



Sellafield Programme

**ONR consideration of further regulatory action in relation to the resilience of the
Sellafield Site to Severe Accident and Beyond Design Basis Events**

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EXECUTIVE SUMMARY

ONR consideration of further regulatory action in relation to the resilience of the Sellafield Site to Severe Accident and Beyond Design Basis Events.

This Project Assessment Report (PAR) considers what is the appropriate enforcement action in relation to concerns regarding the timeliness of Sellafield Ltd.'s progress with the implementation of improvements relating to Sellafield Site Resilience further to previous ONR interventions in the area of severe accident analysis (SAA) as well as to the events that took place at Fukushima Dai-ichi Power Station in Japan in March 2011.

In accordance with ONR guidance on the use of the Enforcement Management Model (EMM), <http://www.onr.org.uk/operational/inspection/ns-enf-gd-002.pdf>, I have formally applied the HSE EMM (<http://www.hse.gov.uk/enforce/emm.pdf>) to these concerns to arrive at an initial enforcement expectation. In so doing I have considered the risk gap in relation to the impact of a severe accident or beyond design basis event and considered both the likelihood of the event and the associated consequences.

I have then considered the duty holder and strategic factors as part of my assessment to provide a balanced judgement in relation to what enforcement action is warranted and appropriate in this case. The assessment has been performed in line with the principles of proportionality, targeting, consistency, transparency, and accountability as detailed within ONR's Enforcement Policy Statement (EPS) (<http://www.onr.org.uk/documents/2014/enforcement-policy-statement.pdf>).

My recommendation, contained within this PAR, was then considered and accepted by ONR management as part of the management review process in accordance with the requirements of the ONR business management system, HOW2.

Assessment and inspection work carried out by ONR

During 2007, the Nuclear Installations Inspectorate (NII), the former name of the ONR, sought improvements in SL's arrangements and their associated implementation in the area of severe accident analysis. There were a number of regulatory letters issued to SL and responses received during the period from 2007 to 2011. The progress made by SL during this period did not meet the expectations of ONR. The first element of this PAR considers the regulatory action taken during this period and ascertains the current status of compliance with the shortfalls identified during this period.

From the evidence assessed it is my opinion that there has been slower than expected progress in relation to SAA and Severe Accident Management Strategies (SAMS), however, from January 2010, it is my opinion that the evidence suggests that good progress had started to be made within this area. The evidence reviewed has confirmed that the shortfalls associated with SAA had been adequately addressed. This assessment finds that the work on the SAMS towards the end of 2010 had not been fully addressed and there was work outstanding in relation to review and implementation. There is also evidence within the ONR Issues Database that progress in relation to the SAMS was subject to regulatory oversight from 2010 onwards.

The second element of the PAR considers the SL response to the events that took place at Fukushima Dai-ichi in March 2011. It assesses the current status of SL's progress in improving resilience following the issue of recommendations from ONR and the European Council which sought improvements in safety to a beyond design basis event at UK nuclear licensed sites.

There were a total of 138 recommendations of which 122 have been closed to normal regulatory business. The focus of this report is not to review in detail the work that has been

completed, but to consider whether SL has made adequate progress and if not whether further enforcement action is warranted. The driver is to ensure that the outstanding recommendations are accelerated such that ONR gain confidence in the enhanced capability should a beyond design basis event occur at the Sellafield site.

From my assessment, it is evident that SL has made slower than expected progress in relation to addressing the recommendations and considerations raised further to the events at Fukushima. Given the status of the work performed in addressing the recommendations across other UK licensees this is disappointing and has been reflected as such by the specialist inspectors involved. The implementation of capability enhancements further to the events at Fukushima has also fallen below ONR expectations given that these were initially planned to be completed by the end of 2014.

SL recognises the slower than expected progress within this area and has accelerated the work over recent months. Further enhancements in capability have been realised since January 2015 and there now appears to be greater ownership by SL. There are now formal commitments to address the areas of greatest impact on hazard and risk reduction over the remainder of the financial year, which will enable further recommendations to be closed to normal regulatory business by ONR.

Matters arising from ONR's work

Within my assessment, the focus has been to concentrate on making a judgement on whether further regulatory action was appropriate based upon the principles of the EPS and the EMM. This judgement takes into account the arguments and evidence presented in the areas of SAA and beyond design basis events from both an ONR and SL perspective. I have assessed the interventions performed by ONR and the associated responses from SL. One matter arising from my assessment in this area is the need to closely monitor progress through our normal regulatory processes to ensure that the risk gap identified is progressively reduced through the implementation of the enhanced capability.

Conclusions

I consider that ONR has applied its arrangements and due process appropriately with a view to influence SL to make improvements in their arrangements. Progress has been unacceptably slow in addressing the expectations of ONR in both severe accident analysis and beyond design basis events. I have applied the EMM and established that the initial enforcement expectation is the issue of an Improvement Notice. Application of the Improvement Notice flow chart within the EMM relating to duty holder factors has not changed this conclusion. Notwithstanding this, I believe that it is important to recognise that the SAA and the SAMS have been completed and that the work in relation to beyond design basis events has been accelerated over recent months. These factors coupled with the commitments provided by SL to implement further enhanced capability over the remainder of the financial year 2015/16 and beyond, leads to me to conclude that an Improvement Notice would not be the most appropriate enforcement option in this instance and would not constitute a proportionate response to the shortfalls. The indicated enforcement action following consideration of duty holder factors is therefore that an enforcement letter be sent to SL.

Upon application of the strategic factors, the indicated enforcement action of an enforcement letter coincides with the public interest as the action would result in a net benefit to the wider community in terms of targeting resources on risk and meeting public expectations of ONR. I consider that the issue of an enforcement letter would be proportionate given the commitments provided by SL to address the outstanding work within the resilience area.

