who confirmed the high standard of Sizewell's training.

Some of the observed facts in the area of solid waste management reflect the very different expectations of different national regulatory regimes. The UK environmental regulator continues to drive UK licensees to maximize the quantity of solid waste that is sentenced to conventional, non-radioactive, waste routes even where the consequence is a relatively high proportion of "failures" at the waste package monitoring stage of the process. The UK environment regulator has requested licensees to attempt to identify waste originating in Contamination Areas ("Yellow Stream") as suitable for disposal as conventional waste. This will inevitably increase the ratio of waste that fails the monitoring stage however meets the expectation of UK's national radioactive waste policy.

Sizewell's contamination control performance since OSART is summarized in the graph below. This shows some improvement since OSART although the longer term trend is fairly static. The trend reflects the challenge of driving an improvement where (i) performance is already at a good international standard and (ii) the gaps to excellence are the result of long-standing behavioural and cultural issues that will inevitably take a longer period to address. Most of the simple or high-impact actions on contamination control have already been adopted by EDF Energy and/or Sizewell before the OSART inspection, with the consequence that what remains is inevitably a long journey of small incremental steps to the peak of international contamination control performance.



The majority of the actions listed in section B above have been implemented however, as explained earlier, they will need considerable time before they begin to positively influence performance. Wherever practicable existing company processes, for example the Fleet RP Improvement Plan, the Corrective Action Plan and Organisational Learning are being used to initiate further incremental improvements.

The two remaining specific actions, to develop a detailed PCE mitigation plan (using US NPP examples as the template) and to prepare a detailed RP Coaching Guide, are not planned for implementation until after the OSART return visit.

IAEA comments:

To response to this issue the station conducted analysis and benchmarking. This revealed two root causes for the lack of rigouron practices in the RCA to support contamination control improvement: 1) workers do not understand clearly what is wrong in their practices, and 2) supervisors were not sufficiently intrusive to correct inadequate practices.

To address this the station developed a detailed Coaching Guide for line supervisors to help them identify good and poor practices in terms of contamination control. This guide shows actual photographs from the field representing both good and poor practices. These pictures are displayed on the screens in the RCA and the Coaching Guide will be used to support training, to direct themed coaching focus areas and be used by leaders when performing task observations. Every month, a topic related to contamination control is reviewed in order to raise awareness of workers and to improve their adherence.

Also, a detailed Personal Contamination Event (PCE) mitigation plan has been elaborated for the forthcoming refuelling outage, based upon benchmarking. This plan contains specific actions to improve contamination control performance, including actions specific to worker

practices. The PCE Mitigation Plan includes for the first-time specific targets for Work Groups, to encourage line management accountability for their team's performance.

However, although this action has been well received and accepted by the plant personnel, improvements are not yet evident. The PCE plan will be tested for the first time during the next outage in November 2017 and the behavioural change expected with the Coaching Guide is expected to require at least a two/three years' period to become embedded.

Conclusion: Satisfactory progress to date.

7.4. CONTROL OF OCCUPATIONAL EXPOSURE

7.4(1) Issue: The station process for the setting of goals and tracking of medium risk work dose does not involve all relevant work groups to ensure the optimisation of doses.

The following observations were made:

- For work at power, radiological goals are established by the RP department based on the work that is supposed to be performed. There is no dedicated meeting or challenge with other Departments to establish dose goals.
- Tier 1 dose estimates are set in November of the preceding year. These estimates are set exclusively by RP department without systematic input from other departments. This does not allow the dose estimate to be reviewed by work groups, in order to optimise them.
- In the preparation phases, there is seldom interaction between RP and other work groups in order to analyse the risks and to optimize doses.
- Emergent defects associated with RHR pump maintenance required additional Maintenance and Operation resources in higher dose rate areas. At no stage were there discussions between RP and the work groups to ensure optimisation of doses.
- Sizewell B outage doses compared to similar stations were in the first quartile in 2014, however for the same benchmark Sizewell B at power doses were in third quartile.
- There is a lack of preparation with other work groups before the more significant jobs are carried out at power. An example is the planning & preparation of active waste container loading (CR # 957678 reference). At the end of the operation the waste container was found with a number of filters different from those initially specified. This necessitated the removal of the majority of the filters in order to count them again and therefore resulted in a collective dose higher than expected.

By not involving all relevant work groups in the setting of goals and tracking of dose, for medium risk work, doses may not be consistently optimized.

Suggestion: The station should consider enhancing the process for setting of goals and tracking of medium risk work dose to ensure that all relevant work groups are involved in the optimisation of doses.

IAEA Bases:

SSR-2/2

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

RS-G-1.1

4.6. Optimization of protection in operation is a process that begins at the planning stage and continues through the stages of scheduling, preparation, implementation and feedback. This process of optimization through work management is applied in order to keep exposure levels

under review, to ensure that they are as low as reasonably achievable [15]. The elaboration of a radiation protection programme, adapted to the specific exposure situations, is an essential element of work management.

4.19. To apply the optimization principle, individual doses should be assessed at the design and planning stages, and it is these predicted individual doses for the various options that should be compared with the appropriate dose constraint. Options predicted to give doses below the dose constraint should be considered further; those predicted to give doses above the dose constraint would normally be rejected. Dose constraints should not be used retrospectively to check compliance with protection requirements.

4.20. Dose constraints should be used prospectively in optimizing radiation protection in various situations encountered in planning and executing tasks, and in designing facilities or equipment. They should therefore be set on a case-by-case basis according to the specific characteristics of the exposure situation. Since dose constraints are source related, the source to which they relate should be specified. Dose constraints may be set by management, in consultation with those involved in the exposure situation. Regulatory authorities may use them in a generic way — for categories of similar sources, practices or tasks — or specifically, in licensing individual sources, practices or tasks. The establishment of constraints may be the result of interaction between the regulatory authority, the affected operators and, where appropriate, workers' representatives. As a general rule, it would be more appropriate for the regulator to encourage the development of constraints for occupational exposure within particular industries and organizational groupings, subject to regulatory oversight, than to stipulate specific values of constraints.

4.21. The process of deriving a dose constraint for any specific situation should include a review of operating experience and feedback from similar situations if possible, and considerations of economic, social and technical factors. For occupational exposure, the experience with well managed operations is of particular importance in setting constraints, as it should be for implementing the optimization principle in general. National surveys or international databases, delivering a large amount of experience with exposures related to specific operations, can be used in setting constraints.

NS-G-2.7

3.39. The planning of work to be undertaken in controlled areas where it is possible that levels of radiation or contamination may be significant is an important means of keeping doses as low as reasonably achievable and should be considered. The radiation protection group should take part in the planning of any activities that might entail significant doses and should advise on the conditions under which work can be undertaken in radiation zones and contamination zones.

3.40. Such work planning should include the provision of written procedures as appropriate. Matters that should be considered in the planning of work include:

- (a) information on similar work completed previously;
- (b) The intended starting time, the expected duration and the personnel resources necessary;
- (c) the plant's operational state (cold or hot shutdown, operation at full power or decreased power);
- (d) other activities in the same area or in a remote area of the plant that may interfere with the work or may require the work to be conducted in a particular manner;

- (e) the need for preparation for and assistance in operations (such as isolation of the process, construction of scaffolding or insulation work);
- (f) the need for protective clothing and a listing of tools to be used;
- (g) communication procedures for ensuring supervisory control and co-ordination;
- (h) the handling of waste arising;
- (i) requirements and recommendations for industrial safety in general.

3.41. Responsibilities with regard to interfaces between different working teams should be clearly identified. A responsible work supervisor should be designated who should ensure that all participants have received training, including training in radiation protection, as needed for the type of work and the conditions in which the work will be undertaken.

Plant Response/Action:

A – Apparent Cause of Suggestion

Radiation doses have historically been regarded as primarily the responsibility of the Radiological Protection group.

Sizewell is thought to have low radiation doses so there has not been stakeholder challenge to reduce on-line doses further.

Preparation for on-line work is quite weak by international benchmarks even after the station's improvements in work management. Jobs frequently extend well beyond their scheduled completion time with little challenge.

Cause MS1b: Process for on-line dose management is not up to best industry standards.

B – Summary of action plan

The following actions have been placed to address this suggestion:

The definition of a critical task, within the Work Management process now includes the criterion of "Tasks where dose rate limitation is a significant factor". In support of this process Radiological Protection have defined a collective dose threshold of 1 man.mSv to determine the basis for detailed dose planning. The expectation is for the work groups to engage with RP to develop detailed dose plans.

Departmental dose data is now presented to the station ALARP committee.

