



**Fuel Handling Plant Gamma Gates**  
**ONR decision on whether to require Phase III Improvements**

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## EXECUTIVE SUMMARY

### Fuel Handling Plant Gamma Gates – ONR decision on whether to require Phase III Improvements

This report summarises ONR's review of whether it appears reasonably practicable for Sellafield Limited (SL) to make further improvements to decanner gamma gates at its Fuel Handling Plant (FHP) and in consequence, whether ONR should now require SL to make these improvements

#### Permission Requested

None – this report documents a management review of whether regulatory action would be proportionate in this instance.

#### Background

ONR recently extended the compliance date for an Improvement Notice (IN) on one of the gamma gates at FHP. In parallel, ONR has pressed for improvements to be made to seven other gamma gates at FHP, although it did acknowledge that these were of lower priority. SL has however been reluctant to make these improvements (known as Phase III), suggesting these would not be reasonably practicable.

The issue of concern relates to worker risks from the potential for accidental shine doses when fuel flasks are lifted away from the roofs of the cells they were previously connected to for irradiated fuel loading and unloading operations. Such lifts are controlled by mechanical interlocks and other procedural measures designed to ensure that the relevant gates and doors on the flask and cell are all shut during lifts. These gates and doors are designed to provide shielding to the operators. If they were to be open when a flask is lifted from the cell, a shine path can be opened up which would result in high radiation exposure to any operators in the immediate vicinity.

Discussions between ONR and SL on Phase III have been running for some considerable time, but without any agreement being reached. In line with ONR's Sellafield Strategy, which amongst other things, seeks to avoid distracting SL from priority high risk and hazard reduction, the ONR Delivery Lead responsible for Sellafield enforcement has carried out a management review of this case. The outcomes of this review are presented here.

#### Assessment work carried out by ONR

As part of its assessment, ONR identified the following eight areas that pointed in favour of implementation of the Phase III improvements:

- a) Phase III is reasonably practicable because SL's own review says it is
- b) The bulk of the work needed to achieve Phase III will already have been completed through delivery of (the earlier) Phases I and II
- c) Though SL has claimed that completing Phase III will divert it from higher priority activities, no specific examples have been provided
- d) SL's own safety standards identify two independent lines of protection are needed in these circumstances
- e) SL's determination of reasonable practicability is based on questionable probabilistic risk assessments
- f) Application of ONR's Numerical Targets indicates an ALARP justification is needed before we can accept SL's case
- g) Inspection evidence has drawn the reliability of the existing protection into question

- h) SL has previously committed to doing this work and then not delivered on its promises

These eight points were explored in detail with SL, who was able to give good reasons for why none provides any valid reason for proceeding with Phase III. Specifically the fault sequences of concern appear to have suitable protective arrangements meeting appropriate standards.

Some of ONR's points had arisen through misunderstandings of the scope and nature of different phases of SL's gamma gate improvement project. Others have been superseded by subsequent work carried out (or about to be carried out) by SL. Once these aspects were clarified, it is clear that the risks to workers in the absence of the Phase III improvements are very low. In particular, the risks are judged to be lower than relevant ONR Basic Safety Objectives (BSOs, risk levels in the Safety Assessment Principles (SAPs) below which it is ONR policy not to devote resource). At these low levels of risk, implementing Phase III does not appear to be reasonably practicable.

### **Matters arising from ONR's work**

In performing this review I noted apparent shortfalls in SL's NACCI (Notification of an Asset Care Concern or Issue) process with respect to the licensee's legal duties under the Health and Safety at Work (etc) Act. SL uses NACCI to prioritise identified plant improvements. However, application of NACCI in its present form may mean that implementation of lower priority improvements could become unreasonably delayed due to lack of resources even though the improvements are reasonably practicable individually. ONR is continuing in discussions with SL over how to improve NACCI so that the process feeds into decisions on overall resourcing levels for different parts of SL's operations.

### **Conclusions**

SL was able to provide good and convincing evidence to satisfy all eight areas of concern raised by ONR. In particular, I am satisfied that the Phase III work would do little to reduce risks which, by virtue of improvements already achieved or imminent, are already at very low levels (i.e. below ONR BSOs). As such I do not consider the Phase III improvements to be reasonably practicable.

SL needs to improve its NACCI process so that this informs its ongoing resourcing requirements.

### **Recommendation**

ONR should not require SL to make the Phase III improvements to its decanner gamma gates at FHP.

