



**Plutonium Management Facilities (North) Asset Care**

**Agreement to commence modification, active commissioning and operation of the  
Plutonium Management Facility – North Fan 6 and 7**

Project Assessment Report ONR-SDFW-PAR-17-003  
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## EXECUTIVE SUMMARY

### Title

Agreement to commence modification, active commissioning and operation of the Plutonium Management Facility – North Fan 6 and 7

### Permission Requested

Sellafield Ltd (SL) has requested the Office for Nuclear Regulation (ONR) agreement to commence modification, active commissioning and operation of the Plutonium Management Facility – North (PMF(N)) Fan 6 and 7, in accordance with its arrangements made under Licence Condition (LC) 22: Modification or experiment on existing plant.

### Background

The PMF(N) complex contains some ageing legacy plant that contain high levels of loose radiological contamination within radiologically designated areas. Therefore, the building ventilation extract system performs a principal role in preventing the spread of contamination from these areas to normal access and external areas by maintaining a sufficient atmospheric depression. The ventilation extract system comprises Fans 6 and 7. These currently operate continuously at fixed speed on a direct feed from the electrical distribution system within PMF(N) in a duty/standby configuration.

The extract system infrastructure is suffering from significant degradation and obsolescence issues. As a result, SL is proposing to replace and modify the infrastructure supporting the PMF(N) extract system. The modification includes the incorporation of variable speed drives (VSD) into the fan trains to allow adjustment of the extract flows to support future facility risk reduction operations.

This modification introduces new initiating events that could lead to a loss of extract. It also introduces a new fault sequence of fan over-speed, which could cause significant fan failure or containment boundary damage due excessive atmospheric depression. SL has recognised this and as part of the modification is installing a new over-speed trip to protect the fans and containment boundary. This project assessment report provides the ONR judgement on the adequacy of SL's safety case underpinning its request to implement the proposed modification.

### Assessment and inspection work carried out by ONR in consideration of this request

Following initial consideration of SL's proposed modification, I judged it proportionate to obtain specialist inspector advice based on the potential faults that could arise from its implementation. I therefore sought advice from fault studies, human factors, mechanical, electrical and control and instrumentation engineering specialist inspectors. In addition, ONR has undertaken a readiness inspection of PMF(N) to assess SL's implementation of its LC 22 arrangements for the proposed modification to inform the permissioning decision.

### Matters arising from ONR's work

The fault studies, human factors, mechanical and electrical engineering inspector's assessments of SL's proposed modification did not identify any nuclear safety shortfalls or raise any recommendations to prevent ONR agreeing to SL's request. The control and instrumentation inspector has judged that SL has not implemented all reasonably practicable precautions that would reduce the risks of fan over-speed failure so far as is reasonably practicable for the proposed modification, and has recommended seeking further improvement.

ONR's readiness inspection judged SL's implementation of its LC 22 arrangements for the proposed modification as adequate. The inspection did identify a number of actions, which SL has adequately addressed. In addition, SL has confirmed to my satisfaction that its proposal has been subject to independent internal governance by its management safety committees

and oversight by its internal regulator. All have concluded that they have no objection to SL's proposed modification, which provides additional regulatory confidence.

## Conclusions

Based on the evidence sampled, I judge that for the proposed modification SL has:

- Adequately justified it from a fault studies, human factors, mechanical and electrical engineering perspective with the respective inspectors advising they have no objection to its implementation.
- Adequate contingency arrangements from a people, process and plant perspective to mitigate the elevated risk of loss of ventilation during the modification works when only one fan train is available. This judgement is further supported by a recent ONR LC 11 Emergency arrangements inspection, which judged PMF(N) implementation of its arrangements as adequate;
- Demonstrated an adequate level of independent internal challenge and governance in accordance with its established arrangements;
- Not adequately demonstrated that all risks have been reduced so far as is reasonably practicable from a C&I perspective, specifically in relation to the design of the fan over-speed trip system. SL has recognised this shortfall and believes that it has made an adequate safety case in this respect based on arguments centred on the low probability of an over-speed fault in the fan trip system. Nevertheless, the C&I inspector considers that it is reasonably practicable for SL to provide additional protection in the trip amplifier system against this fault.