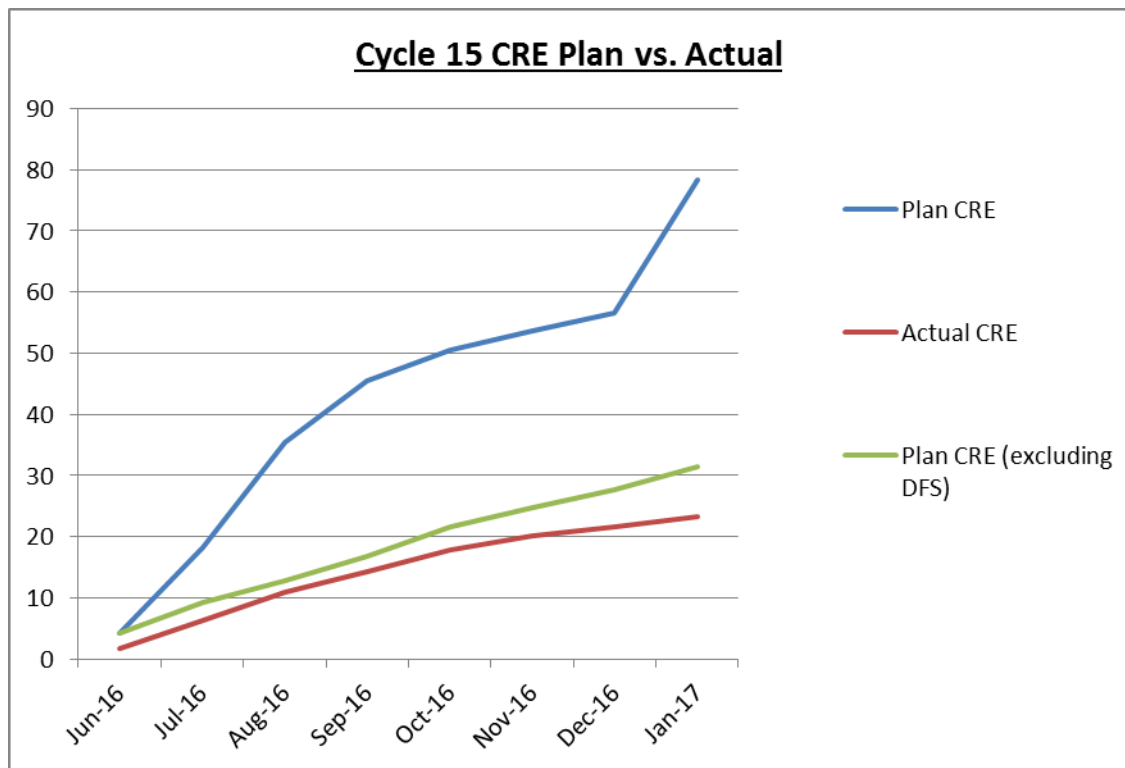
Detailed dose plans have been prepared for Low Level Waste shipments using operational dose data to derive dose budgets for the shipment.

Extensive detailed dose plans have been prepared for the Dry Fuel Storage project involving all major work groups.

C - Action plan effectiveness review

Calendar year 2016 end CRE was around 6% above budget principally due to an overrun in Refuelling Outage 14, which contributed 93% of the annual CRE. However for the on-line period doses were around 50% of budget and showed a reduction of 30% for the same period in the previous calendar year. In 2016 on line doses were the lowest value since 2012. For

Cycle 15 doses are significantly below budget because of delays in Dry Fuel Store commissioning. If the contribution of the Dry Fuel Store work is removed from the projections then the CRE is only 80% of the dose budget (see graph below) which supports the conclusion that radiation doses are being managed well.



Within the EDF Energy fleet Sizewell B recorded the lowest variance between dose budget and actual doses for calendar year 2016.

IAEA comments:

The analysis conducted on this issue concluded that reducing on-line doses was not a challenge due to the fact the doses are low. Also, it appeared that jobs frequently extend beyond their schedule with an impact for the dose due to too light preparation for on-line work.

To better involve relevant work groups in the optimisation of doses these two actions have been settled:

- When dose rate limitation is a significant factor (equal or above 1 man. mSv) the task is listed as “critical task”. That means an owner for the task is nominated and has the responsibility for planning and preparation taking into account among other things the dose budget. Some progress has already been seen: in 2016 the dose received during normal operation (34 man. mSv) is lower compare to the previous cycles (51 man. mSv in 2015, 40 man. mSv in 2014).
- For normal operation, specific dose targets for every Department i.e. maintenance, operation, technical safety, investment delivery project, engineering, nuclear logistic, contractors are now issued. The departmental dose target is given to the manager and, as a result, a much better ownership concerning the dose has already been seen.

Conclusion: Issue resolved.

8. CHEMISTRY

8.2. CHEMISTRY PROGRAMME

The station has a qualification process for labelling, storage and use of any chemicals. The user has to complete an application form and provide the safety data sheet and information about the activity. A chemist is responsible for managing the Control of Substances Hazardous to Health (COSHH) process. In parallel, a sample of the chemical can be analysed for impurities. If both processes are positive, the user is allowed to purchase the chemical and to use it for the intended activity. However, chemicals and substances are not labelled according to the area in which they are permitted to be used.

The team recognized that the handling of chemicals is not consistently applied across the station to ensure that the use of chemical substances and reagents do not always have an adverse effect on station equipment or industrial safety. The team made a suggestion in this area.

The secondary circuit pH was successfully increased in three steps from 9.3 to 10 to minimize the iron concentration. Iron concentration is monitored by daily trending. Every year, when the steam generators are cleaned, sludge is analysed and trended. The result in reduction of iron is significant, which the team identified as a good performance.

The Chemistry staff takes part in international round robin tests to ensure the quality of the analyses. All chemistry analyses data are documented in a Laboratory Information Management System (LIMS) which is the important source for quality control and trending. By trending all results of analyses, deviations in chemistry parameters typically are discovered immediately and corrective measures are typically promptly initiated. The Chemistry staff reacts early to deviations long before action limits are reached. This demonstrates an excellent understanding of safety culture. The team identified this as a good performance.

For any new chemicals there is a qualification process. The user has to complete an application form and provide the Material Safety Data Sheet (MSDS) and information about the activity. The station staff is required always to use the current version of the MSDS, so the station found an easy and user-friendly way to be up to date. All MSDS for the chemicals used in the station are delivered in a way which ensures that all MSDS's are always up to date. Data are provided to customers via a secure web site. The Team recognized this as a good performance.

DETAILED CHEMISTRY FINDINGS

8.2. CHEMISTRY PROGRAMME

8.2(1) Issue: The station policy for handling chemicals is not always consistently applied in order to avoid the potential of chemical substances and reagents having an adverse effect on station equipment or industrial safety.

During the mission the team observed the following facts:

- Two bubblers for Tritium sampling were incompletely labelled. The description of the contents (diluted nitric acid) was missing.
- There is a problem in affixing labels to the rubber solvent bottles. The labels do not stick to the surface of the bottles.
- Two bottles of methanol out of 76 in the radiochemistry laboratory were not correctly labelled (only labelled flammable and hazardous); the mandatory toxic label was missing.
- A box containing graphite was found in a cabinet in the workshop. The label on the box was dirty and unreadable.
- A box containing petroleum jelly was labelled three times: the original label from the supplier said the shelf life was 3 years from purchase, the other given by the station said it was valid until 2020. Additionally a third label added by the corporate depot showed the warning for harmful and toxic chemicals which is wrong in this instance.
- The station has a formal process for material compatibility control. However, chemicals and substances are not labelled according to the area in which they are permitted to be used.
- The station has self-identified deficiencies in handling chemicals; for examples in 2014 there were 6 relevant operational events.
- A new cabinet was filled with flammable chemicals but was not labelled, even though it was registered on the stations chemical storage log (cabinet 140).
- One out of 14 cabinets (cabinet 59) in the Main Store is labelled “flammable” but contained both flammable and corrosive chemicals.

Without having a consistently applied policy for handling chemicals, the station cannot ensure that the use of chemical substances and reagents may not adversely affect station equipment or industrial safety.

Suggestion: The station should consider enhancing the application of its policy for handling chemicals to ensure that the use of chemical substances and reagents does not have an adverse effect on station equipment or industrial safety.

IAEA Bases:

SSR-2/2

7.17: “The use of chemicals in the plant, including chemicals brought in by contractors, shall be kept under close control. The appropriate control measures shall be put in place to ensure

that the use of chemical substances and reagents does not adversely affect equipment or lead to its degradation.”

SSG-13

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

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

Safety in the use of chemicals at work – ILO; 4.2.5: “Each container or layer of packaging should be marked. The particulars should always be visible on the container or package during each stage of the supply and use of the chemicals.”

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

- a) the classification of the chemical;
- b) its hazards;
- c) the precautions to be observed.

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

Plant Response/Action:

A – Apparent Cause of Suggestion

An investigation of this issue suggested the apparent cause is driven by the following.

The EDF Energy Specification of Chemical Storage while consistent with the expectations of the WANO PO&Cs wasn't fully aligned with the standard in the IAEA Guidelines.

Causal Code - **MS1b & MS2c** - Management Systems - Standards, Polices or Admin Controls (SPAC) Not strict enough / Enforcement.

The required standard of Chemical Storage and Labelling was not being rigorously applied by the Chemical Storage Location Owners, probably due to inadequate expectation setting and knowledge outside the chemistry function.

Causal Code – **WD1c** - Work Direction, Preparation, Pre-job briefing needs improvement.

Causal Code – **TR2d** - Training Understanding, Practice / Repetition needs improvement.

In addition a single fact associated with “Chemicals are not labelled according to the area in which they are permitted to be used” is related to the fact that EDF Energy operates a process for Materials Compatibility and Chemical Control where chemicals are specified via Work Orders and can therefore only be withdrawn from stores for the intended application. This is a

different approach to that in the IAEA guidelines. However it achieves the same goal and is documented in the Sizewell B Materials compatibility standard.

B – Summary of action plan

The following is a summary of the action plan activities that have taken place to address the shortfall in Chemical Storage and Labelling:

- EDF Energy Standard (Guidance for Chemical Storage BEG/SPEC/ENG/TGN/062) revised.
- Redesigned Chemical Container Labels stocked in the Station stores.
- Planned General Inspection Training updated with Chemical Safety Expectations.
- Chemical Safety guidance provided for performing observations and PGIs.
- Advice containing blank chemical container labels produced for stores decanting area.
- Storekeepers briefed about storage and labelling requirements.
- Communications on Chemical Storage and labelling via Team Briefs and Safety Messages.
- Chemical Safety Awareness Refresher rolled out (including enhanced storage and labelling information).
- Chemical Store Audits reviewed and coaching provided to ensure chemistry staff are applying the correct standards.
- The Materials Compatibility Standard for Sizewell B has been updated to reflect the practices used for control of chemicals in the field.

C - Action plan effectiveness review

The action plan summarized above appears to have had the expected impact of improving both knowledge of Chemical Storage standards and compliance with those standards. Evidence for this includes.