Recommendation

It is my recommendation that an enforcement letter be sent to SL reinforcing ONR's expectations in relation to delivering the enhanced capability committed to by SL.

LIST OF ABBREVIATIONS

ALARP	As low as reasonably practicable
DECC	Department of Energy and Climate Change
DMV	District Monitoring Vehicle
EC	European Council
EDT	Emergency Duty Team
EI	Emergency Instructions
EMIP	Emergency Management Improvement Programme
EMM	Enforcement Management Model
ENSREG	European Nuclear Safety Regulators Group
EPS	(Office for Nuclear Regulation) Enforcement Policy Statement
HALES	High Active Liquor Evaporation and Storage
HOW2	(Office for Nuclear Regulation) Business Management System
IAEA	The International Atomic Energy Agency
IN	Improvement Notice
IR	Interim Recommendation
NDA	Nuclear Decommissioning Authority
NII	Nuclear Installations Inspectorate
NPP	Nuclear Power Plant
ONR	Office for Nuclear Regulation
PAR	Project Assessment Report
PFCS	Pile Fuel Cladding Silo
SA	Severe Accident
SAA	Severe Accident Analysis
SAMS	Severe Accident Management Strategies
SAP	Safety Assessment Principle(s)
SBO	Site Black-Out
SL	Sellafield Limited
SLC	Sellafield Limited Consideration
SRP	Sellafield Resilience Programme
STF	Stress Test Finding
WENRA	Western European Nuclear Regulators Association

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1 DECISION UNDER CONSIDERATION

1. This Project Assessment Report (PAR) considers what is the appropriate enforcement action in relation to concerns regarding the timeliness of Sellafield Ltd.'s (SL's) progress with the implementation of improvements relating to Sellafield Site Resilience further to previous ONR interventions in the area of severe accident analysis (SAA) as well as to the events that took place at Fukushima Dai-ichi Power Station in Japan in March 2011.
2. In accordance with ONR guidance on the use of the Enforcement Management Model (EMM) (Ref. 1), I have formally applied the HSE EMM (Ref. 2) to these concerns to arrive at an initial enforcement expectation. In so doing I have considered the risk gap in relation to the impact of a severe accident or beyond design basis event and considered both the likelihood of the event and the associated consequences. I have then considered the duty holder and strategic factors as part of my assessment to provide a balanced judgement in relation to what enforcement action is warranted and appropriate in this case. The assessment has been performed in line with the principles of proportionality, targeting, consistency, transparency, and accountability as detailed within ONR's Enforcement Policy Statement (EPS) (Ref. 3).
3. This PAR makes recommendations to ONR management as part of the management review process in accordance with the requirements of the ONR business management system, HOW2.

2 BACKGROUND

4. During 2007, the Nuclear Installations Inspectorate (NII), the former name of the ONR, sought improvements in the SL's arrangements and their associated implementation in the area of severe accident analysis. There were a number of regulatory letters issued to SL and responses received during the period from 2007 to 2011. The progress made by SL during this period did not meet the expectations of ONR. The first element of this PAR considers the regulatory action taken during this period and ascertains the current status of compliance with the shortfalls identified during this period.
5. The second element of the PAR considers the SL response to the events that took place at Fukushima Dai-ichi in March 2011. It assesses the current status of SL's progress against in improving resilience following the issue of recommendations from ONR and the European Council which sought improvements in safety to a beyond design basis event at UK nuclear licensed sites.
6. SL set-up the Sellafield Resilience Programme (SRP) to address the recommendations raised by ONR and the EC. The vision of the programme was to enable the Sellafield Site to be resilient to a defined set of beyond design basis events, as far as is reasonably achievable.
7. The SRP goals are:
 - Key plants will be self-reliant for the first 24 hours for a loss of power event either at the plant or across the site e.g. site black out (SBO) caused by loss of grid or loss of internal supplies.
 - Sellafield Site will be self-sufficient for 3 days, with an aspiration to reach 7 days for a loss of site power.
 - Sellafield site will be self-sufficient for 3 days in the event of a radiological challenge

3 ASSESSMENT AND INSPECTION WORK CARRIED OUT BY ONR IN CONSIDERATION OF ENFORCEMENT ACTION

8. The assessment detailed within this PAR has been based upon a detailed review of all regulatory correspondence including actions placed upon SL by ONR and commitments provided by SL. For each element, the associated correspondence has been reviewed (Refs. 4, 5) to capturing the extent and detail of the action placed and the response provided. The following sections detail the assessment of the status of this work and are separated into the two separate elements to ensure clarity.
9. Section 3.4 brings both elements together and applies the EMM to the initial enforcement expectation. As part of this assessment the duty holder and strategic factors have been applied in order to arrive at a recommended enforcement action.
10. The EMM1 form documenting these aspects is filed at Reference 6.