I judge that the current condition of the ventilation extract system presents a significantly greater nuclear safety risk than not undertaking the modification immediately. This is despite the C&I shortfall, which can be addressed as soon as is reasonably practicable post modification. Given the immediate safety improvement and risk reduction afforded by the modification, I therefore consider that it would be disproportionate to withhold our permission at this time until further improvement is made.

## Recommendations

ONR should issue licence instrument 503 agreeing to SL's request to commence modification, active commissioning and operation of the Plutonium Management Facility – North Fan 6 and 7.

ONR to seek modification of the trip amplifier component of the Fan 6 and 7 over-speed trips to remove the single point vulnerabilities as soon as is reasonably practicable via an appropriate level of enforcement. Regulatory oversight of implementation of this modification should be maintained via Regulatory Issue 4995.

## LIST OF ABBREVIATIONS

C&I	Control and Instrumentation
EA	Environment Agency
HOW2	(Office for Nuclear Regulation) Business Management System
LC	Licence Condition
LCM	Low Consequence Methodology
LI	Licence Instrument
MSC	Management Safety Committee
ONR	Office for Nuclear Regulation
PAR	Project Assessment Report
PMF(N)	Plutonium Management Facilities - North
PMP	Plant Modification Proposal
SL	Sellafield Limited
Sv	Sieverts
VSD	Variable Speed Drive

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## **1 PERMISSION REQUESTED**

1. Sellafield Ltd (SL) has requested the Office for Nuclear Regulation's (ONR) agreement to commence modification, active commissioning and operation of the Plutonium Management Facility – North (PMF(N)) Fan 6 and 7, in accordance with its arrangements made under Licence Condition (LC) 22 to modify or experiment on existing plant (Ref. 1).
2. This project assessment report (PAR) provides the ONR judgement on SL's request. It has been produced in accordance with ONR HOW2 guidance (Ref. 2). In accordance with this guidance, the permissioning strategy for this regulatory hold point has been previously agreed with the ONR Sellafield Programme sub-programme delivery lead (Ref. 3).

## **2 BACKGROUND**

3. The PMF(N) complex includes operational, decommissioned, decommissioning, care and maintenance areas and special nuclear material stores. The complex contains an ageing facility with some legacy plant areas that contain high levels of loose radiological contamination within radiologically designated areas. The building ventilation extract system performs a principal role in preventing the spread of contamination from these areas to normal access and external areas by maintaining a sufficient atmospheric depression.
4. The ventilation extract system comprises Fans 6 and 7. These currently operate continuously at fixed speed on a direct feed from the electrical distribution system within PMF(N) in a duty/standby configuration (i.e. only one of the fans is required to achieve the required ventilation system flowrates). The extract system infrastructure (i.e. motors, power supplies, switchboards, fan pulleys and drive belts) is suffering from significant degradation and obsolescence issues. In addition, a change in the functional requirements of the extract system is required to support forthcoming modifications to improve containment within the facility. This requires the capability to reduce the rate at which the fans extract air.
5. As a result, SL is proposing to replace and modify the infrastructure supporting the PMF(N) extract system. The modification includes the incorporation of variable speed drives (VSDs) into the fan trains to allow adjustment of the extract flows. SL's proposal also includes the provision of diesel generator plug-in point to improve the resilience of the system to loss of electricity supply faults.
6. The scope of SL's proposal is identified by References 4 and 5. In summary it includes modification, commissioning and operation of each fan train. Fan 6 will be modified and commissioned first followed by modification and commissioning of Fan 7, before return to normal operations of the modified duty and standby arrangement. During the modifications there will be a period of increased risk of PMF(N) loss of extract as there will be no standby arrangement (as it will be being modified). During this time SL has identified a number of contingencies to mitigate this risk. The adequacy of these contingencies was assessed by the mechanical engineering inspector with the findings detailed in Section 4 of this report.
7. Initially, SL's proposal was to modify Fan 7 first as it includes the diesel plug-in point and would improve ventilation resilience during the following modification of Fan 6. However, following a recent failure of Fan 6 (which has now failed four times in the last three years compared to no failures of Fan 7 in 60 years of operation) SL has changed the order in which they will be modified.
8. This modification introduces new initiating events that could lead to a loss of ventilation extract. It also introduces the new fault sequence of fan over-speed, which could cause

catastrophic fan failure or containment boundary damage due excessive atmospheric depression. In turn, this has the potential to result in leakage and escape of radioactive material. SL has recognised this and as part of the modification is installing a new over-speed trip to protect the fans and containment boundary.