- Records and discussion based on the Annual review of chemical stores (completed by chemists) have indicated fewer deviations from expectations.
- CR trend analysis indicates that Chemical Storage standards are known and action is being taken in the field by work groups to resolve identified issues.
- 5 Positive CRs have been raised since the OSART visit (until Jan 17) linked directly to improvements delivered by the OSART action plan.
- The Head of Chemistry and their deputy did an un-notified Chemical Storage location walkdown of a selection of stores and the standard of compliance was very good (CR 1025531).
- The learning from the Sizewell B OSART has resulted in an update of the EDF Energy Fleet Standard and a formal CAP actions to drive fleet learning.
- No CRs or other evidence of issues associated with chemicals being used inappropriately.
- Evidence of the robust nature of the materials compatibility process from assessments done in RO14, for investment projects and a recent fleet pilot training programme

(CR1024327).

IAEA comments:

In response to the suggestion made by the OSART team during the original mission, the plant has made efforts to identify causes of the issue of gaps in the Specification of Chemical Storage and Labelling and inconsistent application of the station requirements. These gaps were due to inadequate expectation setting and awareness of the plant personnel in area of handling of chemicals. In addition, lack of training, supervision and coaching by the station managers in the field has been identified as a contributing factor.

The EDF Energy Fleet has learnt from Sizewell B OSART mission results with the company standard for Chemical Storage and Labelling being updated and implemented across the fleet in mid-2016.

In excess of 500 staff and permanent contractors have received refresher training on Chemical Safety and Chemical Storage. Key staff (such as Planned General Inspection Leads) has been provided with additional supplementary training to support their specialist roles and to allow them to coach on chemical safety in the field.

Approximately 150 Site Chemical Stores have received their annual Inspection by the Chemistry Team since the last OSART visit. Standards were, in general, at the expected level with only minor deviations noted and corrected at the time of the inspection. The results of the 2016 inspection showed an approximate 50% reduction in total issues noted when compared with 2015. This included a 25% reduction in labelling deficiencies, a 62% reduction in Chemical Store housekeeping issues and a 44% reduction in expired chemicals requiring disposal. The absolute number of issues noted was low and affected less than 1 in 3 Chemical Stores.

Over the calendar year 2016 14 CRs were raised on Chemical Storage. 5 CRs were to recognise positive behaviours. The remaining 9 CRs were raised for cognitive trending to record where gaps to standards had been corrected. Both statistics are considered positive indicators of improved Chemical Safety Culture.

Conclusion: Issue resolved

9. EMERGENCY PREPAREDNESS AND RESPONSE

9.1. ORGANIZATION AND FUNCTIONS

The station has performed a hazard assessment for emergency planning purposes. The hazard assessment selected design basis accidents as a basis for the emergency plans. In addition, the station is considering the concept of extendibility to cover beyond design basis accidents. The team has made a suggestion to consider benchmarking the hazard assessment against the approach used in other countries.

The team observed that the “EP Focus Index” was the lowest in the EDF-Energy fleet in May 2015. This has since showed constant improvement up to now. The separate “EP scorecard”, which allows corporate management to compare the performance between the sites, is no longer being updated at Sizewell B. The use of two separate indices is due to a mismatch between the generic fleet requirements and the way Sizewell B can meet those requirements. The team encourages the station to resolve those issues and continue to monitor performance of the emergency preparedness programme at Sizewell B.

9.2. EMERGENCY RESPONSE

When an emergency is declared, the Rapid Reach pager system for emergency recall is used to promptly notify the personnel on duty and the public authorities. The system failed repeatedly to reach all persons on duty during tests, due to network coverage in the local area. The station is encouraged to continue the investigation of this problem and to find a solution.

The Sizewell B Emergency Manual describes the conditions for the classification of an emergency. Some conditions refer to Site Operating Instruction SOI 8.1 – Critical Safety Function Monitoring, which uses a classification system based on station parameters. This meets the intent of the IAEA guidance. However, the Emergency Manual includes other conditions that are not specific to the Sizewell B station and may not trigger the appropriate classification unambiguously. Examples include “Emergency Services personnel are required to make access to a Radiological Controlled Area (RCA) in significant numbers”, “A significant increase in site radiation levels is observed”, and “An increase in containment radiological and/or environmental conditions is observed”. The station is encouraged to make all conditions for the classification of an emergency more quantitative rather than qualitative and specific to the Sizewell B station.

The station has telephone land lines with backup and redundancy at all emergency facilities. It also has mobile satellite phones that can connect with the corporate Central Emergency Support Centre. The local police have their own satellite phones, but the satellite phone numbers have not been shared between organizations. The station is encouraged to share all phone numbers, including satellite phones, between organizations involved in the response to an emergency.

The process used by the station to assess off-site radiological consequences, transmit data and recommendations to the public authorities has not been optimized to reduce unnecessary delays. The team made a suggestion in this area.

The habitability criterion for Muster Points is 100 $\mu\text{Sv/h}$ (based on the Electronic Personal Dosimeter alarm setting), but the Emergency Handbook, Section 10.3.6 sets the on-site survey evacuation criterion at 30 000 $\mu\text{Sv/h}$, while Section 10.10.2 sets the on-site dose rate limit for all staff not actively engaged on station control or damage control to 300 – 3 000 $\mu\text{Sv/h}$. The station is encouraged to ensure that the habitability criteria are consistent across procedures and policy documents.

Dose to emergency workers above 100 mSv, up to 500 mSv are approved for life saving operations by the Emergency Controller. The station doesn't have a documented or pre-established briefing for emergency workers who could receive doses in excess of 50 mSv. The position of the station is that emergency workers have been trained and are aware of the risks. The team encourages the station to ensure that emergency workers who could receive a dose in excess of 50 mSv are always volunteers who have been clearly and comprehensively informed of associated health risks.

9.3. EMERGENCY PREPAREDNESS

The station has a well-developed exercise evaluation program, but the evaluation report does not list the facts used to develop the evaluation. The evaluation report would be more credible if each finding mentioned in the report was based on well supported observations. The team made an encouragement in this area.

The station created a very comprehensive list of emergency exercise constraints that must be exercised every five years. The team recognized a good practice in this area.

DETAILED EMERGENCY PREPAREDNESS AND RESPONSE FINDINGS

9.1. ORGANIZATION AND FUNCTIONS

9.1(1) Issue: The station has not benchmarked its methodology for conducting the hazard assessment required within the IAEA Safety Standard for emergency planning against the approach applied in other countries.

The team noted that the station has invested considerable resources in an Emergency Response Centre and in Emergency Backup Equipment that will help mitigate the progression and consequences of beyond design basis accidents.

However, the team has made the following observations:

- The current planning basis for nuclear and radiological accidents is described in “REPPIR Report of Assessment for Sizewell B 2014”; Section 3.1.13 n) and Appendix A. The planning basis is further explained in document “The REPPIR Reference Accident – Additional Information for Sizewell B”. Following a consideration of the likelihood and consequences of the entire range of fault sequences examined in the Station’s Safety Case (including events of very low probability and outside the design basis of the station), the most severe design basis faults were selected as the basis for defining detailed off-site plans. The UK approach is for these detailed plans to provide the basis for a more extensive response to even less likely but potentially more severe consequences (what the UK refers to as “extendibility”). This approach meets UK regulations but is different to that used in most other countries who base plans on events involving severe damage to the reactor fuel.
- The Emergency Control Centre and the Technical Support Centre located in the Auxiliary Shutdown Building do not have equipment to check personnel for contamination (contamination monitor or portal monitor) before they come into the building during an emergency. There is a single personal electronic dosimeter in the Emergency Control Centre, a whole building intake air monitoring but no local ambient gamma detector or air sampler. In contrast, the backup Emergency Control Centre at Sizewell A has the appropriate suite of detection equipment. The Emergency Response Centre is in the process of acquiring the appropriate detection equipment, but already has a portal monitor and decontamination facilities.

Without benchmarking its methodology to conducting the hazard assessment for Sizewell B’s emergency planning against the methodology used by similar stations in other countries, the station may not understand the reasons for differences and may not consider whether changes are desirable.

Suggestion: The station should consider benchmarking its methodology to conducting emergency planning hazard assessment against the methodology used by similar stations in other countries to ensure that events involving severe damage to the reactor fuel are adequately addressed in emergency plans.

IAEA Bases:

GSR Part 7

4.18: “Hazards identified and potential consequences of an emergency shall be assessed to provide a basis for establishing arrangements for preparedness and response for a nuclear or radiological emergency. These arrangements shall be commensurate with the hazards identified and the potential consequences of an emergency.”

4.19: “For the purposes of these safety requirements, assessed hazards are grouped in accordance with the emergency preparedness categories shown in Table I. The five emergency preparedness categories (hereinafter referred to as ‘categories’) in Table I establish the basis for a graded approach to the application of these requirements and for developing generically justified and optimized arrangements for preparedness and response for a nuclear or radiological emergency.

TABLE I. EMERGENCY PREPAREDNESS CATEGORIES

Category	Description
I	Facilities, such as nuclear power plants, for which on-site events (including those not considered in the design – this includes events that are beyond the design basis accidents and, as appropriate, conditions that are beyond design extension conditions) are postulated that could give rise to severe deterministic effects off the site that warrant precautionary urgent protective actions, urgent protective actions or early protective actions, and other response actions to achieve the goals of emergency response in accordance with international standards, or for which such events have occurred in similar facilities.

4.20: “The government shall ensure that for facilities and activities, a hazard assessment on the basis of a graded approach is performed. The hazard assessment shall include consideration of:

(a) events that could affect the facility or activity, including events of very low probability and events not considered in the design;”

EPR-NPP 2013

4: “The sizes of the zones and distances can be established based on specific analysis of the nuclear power plant, as long as releases that are representative of those expected for an emergency involving severe damage to the reactor fuel are considered, as illustrated in Appendix 1.”