3.1 ASSESSMENT OF THE ONR INTERVENTIONS ASSOCIATED WITH SAA AND SAMS

11. The review (Ref. 4) conducted into the interventions and regulatory action associated with SAA and Severe Accident Management Strategies (SAMS) considered the period from September 2007 to July 2011. Rather than repeat the content of the review in detail, the following summarises the enforcement history as well as the outcome and current position.
12. Initially the shortfalls arose as a result of an inspection performed on 28 May 2007. These shortfalls were related to the need for SL to perform a review of the production process and scope of SAMS and SAA. The letter (Ref. 7) identified the following expectations:
 - *Sellafield Ltd (SL) needs to document its process for producing Severe Accident Management Strategies (SAMSs).*
 - *SL should review whether limiting the SAMSs to plants with off-site consequences, i.e. not considering faults limited to on-site consequences, leads to important omissions.*
 - *The SAMSs should be subject to a formal QA process.*
 - *The SAMSs should be subject to periodic review and re-issue.*
 - *SL needs to incorporate severe accident analysis (as described in paras 500 and 543 of NII's 2006 SAPs) into its safety case process.*
 - *SL needs to address severe accident analysis at plant as well as at site level.*
 - *SL's severe accident analysis should include additional best estimate analysis, and not rely solely on the conservative analysis produced for the design basis safety case.*
 - *SL's severe accident analysis should include consideration of the quantity, location and deployment of materials needed to address identified scenarios.*
 - *SL needs to consider how to address multi-plant aspects (e.g. interactions and repercussions) of severe accidents.*
13. Further correspondence between the ONR Fault Studies specialist and SL (Refs 8, 9, 10, 11, 12, 13) detail the progress in addressing the shortfalls, however, there are a number of circumstances where further letters requesting improvements across similar areas are identified. The responses to the letters consisted of commitments to review the arrangements and engage through future level 4 meetings. At each juncture there is slow progress and delays to delivery identified. Throughout the period from 2007 to 2009 there are numerous site inspection reports, contact records, emails, and notes of telephone discussions (Refs 14, 15, 16, 17, 18, 19, 20, 21). Within this correspondence it is confirmed that all but one of the SAMS had been produced and

the SAA guidance was progressing with a view to being issued by the end of September 2009. Progress was being made with the resolution, however this had not met ONR's expectations due to the slow pace of delivery.

14. A further site inspection was performed by the Fault Studies Specialist Inspector, the Sellafeld Nominated Site Inspector, and the facility Site Inspector as a follow up to the inspection performed in 2007 to gauge the extent of improvements made. The record of the inspection is captured within Reference 22. A number of findings, commitments, and actions were raised as a result of an inspection that rated the areas of LC11 under the IIS as either 4 or 5 in all areas inspected relating to SAA and SAMs. As a result an issue (ONR ID1451) was entered onto the ONR Issues Database. In addition a follow up letter, SEL70339N, was sent to SL (Ref. 23) on the 7th January 2010. The letter makes reference to disappointing progress in relation to the findings captured within SEL76649, 76650R, 76657R, and 76658R and details the following items that ONR considered that SL should address:
- *SL needs to give due priority to developing adequate Severe Accident Management Strategies (SAMSs) at all relevant plants based on your existing level of knowledge.*
 - *SL needs to identify and apply industry good practice on severe accident management across the site.*
 - *SL needs to ensure that a consistent approach is followed for preparing Emergency Instructions (EIs) adopting good / best practice and consistent with reducing risks to as low as reasonably practicable (ALARP).*
 - *SL needs to develop better processes for controlling and managing equipment needed for emergency response.*
 - *SL needs to give due priority to its programme to develop SAA within its safety cases so that its SAMSs and EIs are better underpinned.*
15. A Level 4 meeting was held in October 2010 (Ref. 24) to discuss progress made towards addressing issues raised in SEL70339N. SL had completed a number of activities, based on existing data in support of SAMS and identified a programme of work to further develop technical expertise in this area and improve the SAMS on the SL site and on individual facilities. During the meeting SL stated that work towards completion of phase one activities to update SAMS documentation and arrangements is near completion based on existing data. SL invited NII to comment on the final documents in December 2010 and they confirmed that a further programme of work would commence in January 2011 to provide underpinning details in support of SAMS.

3.1.1 SAA AND SAMS ASSESSMENT CONCLUSIONS

16. From the evidence assessed it is my opinion that there has been slower than expected progress in relation to SAA and Severe Accident Management Strategies (SAMS), however, from January 2010, it is my opinion that the evidence suggests that good progress had started to be made within this area. The evidence reviewed has confirmed that the shortfalls associated with SAA had been adequately addressed. This assessment finds that the work on the SAMS towards the end of 2010 had not been fully addressed and there was work outstanding in relation to review and implementation. There is also evidence within the ONR Issues Database that progress in relation to the SAMS was subject to regulatory oversight from 2010 onwards. The review of the ONR Issues Database is included within Section 3.3 of this report.

3.2 ASSESSMENT OF THE ONR INTERVENTIONS ASSOCIATED WITH BEYOND DESIGN BASIS EVENTS

17. Further to the events that took place at Fukushima Dai-ichi in March 2011, the Secretary of State for Energy and Climate Change formally asked the ONR Chief

Nuclear Inspector, Dr Weightman, to provide a report to Government on the implications and lessons learnt for the UK nuclear industry. This resulted in an interim report (Ref.28) issued in May 2011 detailing a number of recommendations for the UK nuclear industry to address and to provide responses within the immediate term. SL provided responses (Ref. 26, 27) to the 26 recommendations identified within the interim report. In September 2011 a Final Report was produced (Ref. 29) that detailed the response from UK licensees as well as captured further recommendations for industry.