9. The new over-speed fault poses the greatest potential hazard within the scope of SL's proposed modification. It could occur as a result of a faulty signal from the software-controlled VSD producing a fan over-speed condition and the over-speed trip failing to perform on demand. This fault sequence has the potential to result in worker and public doses within SL's Low Consequence Methodology (LCM) region (i.e. 2-20mSv and 1-100 µSv respectively) based on the time taken for the operators to evacuate and the contamination to migrate to operational areas (Ref. 6). SL has based its consequence modelling on real on-plant readings of contaminated air drawn from the building complex and its operational experience from previous loss of ventilation events.
10. During early project engagement, we advised SL that ONR's assessment would focus on SL's understanding of the consequences from reasonably foreseeable faults as a result of the proposed modification (Ref. 7). This was because it was not apparent how the consequences fall into SL's Low Consequence Methodology range when there is the potential for leakage and escape of radioactive material. The adequacy of SL's application its LCM was assessed by the fault studies inspector with the findings detailed in Section 4 of this report.

### **3 ASSESSMENT AND INSPECTION WORK CARRIED OUT BY ONR IN CONSIDERATION OF THIS REQUEST**

11. I judged it proportionate to obtain ONR specialist inspector advice. I therefore sought advice from the following specialist areas, as agreed with the ONR delivery lead as part of the permissioning strategy (Ref. 3):
  - Fault studies
  - Control and Instrumentation (C&I) engineering
  - Electrical engineering
  - Mechanical engineering
  - Human factors
12. Following initial consideration of SL's proposal, I targeted these disciplines given that the proposed modification:
  - Introduces both new initiators to the existing loss of extract fault and a new potential fault sequence that could result in the leakage and escape of radioactive material.
  - Includes the incorporation of new and modification of existing electrical and C&I equipment, some of which form a principal means of ensuring key nuclear safety functions.
  - Has significant reliance on contingency measures that require the effective deployment of mechanical containment systems during fault conditions.
  - Has significant reliance on operators during both normal and fault conditions.
13. As part of the regulatory engagement on this proposal, a series of meetings were held between SL and ONR that focussed on clarifying ONR's understanding of the modification and advising on regulatory expectations (Ref's 7-12).
14. In addition to the above and to inform the permissioning decision, ONR has also undertaken a facility-based readiness inspection to assess SL's implementation of its

LC 22 arrangements for the proposed modification (Ref. 13). This was supported by human factors, mechanical and electrical engineering inspectors.