Plant Response/Action:

A – Apparent Cause of Suggestion

The apparent cause of this shortfall is the lack of benchmarking at other light water reactors. Sizewell B’s emergency arrangements follow the same planning methodology as the AGR fleet without specific comparison with similar reactors in other countries.

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

Causal Code – **MS3b** – Management Systems, Oversight/Employee Relations, audits and evaluations lack depth.

B – Summary of action plan

Observation 1

This observation recognises that the UK covers the requirements of REPPIR legislation and the need for extendibility but that this is not aligned to most other countries. It points out that although this is acceptable under UK legal framework it would be beneficial for benchmarking exercises to be carried out at light water reactors in other countries in order to consider whether the UK approach is the best one or whether improvements could be made.

Corporate Emergency Planning Group (EPG) is responsible for policy making within the Fleet Emergency Arrangements. Part of this responsibility entails benchmarking at other Stations both domestic and international. EPG should consider whether it is beneficial to undertake such benchmarking visits on behalf of Sizewell B and future light water reactors and feedback findings as part of this OSART review. Benchmarking visits should then be used to evaluate whether the current Emergency Arrangements in place in the UK should be changed (or not) in line with international best practice. If benchmarking has already been carried out then, once more, the findings should be published and reasons for no changes to the current arrangements for UK PWR made apparent.

Action EPG has undertaken benchmarking of other light water reactors (PWR) in other countries in order to evaluate the efficacy of current emergency arrangements for the UK PWR.

Observation 2 – Lack of monitoring in ECC.

This observation may be split into two parts:

- a) Lack of personnel monitoring equipment within the Auxiliary Shutdown building for people accessing the ECC and TSC in an emergency.
- b) Lack of gamma monitoring/air sampling equipment within the ECC.

Addressing these in turn:

- a) This is a correct observation. Currently there is no means by which personnel accessing the ECC can monitor themselves on entering the Auxiliary Shutdown building.

Action: Personnel monitoring equipment has been installed into the entrance lobby area of the Auxiliary Shutdown building.

- b) This is an incorrect assumption which was brought to the attention of the OSART team at the time of their visit. The entire Auxiliary Shutdown building is monitored for external airborne contamination on its inlet HVAC through a Particulate-Iodine-Gaseous (PIG) monitor. On seeing raised levels of activity on the air inlet this system automatically switches off the air intake to the building. The MCR (or a person manually in the TSC) has the ability to then re-align the intake to pass through the HEPA and Iodine filtration system thus protecting the entire building from an airborne activity hazard. Secondly, there is an installed ion chamber gamma monitor located within the TSC. Both the TSC and ECC are supplied via the same HVAC system. The two rooms are linked by HVAC and also via doorways and ventilation

grills and are located adjacent to each other. Therefore, the ECC does have installed monitoring equipment as any gamma radiation detected within the TSC is indicative of radiation in the ECC.

Recommendation: No changes are required to ECC gamma monitoring.

C - Action plan effectiveness review

EPG has completed benchmarking of other light water reactors (PWR) and data obtained for further analyses.

Analysis of the returns from the benchmarking questionnaire is currently being performed; this will result in EPG producing a report with recommendations for Sizewell B to implement or preparation of a statement justifying no change is in progress within EPG.

A CM11 Frisker has been installed in the entrance lobby area of the Auxiliary Shutdown building this enables individuals to monitor their entire body on entering the building. Maintenance and service routines have been established.

IAEA comments:

The station has analysed the apparent causes of the suggestion and a ‘Benchmarking questionnaire’ was developed by Corporate Emergency Planning Group (EPG) in November 2016. The questionnaire was circulated to all operators who are WANO members and responses were received from 6 operators of PWR units in Europe. EdF Energy is in the process of analysing the results from the survey and may need to seek further clarifying information from some of the contacted operators.

During the OSART follow-up mission the results from analysis of the received responses were presented (Report OTS/REP/EPG/035) confirming that although similar methodologies were used, emergency planning zones (eg. PAZ and UPZ) are larger in several of the countries as more severe accidents have been considered as reference ones. Several countries are also currently updating their legislation to implement the latest IAEA requirements on emergency planning as defined by the IAEA GSR Part 2 which was revised after the Fukushima NPP accident. It was noted that many of the differences identified by the benchmarking activity were already recognized and understood and EdF Energy is eager to work with Lead Governmental Department and the UK Nuclear Safety Regulator to identify a solution to address IAEA recommendations through UK legislative work in response to the BSSD.

During the follow-up mission, the station attention was also drawn to the following facts:

- The recent discussions at European level amongst the national nuclear safety regulators (at WENRA level) and national radiation protection regulators (at HERCA level) with the participation of UK regulatory authority provided guidance for consideration within domestic legislative frameworks:
 - evacuation should be prepared up to 5 km around nuclear power plants, and sheltering and ITB up to 20 km;
 - a general strategy should be defined in order to be able to extend evacuation up to 20 km, and sheltering and ITB up to 100 km;

- nuclear and radiation safety authorities in Europe should continue attempts to promote compatible response arrangements and protection strategies amongst the European countries.’

As it was discussed during the original OSART mission the station confirmed that the methodology for conducting emergency planning hazards assessment meets the national regulatory system requirements, however based on the analyses and evaluation of the benchmarking results the EdF Energy EPG is fully committed to work (via the UK Nuclear Emergency Agreement Forum) alongside with all stakeholders involved in the emergency planning in the UK and propose amendments, if such are found necessary, in particular as a result of the forthcoming transposition of the new EU Basic Safety Standards Directive (BSSD) concerning radiation protection. EdF Energy is actively participating in the consultation process for this directive transposition and takes a proactive approach using the results from its benchmark study to provide adequate advice on the establishment of emergency planning zones. The BSSD transposition process will be completed by February 2018. It will be possible to review the progress achieved during the next OSART mission to EdF Energy scheduled for early 2018.

The IAEA acknowledges that on the very last day of the OSART mission they were provided with some information concerning the monitor for airborne contamination on the inlet of the HVAC of the Auxiliary Shutdown building, and the installed ion chamber gamma monitor located within the TSC. During the follow up mission this information was confirmed by the station and accepted by the team as evidence that these two pieces of equipment should ensure long term habitability of the ECC and TSC. The IAEA’s concern about the lack of means of monitoring personal contamination for emergency workers coming into the ECC and TSC facilities during an emergency was resolved by the installation of a CM11 frisker into the entrance lobby area of the auxiliary shutdown building.

Conclusion: Satisfactory progress to date

9.2. EMERGENCY RESPONSE

9.2(1) Issue: The process used to assess off-site radiological consequences during a nuclear emergency is not optimized to reduce unnecessary delays when providing data and recommendations to public authorities.

The following observations were made:

- There is a gap between the expectations of public authorities regarding the timing of response actions, and the clarity of the expectations of the station. For example, the exercise report for Exercise Tiger (25th February 2015) gives a target time of 70 minutes after the site emergency warning signal is activated for the first written counter measure advice to be handed to the Police liaison at the Emergency Control Centre in the Emergency Response Centre building, instead of giving 70 minutes to update the standing advice automatically already implemented within 30 minutes in accordance with the local authorities. The station target time for the first off-site survey results is 90 minutes. In contrast, the Sizewell off Site Emergency Plan assumes that an agreement on off-site protective actions will be achieved within 30 minutes of the declaration of an emergency, and initial radiation monitoring results at the site boundary or near the site will be available within 60 minutes.
- The station currently uses the site boundary ambient gamma dose rate monitoring stations, in combination with other station conditions, to trigger the prompt declaration of an off-site emergency. However, the station could also use these measurements to measure the extent of the radiation contamination around the site by promptly making these measurements available to the public authorities. The alarms and dose rate readings are available on-line at the station and the Central Emergency Support Centre, but they are not available on-line at the Strategic Coordination Centre in Ipswich.
- There is no operational intervention level for gamma dose rate measurements that triggers urgent protective actions. Instead, the Central Emergency Support Centre uses the gamma dose rate measurements, along with wind direction from the on-site meteorological data, to estimate the source term, and subsequently calculate the effective dose. This is then compared with the Emergency Response Level for triggering protective actions in the population. This complex chain of calculations takes time and may delay the response.
- The station has not implemented pre-established operational criteria in the most efficient manner. For example, the only operational intervention levels are associated with gross beta measurements of air samples; taking and counting air samples takes time. The station also performs swab measurements of ground contamination but there is no operational intervention level based on ground contamination measurements that triggers urgent protective actions.

Without improving the process used to assess off-site consequences during a nuclear emergency, unnecessary delays may arise in providing data and recommendations to public authorities.

Suggestion: The station should consider optimizing the process applied for assessment of off-site radiological consequences by using operational intervention levels during the early phase of an emergency, in order to avoid unnecessary delays in providing data and recommendation to public authorities.

IAEA Bases:

GSR Part 7

5.34: “These arrangements as stated in para. 5.32 shall include the use of pre-established operational criteria in accordance with the protection strategy (see para. 4.28(4)) and provision for access to instruments displaying or measuring those parameters that can readily be measured or observed in a nuclear or radiological emergency.”

5.40: “Within emergency planning zones and emergency planning distances, arrangements shall be made for timely monitoring and assessment of contamination, radioactive releases and exposure doses for the purpose of deciding on or adjusting the protective actions and other response actions that have to be taken or are being taken. These arrangements shall include the use of pre-established operational criteria in accordance with the protection strategy (see para. 4.28(4)).”

EPR-NPP 2013

2.2: “Upon identification of condition leading to severe fuel damage (i.e. General Emergency) take the following steps, as illustrated in FIG 1:

Step 1. Within 15 minutes, the shift supervisor declares a General Emergency on the basis of predetermined conditions and instrument readings in the nuclear power plant within the classification system (EALs exceeded).

Step 2. Within 30 minutes, the shift supervisor notifies the off-site decision maker(s) responsible for protecting the public within the PAZ, UPZ, EPD, and ICPD.