18. In addition the European Council (EC) requested a review of safety at all European nuclear power plants (NPP) and the European Nuclear Safety Regulators Group (ENSREG) produced a specification and a plan (Ref. 30) for this review based upon preliminary work carried out by the Western European Nuclear Regulators Association (WENRA). The reviews are commonly referred to as the 'stress tests'. Every nuclear power generating country in Europe agreed to carry out safety stress tests under request of the European Council. The tests, completed by licensees, involved a targeted reassessment of each stations safety margins in light of extreme natural events, such as earthquake and tsunami. Given that the European Council stress tests only focussed on NPPs, the ONR Chief Nuclear Inspector decided to extend the stress test process to all other licensed nuclear installations within the UK including Sellafield.
19. At the time of writing there are 16 recommendations outstanding from the interim report, the ENSREG report, and Sellafield Limited's own review further to the events at Fukushima. The recommendations are broken down into the following areas:
 - One Interim Recommendation (IR).
 - Four ENSREG Stress Test Findings (STF).
 - Eleven Sellafield Limited Considerations (SLC).
20. The ONR interventions to date have been driven by ONR corporately and have been managed consistently across all United Kingdom (UK) licensees. The ONR report, *"Progress in implementing the lessons learnt from the Fukushima accident"* (Ref. 31) identified that all licensees had done sufficient work in response to both the UK and ENSREG recommendations such that they could be closed to normal regulatory business with the exception of SL and licensees within Defence Programme. It is important to stress that the Defence licensee recommendations remained open due to ONR's assessment of the response having not been completed at the time of writing the report.
21. Initially the timescales for completion of the programme of work associated with SBO and SAMS as well as making sufficient progress in addressing the recommendations was 31 December 2014 (Ref. 31) which was identified by ONR as being challenging (Ref. 32). ONR were appraised of progress to the end of December during a Level 4 meeting held with SL (Ref. 32). It was recognised that a considerable amount of work was achieved by this date, including improvements to 6 key facilities to ensure that they are resilient to SBO and the completion of the work in relation to SAA and SAMS. However, the progress in some other areas had been slower than ONR would have expected. The slower than expected progress has to be balanced with the extent of the challenge facing a multi-facility nuclear licensed site. Throughout the period since the events at Fukushima, ONR has been closely monitoring progress and seeking acceleration in the response by SL. This has proved difficult given the aforementioned complexity of the Sellafield site. Some of the delays I consider to be associated with a degree of inertia and the over-complication of the initial response rather than adopting a more fit for purpose solution that recognised the beyond design basis nature of the potential event.

22. It would be incorrect to state that only limited work and effort has been taken by SL to address the recommendations, rather a great deal of time and effort has been expended in the response. There were a total of 138 recommendations, IRs, STFs, and SLC, of which 122 have been closed to normal regulatory business. Hence the focus of this report is not to review in detail the work that has been completed, but to consider whether further enforcement action is warranted. The driver is to ensure that the outstanding recommendations are accelerated such that ONR gain confidence in the enhanced capability should a beyond design basis event occur at the Sellafield site.

3.2.1 REVIEW OF OUTSTANDING RECOMMENDATIONS

23. As mentioned previously, each of the 16 outstanding recommendations has been reviewed in detail to ascertain the extent of work required to enable closure to normal regulatory business. Specialist ONR Inspectors have reviewed the latest close-out report provided by SL (Ref. 36) and arrived at a judgement over whether sufficient work has been completed to enable the recommendation to be closed to normal regulatory business.

24. The following outstanding recommendations were subject to assessment by the ONR Fault Studies Specialist (Ref. 32):

- ONR Interim Report Recommendations (IR-24)
- Stress Test Findings (STF-21, 65, 67, 72)
- SL Considerations (SL-1, 13, 31, 35, 38, 40, 43, 44, 54)

25. This assessment considered the above 14 outstanding recommendations and concluded that:

“...whilst much important work has been done, many items cannot be closed yet and several significant work items are outstanding. It should also be noted that the pace of delivery of enhancements at Sellafield highlighted as necessary by the experience at Fukushima over 4 years ago has been disappointing to date. In particular, the target date of the end of 2014 for completion of the more significant improvements set by ONR has been missed. ONR will seek to influence SL to improve the pace of delivery.”

26. It is noteworthy that the report identifies the disappointing progress made to date and that there remain a number of items of work outstanding, which include:

- *“Work on ‘domino effects’, such as the challenge a criticality incident might pose to measures to stop severe accident progression, has not yet started (STF-21, SL-54)*
- *The existing programme of emergency exercise scenarios has not yet been extended to cover beyond design basis events and severe accident conditions adequately. In particular there has not yet been a ‘proof of concept’ deployment exercise of emergency equipment intended for use in beyond design basis events/severe accident conditions (STF-65)*
- *Specific contingency plans to extinguish a fire in the [name of facility withheld] have not been developed and substantiated satisfactorily (SL-13)”*

27. There are a number of other items outstanding, however, it is considered that the findings of the ONR assessment of the 14 recommendations could be relatively straightforward for SL to address within a reasonable timescale upon completion of the enhanced capability programmed to be implemented in the forthcoming months.

28. The report recommends that ONR should continue to monitor SL's progress in responding to the lessons learned from the events at Fukushima until ONR agrees that all items are closed and residual work being tracked as normal regulatory business.
29. There are two recommendations, SLC09 and SLC18, which have been considered by an ONR Civil Engineering Specialist. SLC09 involves the procurement of a high volume pump to support a fuel storage pond in the event of a severe seismic event. SL has placed an order for the pump, which is to be delivered by the end of the financial year 2015/16. The ONR specialist has asked SL to demonstrate a number of aspects associated with SLC09 including deployment, training, maintenance, fuel and operational requirements, and the provision of compatible connections with existing pumps and hoses.
30. SLC18 calls for SL to re-engineer applicable flood defences to address very severe rainfall flooding. Work is ongoing in this area by SL with a view to completion by the end of the financial year. The ONR specialist has asked SL to demonstrate that all vulnerable facilities and associated deployable protection measures have been identified together with a strategy for deployment including accessibility, training, and maintenance.
31. The ONR Civil Engineering Specialist anticipates performing further interventions during Quarter 3 and 4 of financial year 15/16 (Ref. 36) to establish whether sufficient has been done in order to support closure of recommendations SLC09 and SLC18 to normal regulatory business.