## **4 MATTERS ARISING FROM ONR'S WORK**

### **4.1 ONR ASSESSMENT**

15. The ONR specialist assessment advice and conclusions are summarised as follows.
16. The fault studies inspector's assessment has focussed on the new over-speed fault, as the proposed modification reduces the likelihood of a loss of ventilation extract and the other aspects of this fault sequence are essentially unchanged (Ref. 14).
17. In conclusion, the inspector judges that the new system will lead to a significant improvement on the current situation and supports the granting of the requested permission. However, the inspector notes that SL has not made a quantitative assessment of the risk of a loss of ventilation from a fault affecting the current electrical supply infrastructure against the risk for a fan over-speed following implementation of the modification. The inspector is content to make a judgement that the residual risks associated with the operation post modifications will be small in comparison to the risk of continued operation of the ventilation extract system in its current state. This is based on the degraded condition of the ventilation extract system infrastructure and multiple failures recently experienced.
18. No fault studies recommendations were raised by the assessment; however it did identify two issues associated with SL's application of its LCM and the identification of meaningful limits and conditions in the overall ventilation safety case.
19. With respect to SL's application of its LCM, the inspector acknowledges that the potential faults as a result of the proposed modification may not have any immediate radiological consequences to workers or the public. This is based on the time taken for the operators to evacuate and the contamination to migrate to operational areas. However, because the LCM is strictly based on dose criterion, it has driven a narrow interpretation of nuclear safety and has failed to reflect the potential wider nuclear safety implications such as a significant loss of control of radioactive material (and associated radiological risk from decontamination activities), impact on the ability to continue risk remediation activities in the facility and the ability to support Magnox reprocessing of fuel from defueled reactors. As a result, it has the potential to undermine the importance of safety functions being performed by systems, structures and components (this is further discussed in the C&I inspector's assessment).
20. With respect to meaningful limits and conditions for loss of ventilation, SL's proposal identifies new and withdraws limits that state timescales that ventilation must be restored within. The inspector states that there appears to be no specific action that is triggered by reaching these new limits and notes that there is also an extant condition to restart fans as soon as possible following an unscheduled outage. The inspector confirms that following discussions with the licensee, it is clear that facility operators are well aware of the significance of the ventilation extract system and the need to restore ventilation as soon as possible. As a result, it is not clear to the inspector that a limit based upon time is the most appropriate, given that the facility operators will be striving to reinstate ventilation as soon as possible and that the basis of the limits is not clear to operators.
21. The inspector has raised two regulatory issues on these (Issue No.'s 5482 and 5485) to communicate ONR's expectations and facilitate regulatory oversight to ensure they are adequately addressed by SL.

22. The fault studies inspector is content that the identified issues are not specific to the permission being requested and as such can be pursued in parallel with implementation of SL's proposed modification. This judgement is based on the degraded condition of the current electrical infrastructure supporting the ventilation extract system and therefore risk of an electrical distribution fault causing loss of ventilation extract. As such, the inspector judges that it would be disproportionate for ONR to withhold the requested permission.
23. The electrical engineering inspector's assessment has focussed on the particular failure modes that have the potential for an extended loss of plant ventilation due to electrical power failure. The assessment has included consideration of the electricity supply capacity, duration, availability, resilience and reliability (Ref. 15).
24. In conclusion, the inspector considers that from an electrical engineering perspective, SL's proposal is justified, is satisfied that SL has followed its due process and relevant good practice and has therefore provided an adequate justification. The inspector considers that the modification to the electrical power supply will represent a significant improvement when compared to the existing infrastructure.
25. No electrical engineering recommendations were raised by the assessment. However it did identify some improvements to the clarity of SL's response to a loss of power supply scenario. The inspector concluded they are not of sufficient safety significance to prevent commencement of the proposed modification and it would be disproportionate to withhold ONR permission. This judgement is based on the safety improvements of implementing the proposed modification outweighing the shortfalls identified, which were of a minor nature. The inspector has therefore raised a regulatory issue (Ref. No. 5433) to communicate ONR's expectations and facilitate regulatory oversight to ensure they are adequately addressed by SL.
26. The mechanical engineering inspector's assessment has focussed on the key hazards and emergency arrangements associated with response to any loss of the radiological containment boundary of the structures, systems and components associated with the proposed modification. The assessment also included a review of the commissioning arrangements and availability of critical operational and emergency spares (Ref. 16).
27. In conclusion, the inspector is satisfied that from a mechanical engineering perspective, SL's proposal has followed relevant good practice and provided an adequate justification for the proposed modification. No mechanical engineering recommendations were raised by the assessment.
28. The C&I inspector's assessment has focussed on the role that C&I systems play in controlling risk associated with key hazards. This has included assessment of the C&I structures, systems and components that will either have their safety performance directly affected by the VSDs, or will need to respond to fault initiators by the VSDs (Ref. 17).
29. In conclusion, the inspector considers that SL's justification of the VSDs to perform their function of providing continued extract (and not operate spuriously resulting in VSD-related initiating events) has not been demonstrably substantiated.
30. Nevertheless, the inspector is satisfied that the upgrade of the fan trains will provide a net improvement in reliability and availability of extract, and that the shortfall in the VSD substantiation demonstration is of limited safety significance in relation to the provision of extract, which will be improved by the replacement of degraded electrical and mechanical equipment in both fan trains.
31. The inspector therefore focussed on the adequacy of the design to prevent the progression of VSD-initiated faults (i.e. fan over-speed, under-speed and rapid