Step 3. Within 45 minutes, the off-site decision maker(s) starts implementing the urgent protective actions for the public, as detailed in Section 5.”

EPR-NPP 2013

2.4: “Networks of automated environmental monitoring stations can also be useful in directing monitoring teams, and when combined with operational intervention levels (OILs), in identifying areas warranting evacuation, relocation and food restrictions following a release. In all cases, tools used as a basis for urgent protective actions must be integrated into decision-making systems in such a way that their use will not delay the implementation of urgent protective actions, especially for making decisions concerning those that need to be taken before or shortly after release to be most effective.”

EPR-NPP 2013

8.1: “Operational criteria need to be developed in advance in order to trigger response actions based on environmental measurements and samples. Procedures to revise default OILs needs to be developed according to the prevailing circumstances. When criteria are developed during an emergency they are not trusted by the public.”

Plant Response/Action:

A – Apparent Cause of Suggestion

The UK uses a different interpretation in its approach to IAEA recommendations for informing public authorities of advice and hazards following an Off-Site Nuclear Emergency. However, though this approach is different, it is not necessarily incorrect or of less value.

Causal Code - **MS1c** – Management Systems, Standards policies or admin controls, confusing or incomplete.

B – Summary of action plan

Observation 1

This recognised a gap between the expectations of public authorities regarding countermeasure advice and those of the Station. It used an emergency exercise (Exercise Tiger) to illustrate this.

The Station does not believe that there is a gap between the expectations of public authorities regarding countermeasure advice and those of Sizewell B for the following reasons:

- a) Exercise Tiger was a very specific exercise designed to test response under unusual and extreme circumstances. This was an out of hours exercise during an severe weather event that impeded access to Site and the surrounding areas. As such, timings were extended to allow for personnel ‘travelling from home, picking up survey vehicles and then going out into the environment to sample’. This was thought to be a realistic response time given the extraordinary conditions postulated by the scenario. Under ‘normal’ environmental conditions, that is with no extreme weather or other confounding factors (floods across roads for example), the first Off-Site survey results would be expected within 60 minutes of declaration. Using other exercise reports would have been more representative.
- b) The UK nuclear industry has agreed with public authorities that in the event of an Off-Site Nuclear Emergency that those external organisations will immediately follow pre-prepared and pre-distributed countermeasure advice. This ‘standing’ countermeasure advice is very conservative and is designed to give reassurance as well as protection to the public immediately after declaration. These recommendations are later backed up when survey results become available. However, the conservative nature of the ‘standing’ advice is such that it is unlikely that recommended actions would change even for fairly extreme events. Therefore it is erroneous to state that the Station does not provide advice within the local authority required 30 minute period.

Action: ‘Standing countermeasure advice’ has been added to the script for future exercises. Its omission in exercise scripts leads to the assumption by observers that there is no public protection advice until survey results have been processed.

Observation 2

It was noted that although the Station and CESC are able to see live dose-rate readings and alarms on EPGMS fence monitors, the same capability is not available at the SCC which would be useful information for the Off-Site authorities.

Station Response: This is a correct observation. However, the SCC does receive data from the CESC with regards to dose-rate readings through the The Incident Information Management System (TiiMs). Enabling a live feed to the SCC requires a policy change within the Company and not just at Station level as it would need to include all other EDF Nuclear Generation Stations and not just Sizewell. Whether this would actually assist in the Local Authority response is debateable given that ‘standing countermeasure advice’ is extremely conservative (see Observation 1, section b above).

Action: Emergency Planning Group (EPG), Barnwood has reviewed whether there is a case to include live EPGMS monitor feed to the SCC.

Observation 3

It was noted that there is no operational intervention level for gamma dose-rate measurements and that all interventions and countermeasures are based on airborne activity measurements and a complex chain of calculations to estimate effective dose to the affected population.

This observation is correct. The Station uses airborne activity data, coupled with a typical source term for the Station to calculate projected effective dose to individuals in affected areas. This is not unique to Sizewell B as it is the recognised and established methodology for providing advice to protect the public throughout the UK and is endorsed both by the Nuclear Industry, Government (through legislation) and the Regulator (ONR).

The UK has interpreted the recommendations of the IAEA and ICRP by developing a very conservative pre-prepared and pre-distributed countermeasure advice (standing countermeasure advice) in order that Local Authorities and Emergency Services can take steps to protect the public before any radiological data is available, thus removing the urgent need to collect dose-rate data. This pre-distributed advice covers all possible protection requirements for a design basis event recognised in Station Safety Cases. This is, in fact, in line with the IAEA Standards documentation *EPR-NPP Public Protective Actions (2013)* requirements for dose-rates within design basis limits and up to Operational Intervention Level 2 (OIL 2) (dose-rate of up to 100 $\mu\text{Sv h}^{-1}$), which is beyond design basis levels. As a result there is no delay in any recommended actions for public authorities. The 'standing countermeasure advice' allows time for more robust and detailed measurements and analysis to be made thus allowing for better informed decision making with respect to protection of the public. The Station believes that this follows and complies with the intent of the above documentation.

Higher dose-rate levels fall under the category of extreme beyond design basis events. Inclusion requires a policy change within the UK on whether emergency plans should routinely cover these types of events.

It should be noted that any change to introduce gamma dose-rate triggers for the formulation of advice to protect the public would need to be a National decision as the above observation is not exclusively a Sizewell B, or EDF energy issue.

Action: EPG is reviewing whether there is a need to incorporate the use of gamma dose-rate triggers into data provided to public authorities as part of information used to determine advice for the protection of the public. This review will also include discussion with ONR regarding the benefits (or not) of using such data as any decision affects the whole of the UK Nuclear Industry.

Observation 4: Recognising that the current off site airborne sampling procedures introduce delays as the maypacks have to be taken to the District Survey Laboratory (DSL) for gamma spectrometry analysis the fleet has initiated a programme to upgrade the current Off Site Survey vehicles to include a new gamma spectrometry instrument. The instrument utilizes Chromium Zinc Telluride crystals that do not require cryogenic cooling, therefore the instruments can be reasonably small in size and ideal for use in the vehicles. The new instrument will positively identify naturally occurring radionuclides from Radon or (in the case of a genuine off-site release) the reactor radionuclides resulting in dose to the public.

This includes a new software package developed specifically for EDF Energy to meet the emergency scheme requirements.

The software produces a new Maypack Inhalation Dose Assessment (MIDA) report directly from the vehicle.

The new report encompasses the data that was provided by the NIAS report, the old MIDA report and the raw gamma spectrometry results from the DSL.

The new report will be emailed using 3/4G technology via the vehicle mobile phone, directly into the EDF Energy Red network and then into the Blue LAN. It can be emailed to any address necessary.

EDF Energy already has priority on the mobile phone network during an emergency.

Once the report is reviewed at the ECC or CESC, a more effective colour coding method will be applied and plotted onto the maps:

Action: Complete the planned fleet wide project to install Gamma Spec capable equipment into the Off Site Survey Vehicles. This will reduce current delays by removing the need wait for the data being generated at the District Survey Laboratory (DSL).

C - Action plan effectiveness review

Action: Action to include standing countermeasure advice in exercise templates (scripts) has been completed.

Action: Emergency Planning Group (EPG), Barnwood have considered whether inclusion of a live EPGMS data feed into the SCC would be beneficial to the emergency arrangements. A review was undertaken with input from various SCC users. The conclusion is that the intent is to retain the existing arrangement, whereby the Central Emergency Support Centre provides the SCC with plume/radiological data and information. Providing raw data from a singular source (EPGMS) to the SCC would potentially introduce a significant error trap (particularly before the company team arrives in the facility) as one set of indications may be incorrectly used/interpreted by non-SQEPs to determine countermeasure advice. This would be a regression from the established position, whereby this information is reviewed by a team of experts and combined with data from survey vehicles and other indications, before being provided (alongside interpretation) to the SCC team. [The action is complete].

Action: EPG are considering whether there is a need to incorporate the use of gamma dose-rate triggers into data provided to public authorities as part of information used to determine advice for the protection of the public. This consideration will also include discussion with ONR regarding the benefits (or not) of using such data as any decision affect the whole of the UK Nuclear Industry. **Status:** [In Progress].

Action 4: The programme to upgrade the Off Site Survey (OSS) vehicles in order to allow Gamma Spec analysis to be performed within the vehicles is in progress. SZB are expected to be completed by end July 2017. Procurement of a replacement 3rd vehicle has been completed. This allows the two duty vehicles and spare vehicle to be cycled through the refit under the project. Hunterston NPP is the first station to complete and has been the trial to test for the functionality and reliability of the system being implemented. Progress is currently aligned to the fleet programme. **Status:** [In Progress].

IAEA comments:

The station has analysed the OSART mission findings to identify the apparent causes of the suggestion and propose improvements, where appropriate.

As concerns the gap between the expectations of public authorities regarding the timing of response actions, and the clarity of the expectations of the station further information was provided by the station to clarify the OSART mission observations. It was noted, that the exercise Tiger which was considered during the OSART mission was simulating extreme conditions and one of the primary purposes of this exercise was to test several changes made to the emergency arrangements, following the post Fukushima enhancements and Sizewell B taking over responsibility for off-site survey duties from the Sizewell A station being under decommissioning. After the exercise results evaluation more than £10000 have been invested in replacement of the telephone system used in the ERC. Similarly the transfer of the off-site survey capability has now been completed with further training to ensure the station target of 60 min for providing written counter measure advice to the local authority is met. The 9 exercises or training sessions performed since June 2016 demonstrated that such advice is issued within the 60 min of the declaration of an emergency agreed with the public authorities. During the follow-up mission the results from these activities were reviewed and no deviations were observed. The station also included 'standing countermeasure advice' in exercise templates (scripts) and amended the station emergency procedure SZB EM HBK SEC 2 in June 2016 to include issuing promptly 'standing countermeasure advice'.