3.2.2 REGULATORY CORRESPONDENCE

32. An important element of my assessment has been that the slow progress by SL in addressing the outstanding recommendations has not resulted in ONR formally writing requesting commitments to address the recommendations. Whilst not explicitly required to take further regulatory action, it does provide a baseline against which to judge shortfalls in ONR expectations.
33. The lack of formal regulatory action within this area should be balanced with the degree of influence exerted by ONR in seeking improvements and accelerating implementation of the enhanced capability identified. This is captured within the ONR Sellafield Programme Strategy (SPS) (Ref. 39) as part of Objective 9, which states:

"ONR will undertake interventions to ensure SL improves its infrastructure to support Hazard and Risk reduction across the site."
34. As part of the ongoing regulatory oversight associated with the recommendations further to Fukushima, any findings have been considered and their regulatory significance determined. The findings have been shared with the licensee and captured on the ONR Issues Database. Those issues considered to be more significant are forwarded to the Sellafield Programme Board where a decision regarding regulatory follow up is made and recorded. The issues are then followed up by ONR via the regular intervention programme.
35. In the case of the SRP, the ONR Issues Database has been utilised to record the regulatory concern and the associated action required of SL. The issue (ONR ID2964) is a Level 1 issue, which is defined within HOW2 as having the potential to prejudice the delivery of a SAPs (Ref. 40) Category A safety function [any function that plays a principal role in ensuring nuclear safety]. It is currently rated as Amber in relation to SL's progress in addressing the actions raised. Progress is monitored through the monthly Sub-Programme Board Meeting and the Level 3 Regulatory Interface Meeting. As a direct result of this oversight, which recognised the slow pace of SL delivery of

enhanced capability, this PAR was produced to ascertain whether further regulatory action is deemed necessary.

36. The Department of Energy and Climate Change (DECC) has also identified the need at a strategic level in driving the need for the enhanced capability to be realised in the short term and for the recommendations to be addressed such that they can be closed to normal regulatory business.
37. On the 1st September 2015, a letter was received from SL (Ref. 43) providing a series of commitments to support the hazard and risk reduction associated with the capability enhancements for beyond design basis events. Within the letter, SL share ONR's disappointment with progress in this area and identify the following four areas where ONR expectations were not met. These areas were:
 - Delivery of 2 multi-role fire tenders initially planned for the end of May 2015. These tenders were delivered in June 2015 and are now available for use.
 - Completion of a study into the [name of plant withheld] fire detection was due to be completed by the end of July 2015. This review has now been completed with a report due to be issued in September.
 - [Name of plant withheld] Site Black-Out (SBO) improvements. Due to recent industrial action the completion date has slipped from the end of August to the end of September 2015. The auxiliary boiler and compressed air packages have been installed and the only remaining element of the work is to complete the connections to ensure automatic start capability.
 - Delivery of 3 District Monitoring Vehicles (DMV) was to be completed by the end of September, however, there have been delays due to the availability of specialised vehicle chassis from the manufacturer. The first of the DMVs is due to be delivered to site by the end of November with the remaining 2 to be in place by the end of the financial 2015/16 or early into the next.
38. SL recognises the slippage and is working to mitigate the late delivery for the outstanding capability enhancements and has committed to work closely with the supply chain to ensure that the dates are met.
39. The commitments within the letter for capability enhancements for the remainder of the financial year are captured within its Appendix 1 and have been selected based upon the areas having the greatest impact on hazard and risk reduction. The items are aligned with the initial scope of work for financial year 15/16 (Ref. 36) with the exception of elements of non-physical plant modifications i.e. reviews and project management items. I have sought a justification from SL regarding the basis for not fully capturing all the elements of the initial scope (Ref. 44). Completion of the commitments to the agreed timescales will ensure that a significant proportion of the beyond design basis capability enhancements will be available by the end of the financial year. In addition, the letter recognises streamlining of the procurement process, which should enable accelerated delivery of the remaining SRP equipment.
40. SL has also identified the need to have additional independent oversight from the Sellafield Internal Regulator to support delivery of the programme of work. This is positive as it will enable ONR to consider their work in relation to them influencing SRP to deliver the commitments identified.
41. Finally, the letter has identified the enhancements that have been made at Sellafield further to the issue of the close-out report in January 2015 (Ref.36). These have included:
 - Roll out of the 31 SAMS
 - The milestone associated with training 95% of the EDT has been met.

- Completed the work associated with Emergency Management Improvement Programme (EMIP) relating to instructions, facility manuals, training, as well as the site wide recovery plan.
 - 3 Incident Control Centres (ICC) have been fitted out and commissioned with new SBO equipment.
 - Taken delivery of the 2 multi-role fire tenders.
 - Place procurement orders for a number of items in support of the commitments made within Appendix 1 of the letter.
42. It is positive to note the work that has been done to date this calendar year, however, the delivery of the remainder of the plan for 15/16 through meeting the commitments made is fundamental to ensuring that the anticipated hazard and risk reduction is met. In addition to delivering the physical improvements there is a need to ensure that adequate training, maintenance, and storage arrangements are implemented also.
43. SL has committed to provide regular updates through interventions over the remainder of the financial year. In addition, they are to provide a letter by the end of March 2016, which will detail the programme and timescales for the enhancements to be performed during the financial year 16/17.

3.2.3 BEYOND DESIGN BASIS ASSESSMENT CONCLUSIONS

44. From my assessment, it is evident that SL has made slower than expected progress in relation to addressing the recommendations and considerations raised further to the events at Fukushima. Given the status of the work performed in addressing the recommendations across other UK licensees this is disappointing and has been reflected as such by the specialist inspectors involved. The implementation of capability enhancements further to the events at Fukushima has also fallen below ONR expectations.
45. SL recognises the slower than expected progress within this area and have accelerated the work over recent months. Further enhancements in capability have been realised since January 2015 and there now appears to be greater ownership by SL. There are now formal commitments to address the areas of greatest impact on hazard and risk reduction over the remainder of the financial year, which will enable further recommendations to be closed to normal regulatory business by ONR.
46. The letter provides clear commitments for the work that is to be completed this financial year enabling ONR to monitor delivery closely. Should any elements of the committed work fail to be delivered without a suitable justification, further enforcement action may be necessary.
47. As part of a planned intervention in September 2015, it is intended to review the outstanding recommendations and monitor progress with the delivery of the scope of work for the remainder of the financial year.