- deceleration). The inspector judged that SL's proposed mitigation for the latter two faults was adequate and therefore specifically focussed on the new over-speed trip system given the potential consequences of it failing to perform on demand during a VSD initiated over-speed condition as described in Section 2.
32. Following a review of the over-speed trip system design, including its individual components, the inspector has judged that SL has not done all that is reasonably practicable to reduce the risk from it not performing on demand due to single point failures. In particular, the single point vulnerabilities (SPVs) associated with the trip amplifier component. This judgement is informed by the fact that VSD malfunction or mal-operation producing an over-speed initiating event is reasonably foreseeable for which reasonably practicable precautions could be implemented. The over-speed trip system is a single channel and the only protective measure against this fault progression. SL recognises this shortfall and believes that it has made an adequate safety case in this respect based on arguments centred on the low probability of an over-speed fault in the trip system caused by the existence of a single point vulnerability.
  33. However, the C&I inspector does not support SL's safety justification for the proposed modification and therefore recommends that ONR seeks the following improvement: *'In accordance with relevant good practice, the licensee should implement further improvements to the deterministic safety performance of the over-speed trip system (B<sup>\*\*\*</sup>/CE&I/902) by providing redundancy to address SPVs associated with the Trip Amplifier.'*
  34. In response to the C&I inspector's engagement, SL stated that based on initial estimates, the above recommendation would take circa six months to implement (Ref. 18).
  35. Having considered the specialist advice, specifically that of the C&I inspector, I judge that ONR should agree to SL's request to commence the proposed modification in advance of pursuing implementation of the C&I inspector's recommendation. This judgement is based on the following considerations.
  36. The PMF(N) complex contains areas of gross, loose contamination that has historically escaped from its original primary containment (i.e. glove boxes), and is currently contained within a radiologically designated area by a non-standard containment boundary with known vulnerabilities (Ref. 19). As a result, the ventilation extract system performs a continuous primary safety function of maintaining containment.
  37. The ventilation extract system infrastructure is beyond its design life and suffering from significant degradation and obsolescence issues. These issues were identified as a significant shortfall in the facility's 2012 periodic safety review and resulted in the failure to substantiate it to perform its safety function for the next 10 years (Ref. 19). This poor condition and significant gap from modern ventilation standards was also identified by a 2014 ONR system based inspection (Ref. 20). Due to this condition, the ventilation extract system has suffered four failures in the last three years (Ref. 21).
  38. I consider it only a matter of time before the current ventilation extract system fails again. Given that the primary driver for the modification is the poor condition of the fan's electrical infrastructure (Ref. 14), it cannot be deterministically demonstrated that the next failure would not be catastrophic with potential significant radiological consequences i.e. likely prolonged loss of extract from one/both fan trains resulting in the leakage and escape of radioactive material necessitating decontamination activities, delay to operations and future risk reduction activities.