EdF Energy Emergency Planning Group (EPG), has considered whether inclusion of a live EPGMS data feed into the SCC would be beneficial to the emergency arrangements. A review was undertaken with input from various SCC users, including representative of the Local Authority Duty Holder for the off-site Emergency Plan for Suffolk Council. During the follow-up mission the EPG explained the reasoning of not considering the IAEA suggestion on this particular observation as not cost effective given the other channels for information communication. The local authorities contacted during the follow-up, confirmed that they see no benefit of having live EPGMS data in the SCC and provision for easily understood hazard data in the SCC is likely to be taken forward during the on-going work on transposition of new Basic Safety Standards Directive. This was confirmed in by an email from Suffolk Council of 26.04.2017.

During the OSART mission an observation was made that there is no operational intervention level for gamma dose-rate measurements and that all interventions and countermeasures are based on airborne activity measurements and a complex chain of calculations to estimate effective dose to the affected population. The 'standing countermeasure advice' issued on the basis of emergency classification, as applied in the UK, is fully in-line with the IAEA Safety Standard. The use of Operational Intervention Levels is another tool recommended by the IAEA that assists authorities in making prompt decisions when off-site radiological conditions are severe. Both tools should be included in comprehensive and effective emergency plans that comply with IAEA requirements. EPG has analysed this IAEA concern and used the information received from other countries on their respective practices which was part for the emergency preparedness benchmark performed by EPG after the OSART mission. The benchmarking shows that many countries are revising their legislation to align it with the IAEA GSR part 7. The results of EPG analyses were summarized in report 'NEAF Good practices Guide- Estimation of radioactive source terms and provision of real-time information about releases', draft 20.03.2017 and presented during the OSART follow up mission. It was noted the issue is not unique to the Sizewell B station, but rather concerns the whole UK NPP fleet. The conclusion on this matter is expected to be made alongside with

any other changes that might be necessitated as a result of consultation process for the transposition in the UK of the EU new Basic Safety Standards Directive (BSSD) by February 2018.

In order to avoid any delays for gamma spectrometry analyses in case of emergency a project to upgrade the current Off Site Survey (OSS) vehicles to include a new gamma spectrometry instruments was developed at EdF Energy level. The instruments to be used will utilise Chromium Zinc Telluride crystals that do not require cryogenic cooling, therefore the instruments can be reasonably small in size and ideal for processing in vehicles. The requested software to support this processing was developed for EdF Energy. Three vehicles will be available at each site which will allow the vehicles to be cycled through the refit under the project. Hunterston NPP is the first station to complete the action and has been the trial to test for the functionality and reliability of the system being implemented. The equipment installation and personal training was completed for Hunterston station during February - April 2017. During the follow-up mission the project progress was reviewed. All actions are implemented on time and the Sizewell B improvements are scheduled to be completed by end July 2017. This is an excellent initiative using state-of-the art technology and when completed for Sizewell B station will improve the timeliness of the station analysis of airborne samples.

Conclusion: Satisfactory progress to date

9.3. EMERGENCY PREPAREDNESS

9.3(a) Good Practice: The range of emergency exercise constraints that are tracked is very comprehensive.

In conformity with IAEA standards, the station implemented an exercise programme that covers all response functions required during an emergency, and tests the associated exercise objectives and the emergency personnel regularly.

In addition, the station created a comprehensive list of exercise constraints that must be tested over a five year period:

- Normal working hours; outside working hours
- Normal operation; outage
- Mustering with automatic system; mustering with manual system
- Alerting with automatic system; alerting with cascade of telephone calls
- With main communication network available; without main communication network available
- With public address system available; without public address system available
- With Main Control Room available; without Main Control Room available
- With Emergency Control Centre available; without Emergency Control Centre available
- With Access Control Point available; without Access Control Point available
- With Shift Manager; without Shift Manager
- With Emergency Controller; without Emergency Controller
- With external services (police liaison) at Emergency Control Centre; without external services
- Fire with off-site fire service support; without off-site fire service support
- Security event with off-site police service support; without off-site police service support
- Release monitoring with off-site survey available; without off-site survey available
- With electrical grid available; without electrical grid available
- Slow reactor depressurization; Fast reactor depressurization
- With contained accident; with release to the environment
- With high radiation environment for emergency response teams; without high radiation environment

Tracking such a comprehensive list of constraints ensures that the emergency plan is tested under the full range of conditions that could arise during an emergency.

Result: By implementing this process, the station identified corrective actions to cover gaps in the emergency arrangements that would not have been detected otherwise.

Some examples where this has been beneficial to the station include the following:

- Exercising lack of an emergency Controller highlighted a very high burden of work falling on the Shift Manager and subsequently led to the simplification of the Shift Manager first hour response (e.g. introduction of snatch-pack, pre-arranged notification messages agreed with police).
- Exercising loss of ACP availability led to modification of the alternate facility to enable it to run both as a forward control point and a fully operational ACP.
- Exercising loss of electronic muster system led to the introduction of the manual tally system which allows rapid manual accountability of personnel. This is also frequently practiced in exercises and has led to an efficient and well-disciplined manual system that is now seen by the UK regulator as industry best practice.
- Exercising loss of automatic notification system raised the issue of increased burden on the Shift Manager within the first hour in order to carry out notifications. The Cascade officer was introduced as a result of this, thus releasing the Shift Manager from the requirement to follow carry out manual notifications. The cascade officer now also verifies that notifications are complete either via the automatic system or through manual activation.
- Exercising with external emergency services has led to more coherent planning between Station and those services, including collaborative exercises and the setting up of a specific emergency services forum to discuss issues and improvements to response.

10. ACCIDENT MANAGEMENT

10.1. ORGANIZATION AND FUNCTIONS

The station's approach to severe accident management differs from the approach developed by the PWR Owner's Group by investing primary responsibility for decision making in the control room using severe accident procedures, rather than in the Technical Support Centre (TSC) using severe accident guidelines. However, room still exists for the development of additional guidance material for the TSC to enhance its ability to support the control room with technical advice during the course of a severe accident. The station has identified several examples of where additional TSC guidance could be developed, and the team encourages the station to continue its efforts to develop this guidance.

Operators are trained on the severe accident procedure using the simulator as a classroom. The simulator is frozen at the onset of core damage where the simulator software may become unstable and the instructor talks through and walks through the procedures in the simulator with the operating shift on training. This also serves as a validation process to ensure that all the instructions in the severe accident procedure are correct, understandable and can be implemented from the control room panels by the operators. The team considers this as a good performance.

10.2. OVERVIEW OF THE SEVERE ACCIDENT MANAGEMENT PROGRAMME

The bases document for the severe accident procedure does not comprehensively discuss and link some of the severe accident management actions to its technical basis. The team made a suggestion in this area.

10.4. DEVELOPMENT OF PROCEDURES AND GUIDELINES

The severe accident management procedures do not specifically address all station operating states or provide guidance for the prioritisation of fuel storage pond accidents. The team made a suggestion in this area.

10.5. PLANT EMERGENCY ARRANGEMENTS WITH RESPECT TO SAM

The station does not have formal arrangements in place to obtain technical support from the plant vendor or other equivalent international support organisations during a severe accident. The team encourages the station to consider enhancing its off-site technical support mechanisms and to ensure that any support organisations are familiar with the station's design features that are relevant to severe accident management.

DETAILED ACCIDENT MANAGEMENT FINDINGS

10.2. OVERVIEW OF THE SEVERE ACCIDENT MANAGEMENT PROGRAMME

10.2(1) Issue: The bases document for the severe accident procedure does not comprehensively discuss and link some of the severe accident management actions to its technical basis.

The team observed the following:

- Step 17.5 in the severe accident procedure SOI-8.8 instructs the operators to dump steam from a ruptured steam generator after the core has been reflooded, in order to prevent reactor vessel failure. The operators are not required to either notify or request permission from the Emergency Controller for this intentional release. This is not comprehensively discussed in the basis document.
- Step 17.2 in SOI-8.8 instructs the operators to depressurise the steam generators to 0 bar. The bases document does not discuss the negative consequences of losing flow from the turbine driven auxiliary feedwater pumps or the turbine driven charging pumps.
- Step 2.2 in SOI-8.8 directs the operators to go to step 18.0 if the core exit temperature is above 650 °C with one or more reactor coolant pumps in service. The operators can subsequently get stuck in a procedural loop if reflooding and cooling of the core are unsuccessful.
- Step 2.2 and Step 16.6 in SOI-8.8 direct the operators to step 18.0 if the core exit temperature is above 650 °C with one or more reactor coolant pumps in service. This criterion is however not repeated in Step 2.8 where idle reactor coolant pumps are restarted, and no explanation is given in the bases document for this apparent discrepancy.
- Steps 7.1, 9.1, 11.1, 14.1 and 19.1 in SOI-8.8 instruct the operators to check reactor vessel level if the core exit temperature is not decreasing. The Reactor Vessel Level Indication System (RVLIS) system may however become unreliable during a severe accident if molten corium relocates to the bottom vessel head and blocks the lower pressure tap-off of the RVLIS system. This is not highlighted in the bases document.
- Success Path 6 in SOI-8.8 directs the operators to inject water from the fire protection system into containment and consult the TSC to determine how much water to inject. There is however no guidance available in the bases document to assist in making this determination, or whether seawater injection should be considered.
- The bases document for SOI-8.8 does not discuss the differences between the station's severe accident approach and the generic PWR severe accident management guidance. This could create confusion if technical support is received from international organizations during a severe accident. For example, the large size of the station's containment building means that steam inerting is not required as a hydrogen management strategy whereas this is an important part of generic severe accident management approaches.

Without a comprehensive link between the severe accident procedure bases document

and its underlying technical basis, technical support to the main control room and emergency organisation may not be optimal.

Suggestion: The station should consider enhancing the bases document for the severe accident procedure to comprehensively discuss and link the severe accident management actions to its technical basis.