3.3 REVIEW OF ONR ISSUES

48. A review of the ONR Issues Database has been performed to ascertain the extent of regulatory oversight that was in place for SAA and beyond design basis events.
49. An initial ONR issue, ONR ID1451, raised in January 2010 captured shortfalls identified within letter SEL70339N and has since been closed following a review of the issue by Regulatory Assurance. Another issue was then raised (ONR ID1987) in February 2014 to capture the current position and to amend the actions. The actions within Issue 1987 were:

- Action 1: SL is to supply ONR with updated SAA Summary Reports and a description of FR6 accident scenarios by end of 2013.
 - Action 2: SL to produce and implement SAMS by the end of 2014 using existing equipment.
 - Action 3: SL to revise its SAMS post-2014 following procurement of new equipment.
50. Action 1 was completed and the remaining two actions were incorporated into a further ONR issue (ONR ID2013) also raised in February 2014 resulting in Issue 1987 being closed. This is reflected within the basis of issue closure, which confirmed that the SAA work is complete.
51. Issue 2013 was associated with the introduction of the Sellafield Resilience Programme (SRP), post Fukushima and included the following actions:
- Action 1: SL to issue and implement a full suite of completed SAMS documents utilising existing equipment by end of December 2014.
 - Action 2: SL to revise all its SAMS documents following procurement of new equipment by end of December 2015.
 - Action 3: SL to identify (but not necessarily implement) all work needed as a result of the ONR Interim and Final Fukushima Reports Recommendations, ENSREG Stress Test Findings and SL Considerations by end of December 2014.
52. This issue identified a further action for SL in response to the events at Fukushima. Issue 2013 was closed and superseded by a further issue (ONR ID2964), raised in November 2014 as Action 1 had been completed. Actions 2 and 3 had been captured as part of the scope of work for SRP during the financial year 15/16. As part of Issue 2964 a need to consider the implementation of SAMS through training of the Emergency Duty Teams was identified. The following actions were captured within the issue:
- Action 1: Deliver SAMS training to 95% of the Emergency Duty Team (EDT) by the end of Jan 2016.
 - Action 2: Deliver scope of work for SRP 15/16 programme.
53. SL has confirmed that the requirements of Action 1 were met on the 12th August 2015 (Ref. 25). An inspection into the implementation of the training associated with the SAMS training is to be undertaken on the 23rd and 24th September 2015 as part of a wider inspection considering the outstanding beyond design basis recommendations.
54. Action 2 is addressed as part of the beyond design basis resilience and the regulatory interventions have been subject to assessment earlier within this report.

3.4 APPLICATION OF THE EMM

55. The EMM is not a procedure in its own right. It is not intended to fetter inspectors' discretion when making enforcement decisions and it does not direct enforcement in any particular case. It is intended to:
- *promote enforcement consistency by confirming the parameters, and the relationships between the many variables, in the enforcement decision-making process;*
56. promote proportionality and targeting by confirming the risk-based criteria against which decisions are made;

- *be a framework for making enforcement decisions transparent, and for ensuring that those who make decisions are accountable for them;*
- *help experienced inspectors assess their decisions in complex cases;*
- *allow peer review of enforcement action; and*
- *guide less experienced and trainee inspectors in making enforcement decisions.*

57. The EMM and its associated procedures aid review of the decision-making process and inspectors' enforcement actions to ensure the purpose and expectations of the ONR EPS have been met.

58. I have applied the EMM in arriving at my initial enforcement expectation. As the potential consequences relate to an increased radiation dose, I have applied the requirements of the "OC 130/11 – Enforcement Management Model (EMM): application to ionising radiations", (Ref. 41). The Operational Circular, (OC) states,

"Any whole body exposure to ionising radiations is assumed to result in an increase in the risk of an individual suffering from a radiation induced disease in direct proportion to the dose (these are referred to as Stochastic effects and the dose response relationship is known as the linear no threshold model). When considering stochastic effects the primary concern is the induction of fatal cancers which are considered to be a "serious health effect" and equivalent to serious personal injury under the terms of the EMM. Any whole body radiation dose therefore increases the chance that an individual might suffer from a radiation induced fatal cancer and the greater the dose the greater the risk of occurrence."

59. In addition, the OC provides clarity on the application of risk associated with stochastic effects in respect to The Ionising Radiations Regulations 1999 (IRR99) (Ref. 42)

"The overarching requirement of IRR99 to restrict exposures so far as is reasonably practicable (SFARP) results in a level of exposure which is as low as reasonably practicable (ALARP) and is the benchmark in terms of the EMM. Any increased actual or potential dose above the ALARP level could actually or potentially increase the likelihood of a serious health effect (radiation induced disease such as fatal cancer)."

60. As a result I have identified the **actual and benchmark risk** as being **serious health effect** in accordance with the OC. The **actual likelihood** is **remote** given that there is the potential for doses between 100µSv and 1mSv as the beyond design basis capability enhancements have not yet been realised. The **benchmark likelihood** is **negligible** as, with the enhanced capability implemented, the Sellafield site would be resilient to a beyond design basis event. Given the potential stochastic effects, the OC table, "EMM table 2.2 amended for stochastic effects" has been used to inform the extent of risk gap. From the application of risk and likelihood a **substantial risk gap** has been identified.

61. The standards I have applied in this case have been **established** given that the requirements for improvement were derived from expectations both from ONR and from the European Council. "EMM Table 5.1 Revised" of the OC has then been used to arrive at the initial enforcement expectation, which identifies an **Improvement Notice**.

3.4.1 APPLICATION OF DUTY HOLDER FACTORS

62. Further to the identification of the initial enforcement expectation, the duty holder factors are applied, which are detailed below :

- Is there a relevant history?