39. I support the C&I recommendation that SL has not reduced the risks so far as is reasonably practicable. However, based on the above, I consider that implementation of the modification provides immediate nuclear safety improvement and risk reduction such that it would be disproportionate to withhold permission at this time until further improvements are made. Leaving the ventilation extract system in its current condition presents a significantly greater risk of leakage and escape of radioactive material than that posed by a VSD initiated fault and coincident single point failure within the trip amplifier component of the over-speed trip system. I consider that this judgement is further supported by the following:
- The fault studies inspector has advised that from a qualitative perspective, the risks associated with the operation post modifications will be small in comparison to the risk of continued operation of the ventilation extract system in its current state (Ref. 14).
  - The electrical engineering inspector has advised that the modification will represent a significant improvement to the electrical power supply when compared to the existing infrastructure (Ref. 15).
  - The C&I inspector acknowledges that the proposed modification will provide a net improvement in reliability and availability of ventilation extract (Ref. 17).
  - The modification will improve the electrical supply resilience and reduce the current risk posed by loss of ventilation electricity supply faults (which have previously occurred on the site) by providing a mobile diesel generator input point (Ref. 15).
  - The modification will reduce start-up failures associated with the high torque and motor currents that currently exist. The will enable SL to re-optimize the electrical overload protection settings that have been temporarily adjusted in the upstream sub-station, thus reducing the scope for local electrical faults to disrupt supplies to other key facilities supplied by the substation (Ref. 15).
  - The modification will provide the flexibility to adjust the ventilation flows to:
    - That of an alpha plant and provide the conditions to restrict and control movement of the contamination (Ref. 19);
    - Enable the commencement of key risk reduction projects associated with the ventilation plenum divert and improvements to the structural containment boundary (Ref. 19).
  - Each fan train is operated as a duty/standby on a three-monthly basis with the over-speed trips subject to proof tests pre and post service of their respective fan train (i.e. three-monthly proof test interval) (Ref. 18). This provides some additional confidence in the trips ability to perform on demand.
40. Based on the above factors and time at risk, I judge that it is reasonably practicable for SL to implement the C&I inspector's recommendation post implementation of the proposed modification. I therefore recommend that this position be communicated to SL via an appropriate level of enforcement with regulatory oversight of its implementation maintained via Regulatory Issue 4995.
41. In accordance with the ONR/Environment Agency (EA) Memorandum of Understanding, I have consulted with the EA whether it had any objections on environmental grounds to ONR granting the licence instrument (LI). The EA has confirmed that it has no objection (Ref. 22). Similarly, the ONR civil nuclear security inspector has confirmed that they have no objection to ONR agreeing to SL's request and granting the LI (Ref. 23).

#### **4.2 ONR READINESS INSPECTION**

42. In support of the permissioning decision, ONR has undertaken a readiness inspection to assess SL's implementation of its LC 22 arrangements for the proposed modification. ONR's readiness inspection included specialist human factors,

mechanical and electrical engineering inspectors and focussed on the people, process and plant required to safely implement the modifications. Specifically, this included SL's ability to adequately implement its emergency arrangements during fault conditions (i.e. loss of ventilation and loss of electrical supply) and sought assurance that:

- A systematic approach has been taken to the identification and delivery of personnel competence.
- Suitable and sufficient instructions have been written and validated to support reliable human performance of the operations and there is an adequate system for the validation and verification of important operator actions.
- The operational controls and safety measures are in place, available and robust, specifically that the equipment referenced within the emergency arrangements is available.

43. Based on the evidence sampled, ONR judged that SLs' implementation of its LC 22 arrangements as adequate (Ref. 13) as it was judged to align with relevant good practice, specifically the relevant aspects of ONR's Technical Inspection Guide for LC 22 (Ref. 24) and Safety Assessment Principals (Ref. 25). This judgement was based on SL's demonstration that:

- The modification is under the control of plant management and being managed in accordance with the established arrangements. This was evidenced by application of the operational decision making process and management safety committee to approve the order in which the fans will be modified.
- Operational learning has been reviewed and used to inform the modification's implementation. This was evidenced by the use of fan reliability to inform the order in which they are modified.
- Procedures and instructions have been assessed as part of the implementation of the modification and that plant simulations have usefully informed this. This was evidenced by subjecting the emergency operating instructions to an on-plant walk-through of the task steps and exercises, including a full building evacuation drill, which has been supported by operational, human factors and internal regulator reviews.
- It has put in place adequate command and control arrangements as evidenced by implementation of these arrangements for the modification enabling works and initial phases, which have been successfully completed.