IAEA Bases:

NS-G-2.15

2.30 The guidance in both the preventive and mitigatory domains should be supported by appropriate background documentation. This documentation should describe and explain the rationale of the various parts of the guidance, and should include an explanation of each individual step in the guidance, if considered necessary. The background documentation does not replace the guidance itself.

3.57 Adequate background material should be prepared in parallel with the development and writing of guidelines. The background material should fulfil the following roles:

- It should be a self-contained source of reference for:
 - The technical basis for strategies and deviations from generic strategies, if any;
 - A detailed description of instrumentation needs;
 - Results of supporting analysis;
 - The basis for and detailed description of steps in procedures and guidelines;
 - The basis for calculations of set points;
- It should provide basic material for training courses for technical support staff and operators.

Plant Response/Action:

The OSART team raised two distinct suggestions in the Accident Management area. The two suggestions are closely interlinked (same apparent cause) therefore the same approach has been used to resolve them. This response therefore answers suggestions 10.2 and 10.4 and has not been repeated below.

A – Apparent Cause of Suggestion

There is no systematic process for the review and continued development and update of infrequently used procedures.

Causal Code - **MS1** - Standards; Policies and Admin Controls Need Improvements.

B – Summary of action plan

Sizewell B's approach to severe accident management differs from the approach developed by the PWR Owners Group by investing primary responsibility for decision making in the Main Control Room (MCR), rather than in the Technical Support Centre (TSC) using severe accident guidelines. It should be noted that the use of a control room procedure does have the advantage of not relying on the assembly and activation of a TSC (sometimes requiring staff from offsite). Following Fukushima, it was realised that SAMG must be structured to allow

for the possibility that TSC activation may take longer than was assumed in most SAMG approaches (due to possible site disruption/damage caused by the event).

The severe accident management procedure consists of:

- SOI-8.8 ‘Severe Accident Mitigation’ which contains the instructions to the operators in the MCR to execute specific success paths to prevent and mitigate the consequences of a severe accident.
- SOI-8.8 ‘BASES’ which contains the precautions and limitations associated with the procedure, the technical bases underpinning the procedure and additional relevant information/guidance. The bases document is for use by the operators in the MCR, as and when required, and by the TSC.

An action plan has been developed to address the two OSART suggestions and has been integrated into the OSART section of the Station Improvement Plan (SIP).

The action plan has been designed to address the specific findings listed under the two suggestions as well as the overall suggestions.

Seven specific findings were identified under the first suggestion. Six of the findings were categorised as short term improvements with the remainder categorised as a longer term improvement.

Three specific findings were identified under the second suggestion. Two of the findings were categorised as short term improvements with the remainder categorised as a longer term improvement.

The short term improvements have all been addressed in the update to the ‘Severe Accident Mitigation’ procedure, SOI-8.8 and BASES, as part of the Japanese Earthquake Response (JER) deployment and control modification (Engineering Change (EC) 350025). This EC comprises the justification for the deployment and control of the Back-Up Equipment (BUE) made available to Sizewell B post-Fukushima. This BUE includes equipment for use in ‘Resilience Enhancements Routes’ (i.e. to enhance defence in depth of existing systems), as well as general equipment which is foreseen as useful in a range of events to support potential recovery actions.

Addressing the longer term specific findings and the overall suggestions necessitated a review of Sizewell B SOI-8.8 and shutdown fault procedures against the Westinghouse Owners Group (WOG) generic SAMG and International Practice.

The review was completed in December 2016 by a Westinghouse leading expert in severe accidents and SAMG development. The review was conducted in accordance to an EDF Energy NGL specification designed to address the following:

- The longer term specific OSART findings.
- A regulatory (ONR) commitment to benchmark Sizewell B SOI-8.8 against SAMGs.
- Potential improvements identified by Sizewell B Nuclear Safety Group personnel after attending a Westinghouse SAMG course in Belgium in September 2015.

The Westinghouse review has identified a number of differences with the WOG SAMGs which are deemed to represent worldwide ‘best practice’. The differences have been reviewed by an internal EDF Energy NGL workshop attended by several suitably qualified and experienced persons in the SAM area and a phased approach to addressing these differences has been suggested, noting that when considering whether the differences identified should be addressed by changes to SOI-8.8, it was necessary to consider:

- Possible plant-specific grounds for the difference, and
- The balance between resources required to make the changes and the resulting benefits.

The phased approach has resulted in the development of an action plan with some aspects of the work to be delivered in the ‘short term’, some in the ‘medium term’ and the remainder in the ‘long term’, noting that the vast majority of the work falls into the scope of what would need to be done in the ‘medium term’ (mostly falling in the period 2018-2021). Details are as follows:

- **Short term 1:** These represent a number of changes which have already been incorporated into SOI-8.8, e.g. to incorporate/address JER, and some OSART specific findings via an update to SOI-8.8 under EC 350025.
- **Short term 2:** These represent a number of slightly more involved updates (e.g. Bases update to highlight design differences etc, as proposed by the OSART) which could be addressed in the current SOI-8.8 approach.
- **Medium Term (start within 2 years, complete within 5 years):** These are considered to represent ‘philosophical changes’ to the Sizewell B ‘Severe Accident Management’ procedure in order to closer align with best practice.
- **Long Term (at least 10 years away):** Consider adopting WOG SAMG, or French equivalent State Oriented approach and all the necessary ‘Organisational Changes’ in order to closer align with best practice. This change may coincide with a shift in central organisational focus as the Advanced Gas-cooled Reactors (AGRs) close down.

The ‘**short term 1**’ tasks have in essence been completed.

The ‘**short term 2**’ task essentially consists of an update to SOI-8.8 Bases. This is planned to be done as an early task, during the second half of 2017, in order to address some aspects of the OSART suggestions. A further update will then also need to be done when the ‘medium term’ changes to SOI-8.8 are made.

The ‘**medium term**’ tasks are the core of the work that is planned. This is a more involved update to SOI-8.8 that will change the principle underlying it from being a primarily preventative procedure to a more purely mitigatory procedure. These changes may have knock-on effects on other SOIs.

The ‘**long term**’ tasks do not necessarily need to be done, but may become to be seen over time as required by ‘best practice’. At the present time it is only proposed that a ‘watching brief’ is kept on this potential area of development.

C - Action plan effectiveness review

Some of the short term improvements (specifically 6 out of 7 OSART specific findings under the first suggestion and 2 out of 3 OSART specific findings under the second suggestion) have already been successfully implemented.

However, the major updates to the SAM procedure are being delivered in a phased approach with the majority of the work falling into the scope of what is planned to be delivered in the medium term (mostly falling in the period 2018–2021). Therefore, the action plan effectiveness review has been in itself formulated as a specific action within the plan. This will take the form of an independent technical review of the updated procedure. This will be performed by a Westinghouse SAMG expert and is planned to be started in June 2020.

IAEA comments:

The station has analysed both OSART suggestions in the Accident Management review area (as they were related) and has identified the apparent causes of the findings as lack of a systematic process for the review and continued development and update of infrequently used station procedures. The station has made a detailed action plan to address the identified causes for procedures and technical documents supporting the severe accident management at the site. During the follow-up mission this action plan was presented, reviewed and the progress achieved was determined.

The station has taken very comprehensive actions to review its approach to severe accident management (SAM) and to benchmark Sizewell B practices with Westinghouse owners group (WOG) ones. The station has recognized the need to update the severe accident and PSA level 2 analyses used for the initial development of severe accident mitigation procedures; the need to seek external technical support; and consider different options for updating the station approach and documentation to support SAM. Further consideration was given to possible upgrading of the station simulator so it can be used for operator training in SAM. The later would require that new software as RISK SPECTRUM and MAAP5 is used for PSA level 2 and severe accident analyses respectively. Benchmarking was undertaken in 2016. As a result, procedure SIO-8.8 will be updated such that it is informed by the review findings and recommendations. In the long term, the possibility of transition to the WOG SAMGs will be considered. The plant is fully aware that the major updates to the SAM documentation will take some time and have factored this into their future plans. The station has also secured support from the Company Central Technical Organization (CTO). During the OSART follow-up mission the phased approach proposed by the station for comprehensive review and upgrading of station documentation concerning SAM was discussed. The prepared detailed action plan for updating SOI-8.8, which is part of the multi-annual Sizewell B Improvement Plan, allocates the requested resources and responsibilities up to January 2022. The Sizewell B Improvement Plan also includes ~£ 1 M of work placed with the CTO to update its level 2 PSA analyses. This will further inform the enhancement to SAM procedures.

During the follow-up mission it was confirmed that immediate updates required to procedure SOI-8.8 (e.g. steps 1.3, 2.2, 2.9, 3.15, 7.0, 9.0, 11.0, 14.0, 16.0, 17.1, 17.4, 19.0, 19.1, 20.0-20.7) and technical basis SOI-8.8 'BASES' (e.g. chapter 8) underpinning this procedure were implemented and demonstrated available. Updates which will require more detailed analyses e.g. concerning the possibility to inject sea water into the containment, unreliability of Reactor Vessel Level Indication System (RVLIS), acknowledging the differences in the Sizewell B and Westinghouse approach to SAM, etc. will be addressed at a later stage as part of the comprehensive review of the Sizewell B SAM.

The OSART team found the station approach developed for comprehensive review and upgrading of station documentation concerning SAM commendable. It is recognised that for the full resolution of the issue some time will be needed which could extend over several years. The implementation of the improvement measures will also require substantial efforts in terms of human and financial resources, however the detailed plans presented during the

follow-up mission and station staff and management commitment, give reasonable assurance that the improvements will be completed as expected.

Conclusion: Satisfactory progress to date

10.4. DEVELOPMENT OF PROCEDURES AND GUIDELINES

10.4(1) Issue: The severe accident management procedures do not specifically address all station operating states or provide guidance for the prioritisation of fuel storage pond accidents.