63. Although there is no history of related incidents or any evidence to suggest that there have been challenges to nuclear safety at Sellafield site arising from SA or beyond design basis events, it is important to recognise the events at Fukushima that led to ONR making recommendations to UK Licensees. I would conclude that although there is no direct relevant history in relation to the duty holder as per the EMM, there is a relevant history given the potential event, albeit at a very low initiating event frequency.
- Does the duty holder have a history of relevant enforcement being taken against them?
64. Within SAA and SAMS there is a history of enforcement in the form of ONR Issues and letters arising from regulatory inspections. Delivery and improvement were slow and required additional regulatory oversight by ONR specialists in order for improvements to be realised. Ultimately, the work on SAA was completed to ONR's satisfaction towards the end of 2010, the first issue of the SAMS has been issued, and the EDT training has been confirmed as complete. Embedding of the SAMS is committed to being completed during financial year 2015/16 as detailed within correspondence from SL (Ref. 43). This work has been identified as normal regulatory business by the ONR Fault Studies Specialist (Ref. 35) and as such no further enforcement action is currently deemed necessary within the SAA or SAMS areas.
65. With regard to beyond design basis enhancements to site capability, no formal enforcement action has been taken against SL to date. Predominantly the mechanism via which improvements were sought and in a number of cases realised were through influencing SL to make improvements and accelerate implementation of the enhanced capability.
66. As mentioned earlier within this report, SL have now provided formal commitments to ONR to address the slower than expected progress in relation to enhanced capability in response to beyond design basis events. This is seen as a positive step by SL in that they are taking ownership of the programme and seeking to accelerate the improvements identified.
67. I conclude that there is relevant enforcement action in the area of SAA and SAMS but none in the area of beyond design basis recommendations. SL has complied with ONR expectations within the areas of SAA and SAMS and there are commitments to reduce the number of beyond design basis recommendations whilst also considering the greatest reduction in hazard and risk associated with the SRP.
- Is the duty holder deliberately seeking economic advantage?
68. There is no evidence that any economic advantage is being sought.
- What is the level of actual harm?
69. There has been no actual harm realised at Sellafield Site as a result of failure to fully implement the recommendations. It is important to recognise, the events at Fukushima were rated as INES 7 (Major Accident) through the International Nuclear Event Scale (INES) and for this reason, I would consider that failure to address the remaining recommendations in a timely manner continues to leave the site potentially vulnerable to a beyond design basis external event given the work that remains outstanding.
- What is the inspection history of the duty holder?
70. Sellafield Limited is subject to a large number of routine planned regulatory interventions by a number of site and specialist inspectors from ONR. In total there

were approximately 300 days spent on site performing inspection tasks over the last 12 months which included 203 compliance inspections. The breakdown of the Integrated Intervention Strategy (IIS) scores were as follows:

IIS Rating	Number of Interventions
1 - Exemplar	0
2 – Good	17
3 – Adequate	132
4 – Below Standard	50
5 – Significantly Below Standard	4
6 - Unacceptable	0
Total Interventions	203

71. As can be seen from the table above approximately three out of four compliance inspections have an IIS rating of 3 or above, which indicates that they are generally compliant with their arrangements and/or implementation. Also there are no ratings which indicate that the arrangements and/or implementation over the past 12 months have been unacceptable.
72. Over the past year there have been two improvement notices (IN) issued; one associated with the management of asbestos at Calder Hall and the other is associated with failure to follow operating instructions at the Magnox Reprocessing Separation Plant. Sellafeld Ltd has complied with the IN for managing asbestos at the Calder Hall facility and ONR has confirmed that all requirements of the IN have been met. The IN associated with the Magnox plant was issued in July 2015 and the improvement work has yet to be completed.
73. To conclude, I consider that the inspection history of SL taking into account the number of inspections performed, the associated IIS ratings, and the response to the improvement notices is to a reasonable standard.
- What is the standard of general conditions?
74. The consideration of standard of general conditions is not applicable within this area given that the potential enforcement action is not against pre-existing shortfalls in the extant safety case for a facility; rather it is an extension of the arrangements in the area of beyond design basis.
- Does inspector’s assessment of the duty holder give confidence the duty holder can and will comply?
75. Given that SL have provided a letter stating their own disappointment with progress, areas where they had failed to meet their own programme, and commitments to address hazard and risk reduction over the remainder of the financial year, I have some confidence that SL will address ONR expectations.

3.4.2 REVIEW OF DUTY HOLDER FACTORS

76. The table below shows the output of the review of Duty holder factors as captured within EMM1 form (Ref. 6).

Section 5 – Dutyholder factors (all elements do not always apply) See **Table of definitions – Table 6** and **flowcharts**

Is there a history of related incidents, accidents, ill health, etc?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	
Is there a history of previous relevant enforcement?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Did the dutyholder gain or deliberately seek economic advantage from non-compliance?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	
Level of actual harm arising from the matter under consideration?	Serious personal injury or serious health effect <input type="checkbox"/>	No serious harm <input type="checkbox"/>	No harm <input checked="" type="checkbox"/>
What is the inspection history of the dutyholder?	Poor <input type="checkbox"/>	Reasonable or N/A <input checked="" type="checkbox"/>	Good <input type="checkbox"/>
What is the standard of general conditions?	Poor <input type="checkbox"/>	Reasonable or N/A <input checked="" type="checkbox"/>	Good <input type="checkbox"/>
From the Inspector's assessment of the dutyholder, what is the level of confidence that the dutyholder can and will comply?	Little or no confidence <input type="checkbox"/>	Some Confidence <input checked="" type="checkbox"/>	Confident <input type="checkbox"/>

77. On application of the improvement notice flow chart within the EMM relating to duty holder factors the recommended action is the issue of an improvement notice due to the history of previous enforcement. It is, however, important to recognise that the SAA and the SAMS have been completed and that the work in relation to beyond design basis events has been accelerated over recent months. This should be balanced with the response by SL to the shortfall in expectations and the clear commitment to address. The programme of commitments within Appendix 1 of the letter serves to identify the work to be completed by SL and to all intents and purposes would constitute a schedule to an improvement notice. In this case a letter confirming the importance of meeting the schedule together with additional regulatory oversight in ensuring the delivery of the commitments met would appear to be a proportionate response.