44. No shortfalls were identified during the inspection that would prevent permission being granted for the proposed modification. However, at the time of the inspection we requested that SL provides further evidence on certain aspects that we judged relevant to the permissioning decision. These were associated with the following mechanical engineering and human factors specialist areas:

- Quality control of critical spares, availability of emergency repair materials and close out of ventilation safety case recommendations. SL has subsequently provided evidence against these areas, which has been reviewed and judged as adequate by the mechanical engineering inspector (Ref. 16).
- Substantiation of operational designations, close out of human factors safety case recommendations and assessment of training requirements and associated personnel competency assurance. SL has subsequently provided evidence against these areas, which has been reviewed and judged as adequate by the human factors inspector (Ref. 26). The inspector did however identify potential shortfalls in SL's application of its systematic approach to training by SL's corporate training department but noted that this had also been recognised by PMF(N) management, who subsequently developed a range of training to support the development of relevant competences. Although the

human factors review identified some limitations in the robustness of PMF(N) approach, the inspector concluded that it is adequate to support the proposed modification (Ref. 26). The inspector will pursue the potential shortfalls in SL's application of its systematic approach to training as part of the forthcoming 2017 ONR corporate arrangements LC 10/12 intervention.

### 4.3 INTERNAL ASSURANCE AND GOVERNANCE ARRANGEMENTS

45. In support of SL's request to commence the proposed modification (Ref. 1), it has written an associated Plant Modification Proposal (PMP) (Ref. 4). This has been subjected to consideration and approval at SL's PMF Management Safety Committee (MSC) (Ref. 27). This PMP is supported by an addendum (Ref. 21) to address the change in order that the fans will be modified (i.e. Fan 6 will now be modified first). This has also been subjected to consideration and approval at SL's PMF MSC (Ref. 28).
46. In addition, SL's proposed modification has also been subject to:
- Independent Nuclear Safety Assessment review and certification (Ref. 29).
  - Independent inspection and oversight by its Internal Regulator, which has focussed on aspects associated with design, safety case, emergency arrangements, commissioning, governance, maintenance and command and control (Ref. 30). As a result, SL's Internal Regulator has confirmed that it has no outstanding issues affecting commencement of the proposed modification. (Ref. 29).
  - Expanded assurance by independent SL subject matter experts on the safety and engineering documentation supporting SL's proposal (Ref. 31).
47. The independent internal governance identified above provides additional regulatory confidence in the safe implementation of the proposed modification.

## 5 CONCLUSIONS

48. Based on the evidence sampled, I judge that for the proposed modification SL has:
- Adequately justified it from a fault studies, human factors and mechanical and electrical engineering perspective with the respective inspectors advising they have no objection to its implementation.
  - Adequate contingency arrangements from a people, process and plant perspective to mitigate the elevated risk of loss of ventilation during the modification works when only one fan train is available. This judgement is further supported by a recent ONR LC 11 – Emergency arrangements inspection, which judged PMF(N) implementation of its arrangements as adequate (Ref. 32).
  - Demonstrated an adequate level of independent internal challenge and governance in accordance with its established arrangements.
  - Not adequately demonstrated that all risks have been reduced so far as is reasonably practicable from a C&I perspective, specifically in relation to the design of the fan over-speed trip system. SL recognises this shortfall and believes that it has made an adequate safety case in this respect based on arguments centred on the low probability of an over-speed fault in the trip system caused by the existence of a single point vulnerability. Notwithstanding this, the C&I inspector, considers that it is reasonably practicable for SL to provide additional protection in the trip amplifier system against this fault.
49. I judge that the current condition of the ventilation extract system presents a significantly greater nuclear safety risk than not undertaking the modification

immediately. This is despite the C&I shortfalls, which based on the time at risk, can be addressed as soon as is reasonably practicable post modification. Given this immediate safety improvement and risk reduction afforded by the modification, I therefore consider that it would be disproportionate to withhold our permission at this time until the further improvements are made.

## **6 RECOMMENDATIONS**

50. ONR should issue LI 503 (Ref. 33) agreeing to SL's request to commence modification, active commissioning and operation of the Plutonium Management Facility – North Fan 6 and 7 (Ref. 1).
51. In addition, ONR should seek modification of the trip amplifier component of the Fan 6 and 7 over-speed trips to remove the single point vulnerabilities as soon as is reasonably practicable via an appropriate level of enforcement. Regulatory oversight of implementation of this modification should be maintained via Level 1 Regulatory Issue 4995.

## 7 REFERENCES

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