The team observed the following:

- There is no procedural link into the severe accident procedure in shutdown station states should core uncover occur. There are no alternative entry criteria into the severe accident procedure for station states where the core exit temperature is unavailable.
- There is no specific instruction for either the Control Room (for example in SOI-8.8 Appendix S) or the TSC to monitor the fuel storage pond level during a severe accident.
- Procedure SOI-5.13.4 for abnormal conditions in the fuel storage pond instructs the operators to exit the procedure if a reactor trip occurs. There is no specific guidance to determine the urgency or prioritise actions to mitigate challenges to the fuel storage pond that are coincident with a severe accident in the reactor.

Without specifically addressing all station operating states and fuel storage pond challenges in station procedures for severe accident conditions, procedure usage may not be optimal in mitigating these challenges.

Suggestion: The station should consider enhancing its severe accident management - procedures to specifically address all station operating states and fuel storage pond challenges.

IAEA Bases:

NS-G-2.15

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

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

IAEA comments

The station has analysed both OSART suggestions in the Accident Management review area as they were related and has identified the apparent causes of the findings as lack of systematic process for the review and continued development and update of infrequently used station procedures. The station has made a detailed action plan to address the identified causes for procedures and technical documents supporting the severe accident management at

the site. During the follow-up mission this action plan was reviewed and the progress achieved was determined under the evaluation of S 10.2 (1).

As concerns the specific findings identified under S 10.4 (1) it was noted that actions concerning amendment of the procedures SOI-8.8 (Appendix S) and SOI-5.13.4 (step 2.4 and Appendix D) were implemented. During the follow-up the plant demonstrated that the amended procedures are available at the working place. The finding concerning lack of alternative entry criteria into severe accident procedure for station where the core exit temperature is unavailable cannot be resolved at this stage but will be addressed as part of the detailed action plan for review and revision of Sizewell B's approach to SAM.

Conclusion: Satisfactory progress to date

DEFINITIONS

DEFINITIONS – OSART MISSION

Recommendation

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

Suggestion

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

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

Good practice

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

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

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

Note: An item may not meet all the criteria of a 'good practice', but still be worthy to take note of. In this case it may be referred as a 'good performance', and may be documented in

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

**SUMMARY OF STATUS OF RECOMMENDATIONS AND SUGGESTIONS
OF THE OSART FOLLOW-UP MISSION TO SIZEWELL B**

	RESOLVED	SATISFACTORY PROGRESS	INSUFFICIENT PROGRESS
<u>YURI LM</u>			
S1.1(1)	IR		
S1.4(1)		SP	
<u>ANATOLY OPS</u>			
R 3.3(1)		SP	
S 3.4(1)		SP	
S 3.6(1)		SP	
<u>BERNARD MA</u>			
S 4.5(1)	IR		
R 4.6(1)	IR		
<u>VESSELINA TS</u>			
S 5.7(1)	IR		
<u>ANATOLY OE</u>			
S 6.5(1)	IR		
R 6.8(1)	IR		
<u>YURI CH</u>			
S 8.2(1)	IR		
<u>BERNARD RP</u>			
S 7.3(1)		SP	
S 7.4(1)	IR		
<u>VESSELINA EPR</u>			
S 9.1(1)		SP	
S 9.1(1)		SP	
<u>VESSELINA AM</u>			
S 10.2(1)		SP	
S 10.4(1)		SP	
TOTAL %	47	53	

LIST OF IAEA REFERENCES (BASIS)

Safety Standards

- **SF-1**; Fundamental Safety Principles (Safety Fundamentals)
- **GSR Part 3**; Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards
- **SSR-2/1**; Safety of Nuclear Power Plants: Design (Specific Safety Requirements)
- **SSR-2/2**; Safety of Nuclear Power Plants: Commissioning and Operation (Specific Safety Requirements)
- **NS-G-1.1**; Software for Computer Based Systems Important to Safety in Nuclear Power Plants (Safety Guide)
- **NS-G-2.1**; Fire Safety in the Operation of Nuclear Power Plans (Safety Guide)
- **NS-G-2.2**; Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants (Safety Guide)
- **NS-G-2.3**; Modifications to Nuclear Power Plants (Safety Guide)
- **NS-G-2.4**; The Operating Organization for Nuclear Power Plants (Safety Guide)
- **NS-G-2.5**; Core Management and Fuel Handling for Nuclear Power Plants (Safety Guide)
- **NS-G-2.6**; Maintenance, Surveillance and In-service Inspection in Nuclear Power Plants (Safety Guide)
- **NS-G-2.7**; Radiation Protection and Radioactive Waste Management in the Operation of Nuclear Power Plants (Safety Guide)
- **NS-G-2.8**; Recruitment, Qualification and Training of Personnel for Nuclear Power Plants (Safety Guide)
- **NS-G-2.9**; Commissioning for Nuclear Power Plants (Safety Guide)
- **NS-G-2.11**; A System for the Feedback of Experience from Events in Nuclear Installations (Safety Guide)
- **NS-G-2.12**; Ageing Management for Nuclear Power Plants (Safety Guide)
- **NS-G-2.13**; Evaluation of Seismic Safety for Existing Nuclear Installations (Safety Guide)
- **NS-G-2.14**; Conduct of Operations at Nuclear Power Plants (Safety Guide)
- **NS-G-2.15**; Severe Accident Management Programmes for Nuclear Power Plants (Safety Guide)

- **SSG-13**; Chemistry Programme for Water Cooled Nuclear Power Plants (Specific Safety Guide)
- **SSG-25**; Periodic Safety Review for Nuclear Power Plants (Specific Safety Guide)
- **GSR Part 1**; Governmental, Legal and Regulatory Framework for Safety (General Safety Requirements)
- **GS-R-2**; Preparedness and Response for a Nuclear or Radiological Emergency (Safety Requirements)
- **GS-R-3**; The Management System for Facilities and Activities (Safety Requirements)
- **GSR Part 4**; Safety Assessment for Facilities and Activities (General Safety Requirements)
- **GS-G-4.1**; Format and Content of the Safety Analysis report for Nuclear Power Plants (Safety Guide)
- **SSG-2**; Deterministic Safety Analysis for Nuclear Power Plants (Specific Safety Guide)
- **SSG-3**; Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants (Specific Safety Guide)
- **SSG-4**; Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants (Specific Safety Guide)
- **GSR Part 5**; Predisposal Management of Radioactive Waste (General Safety Requirements)
- **GS-G-2.1**; Arrangement for Preparedness for a Nuclear or Radiological Emergency (Safety Guide)
- **GSG-2**; Criteria for Use in Preparedness and Response for a Nuclear and Radiological Emergency (General Safety Guide)
- **GS-G-3.1**; Application of the Management System for Facilities and Activities (Safety Guide)
- **GS-G-3.5**; The Management System for Nuclear Installations (Safety Guide)
- **RS-G-1.1**; Occupational Radiation Protection (Safety Guide)
- **RS-G-1.2**; Assessment of Occupational Exposure Due to Intakes of Radionuclides (Safety Guide)
- **RS-G-1.3**; Assessment of Occupational Exposure Due to External Sources of Radiation (Safety Guide)
- **RS-G-1.8**; Environmental and Source Monitoring for Purposes of Radiation Protection (Safety Guide)

- **SSR-5**; Disposal of Radioactive Waste (Specific Safety Requirements)
 - **GSG-1** Classification of Radioactive Waste (General Safety Guide)
 - **WS-G-6.1**; Storage of Radioactive Waste (Safety Guide)
 - **WS-G-2.5**; Predisposal Management of Low and Intermediate Level Radioactive Waste (Safety Guide)
- ***INSAG, Safety Report Series***
- INSAG-4**; Safety Culture
- INSAG-10**; Defence in Depth in Nuclear Safety
- INSAG-12**; Basic Safety Principles for Nuclear Power Plants, 75-INSAG-3 Rev.1
- INSAG-13**; Management of Operational Safety in Nuclear Power Plants
- INSAG-14**; Safe Management of the Operating Lifetimes of Nuclear Power Plants
- INSAG-15**; Key Practical Issues In Strengthening Safety Culture
- INSAG-16**; Maintaining Knowledge, Training and Infrastructure for Research and Development in Nuclear Safety
- INSAG-17**; Independence in Regulatory Decision Making
- INSAG-18**; Managing Change in the Nuclear Industry: The Effects on Safety
- INSAG-19**; Maintaining the Design Integrity of Nuclear Installations throughout their Operating Life
- INSAG-20**; Stakeholder Involvement in Nuclear Issues
- INSAG-23**; Improving the International System for Operating Experience Feedback
- INSAG-25**; A Framework for an Integrated Risk Informed Decision Making Process
- Safety Report Series No.11**; Developing Safety Culture in Nuclear Activities Practical Suggestions to Assist Progress
- Safety Report Series No.21**; Optimization of Radiation Protection in the Control of Occupational Exposure
- Safety Report Series No.48**; Development and Review of Plant Specific Emergency Operating Procedures
- Safety Report Series No. 57**; Safe Long Term Operation of Nuclear Power Plants

- ***Other IAEA Publications***
 - **IAEA Safety Glossary** Terminology used in nuclear safety and radiation protection 2007 Edition
 - **Services series No.12**; OSART Guidelines
 - **EPR-EXERCISE-2005**; Preparation, Conduct and Evaluation of Exercises to Test Preparedness for a Nuclear or Radiological Emergency
 - **EPR-METHOD-2003**; Method for developing arrangements for response to a nuclear or radiological emergency, (Updating IAEA-TECDOC-953)
 - **EPR-ENATOM-2002**; Emergency Notification and Assistance Technical Operations Manual

- ***International Labour Office publications on industrial safety***
 - **ILO-OSH 2001**; Guidelines on occupational safety and health management systems (ILO guideline)
 - Safety and health in construction (ILO code of practice)
 - Safety in the use of chemicals at work (ILO code of practice)

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