3.4.3 APPLICATION OF STRATEGIC FACTORS

78. Further to the identification of the indicated enforcement action of a letter, the strategic factors are applied, which are detailed below :

- Does the action coincide with the public interest?

79. SL has addressed the shortfalls associated with SAA and SAMS, work has been done in addressing the majority of the recommendations, and there are now commitments in place relating to implementing the enhanced resilience capability. I consider that the issue of a letter would coincide with the public interest as steps have been taken to already address the shortfalls by SL. Resources within ONR could then be focussed on other areas of risk across the Sellafield Programme whilst ensuring that the commitments made by SL within this area are closely monitored.

- Are vulnerable groups protected?

80. Vulnerable groups would be protected through the issue of a letter given the acceleration in the work and the commitments made by SL.

- Will the action result in sustained compliance?

81. The action would result in sustained compliance in this area, however, it is considered that sustained compliance can be achieved through close monitoring of the commitments made within the letter from SL (Ref. 43).

- What is the effect of the action on other duty holders?

82. The other UK licensees have met ONR expectations in relation to closure of the post Fukushima recommendations and as a result the action would have little impact. The effect will therefore be neither positive nor negative.

- Will the action result in the benchmark being achieved?

83. Again, should the commitments made by SL be met, the benchmark i.e. addressing both the ONR recommendations and ENSREG findings, would be achieved with the use of a letter.

- Is the functional impact of the action acceptable?

84. The functional impact of the action is acceptable and would reinforce ONR's expectations within this area. That is not to say that the response and ownership by SL demonstrated would not have the same impact.

- Have the principles and expectations of the EPS been met?

85. The policy has been followed.

3.4.4 REVIEW OF STRATEGIC FACTORS

86. The table below shows the output of the review of the strategic factors as captured within EMM1 form (Ref. 6).

Section 6 - Strategic factors – See strategic factors table – Table 7 and flowcharts			
Does indicated action coincide with public interest? (refer to additional guidance)	Yes	<input checked="" type="checkbox"/>	No <input type="checkbox"/>
Are vulnerable groups protected by the action?	Yes	<input checked="" type="checkbox"/>	No <input type="checkbox"/>
Will the action result in sustained compliance?	Yes	<input checked="" type="checkbox"/>	No <input type="checkbox"/>
What is the effect of the action on other dutyholders?	Positive	<input checked="" type="checkbox"/>	Negative <input type="checkbox"/>
Will the action result in the benchmark being achieved?	Yes	<input checked="" type="checkbox"/>	No <input type="checkbox"/>
Is the functional impact of the action acceptable?	Yes	<input checked="" type="checkbox"/>	No <input type="checkbox"/>
Have the principles and expectations of the Enforcement Policy been met?	Yes	<input checked="" type="checkbox"/>	No <input type="checkbox"/>

87. Upon application of the strategic factors, the indicated enforcement action of a letter coincides with the public interest as the action would result in a net benefit to the wider community in terms of targetting resources on risk and meeting public expectations of ONR. I consider that the issue of a letter would be proportionate given the commitments provided by SL to address the outstanding work within the resilience area.

4 MATTERS ARISING FROM ONR'S WORK

88. Within my assessment, the focus has been to concentrate on making a judgement on whether further regulatory action was appropriate based upon the principles of the EPS and the EMM. This judgement takes into account the arguments and evidence presented in the areas of SAA and beyond design basis events from both an ONR and SL perspective. I have assessed the interventions performed by ONR and the associated responses from SL. One matter arising from my assessment in this area is the need to closely monitor progress through our normal regulatory processes to ensure that the risk gap identified is progressively reduced through the implementation of the enhanced capability.

5 CONCLUSIONS

89. This PAR considers what is the appropriate enforcement action in relation to concerns regarding the timeliness of Sellafield Ltd.'s progress with the implementation of

improvements relating to Sellafield Site Resilience further to previous ONR interventions in the area of severe accident analysis (SAA) as well as to the events that took place at Fukushima Dai-ichi Power Station in Japan in March 2011.

90. To conclude, I consider that ONR has applied its arrangements and due process accordingly with a view to influence SL to make improvements in their arrangements. Progress has been unacceptably slow in addressing the expectations of ONR in both severe accident analysis and beyond design basis events.
91. I have applied the EMM and established that the initial enforcement expectation is the issue of an improvement notice. Application of the Improvement Notice flow chart within the EMM relating to duty holder factors has not changed this conclusion. Notwithstanding this, I believe that it is important to recognise that the SAA and the SAMS have been completed and that the work in relation to beyond design basis events has been accelerated over recent months. These factors coupled with the commitments provided by SL to implement further enhanced capability over the remainder of the financial year 2015/16 and beyond, leads to me to conclude that an Improvement Notice would not be the most appropriate enforcement option in this instance and would not constitute a proportionate response to the shortfalls. The indicated enforcement action was therefore a letter.
92. Upon application of the strategic factors, it became apparent that the indicated enforcement action of a letter would coincide with the public interest as the action would result in a net benefit to the wider community in terms of targetting resources on risk and meeting public expectations of ONR. I consider that the issue of a letter would be proportionate given the commitments provided by SL to address the outstanding work within the resilience area.
93. Should my recommendation be adopted, there is a need to closely monitor progress and should there be any failure to meet commitments made without a suitable justification, the EMM would be applied again, and the issue of an improvement notice would be the likely outcome.

6 RECOMMENDATIONS

94. It is my recommendation that an enforcement letter be sent to SL reinforcing ONR's expectations in relation to delivering the enhanced capability committed to by SL.

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