## LIST OF ABBREVIATIONS

ALARP	As low as reasonably practicable
BSO	Basic Safety Objective
FHP	Fuel Handling Plant
HSWA	Health and Safety at Work (etc) Act 1974
IN	Improvement Notice
LTPR	Long Term Periodic Review
MOP	Magnox Operating Plan
NACCI	Notification of an Asset Care Concern or Issue
PSR	Periodic Safety Review
rOI	required Operating Instruction
SAPs	Safety Assessment Principles
SL	Sellafield Limited (the licensee)
SQEP	Suitably Qualified and Experienced Person

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## 1 MATTER UNDER CONSIDERATION

1. This report summarises ONR's review of whether it appears reasonably practicable for Sellafield Limited (SL) to make further improvements to decanner gamma gates at its Fuel Handling Plant (FHP) and in consequence, whether ONR should now require SL to make these improvements.

## 2 BACKGROUND

2. ONR recently extended the compliance date for an Improvement Notice (IN) on one of the gamma gates at FHP (Reference 1). In parallel, ONR has pressed for improvements to be made to seven other gamma gates at FHP, although it did acknowledge that these were of lower priority. SL has however been reluctant to make these improvements (known as Phase III), suggesting these would not be reasonably practicable.
3. The issue of concern relates to worker risks from the potential for accidental shine doses when fuel flasks are lifted away from the roofs of the cells they were previously connected to for fuel loading/unloading operations. Such lifts are controlled by interlocks and other procedural measures designed to ensure that the relevant gates and doors on the flask and cell are all shut. These gates and doors are designed to provide shielding to the operators. If they are open when the flask is lifted from the cell, a shine path may be opened up which would result in high exposures to any operators in the immediate vicinity.
4. Discussions between ONR and SL on Phase III have been running for some considerable time, but without any agreement being reached. In line with ONR's Sellafield Strategy (Reference 2), which amongst other things, seeks to avoid distracting SL from priority high risk and hazard reduction, the ONR Delivery Lead responsible for Sellafield enforcement has carried out a review of the case.
5. Eight specific (though inter-connected) points were identified that pointed in favour of implementing Phase III, and these formed the agenda for the review discussions. The eight points and their basis are set out in Reference 3:
  - i) Phase III is reasonably practicable because SL's own review says it is
  - j) The bulk of the work needed to achieve Phase III will already have been completed through delivery of Phases I and II
  - k) Though SL has claimed that completing Phase III will divert it from higher priority activities, no specific examples have been provided
  - l) SL's own safety standards identify two independent lines of protection are needed in these circumstances
  - m) SL's determination of reasonable practicability is based on questionable probabilistic risk assessments
  - n) Application of ONR's Numerical Targets indicates an ALARP justification is needed before we can accept SL's case
  - o) Inspection evidence has drawn the reliability of the existing protection into question
  - p) SL has previously committed to doing this work and then not delivered on its promises
6. This report documents my (Delivery Lead) management review against these points and the basis for the decision reached.

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

7. My review began with detailed discussions with relevant ONR staff and a telecon with SL's Director of Spent Fuel Management (Reference 4) to ensure I had a good appreciation of the opposing points of view. These discussions led to the generation of the Devil's Advocate points listed above, which formed the agenda for a meeting with SL in November 2014 (Reference 5).

8. At the meeting, SL was able to supply convincing evidence to counter all eight points. In essence, the safety benefits of undertaking Phase III appear significantly smaller than the costs to SL (in terms of money, trouble and time) that would arise. In other words it is not reasonably practicable for SL to complete Phase III. The detail of SL's evidence is set out in the following sections.

#### ***Phase III is reasonably practicable because SL's own review says it is***

9. The SL documents that state that Phase III is reasonably practicable were written for relatively early stages of SL's due process when the potential work was being scoped. At the time of my meeting, SL had nearly completed its due process to determine whether Phase III is indeed reasonably practicable. SL's process for this, known as NACCI (Notification of an Asset Care Concern or Issue), ranks potential improvements in a "batting order" against a set of quantified criteria, so that those with the highest NACCI scores are given the highest priority. Given the NACCI score being proposed for Phase III (which derives from reasons set out below), SL judges it unlikely that Phase III would ever become reasonably practicable.

10. SL's logic here is based on the availability of SQEP (Suitably Qualified and Experienced Person) resource to do the work (or to train the necessary staff) within the timescales of the Magnox Operating Plan (MOP). SL would instead like to deploy its staff on the ~200 improvements at Magnox Reprocessing ranked above Phase III. Though I had concerns with the legality of detailed aspects of SL's ALARP process (see comments below on NACCI) overall, SL's evidence on this point seemed reasonable

#### ***The bulk of the work needed to achieve Phase III will already have been completed through delivery of Phases I and II***

11. This point was included because ONR inspectors had suggested that SL ought reasonably to extend Phases I and II of its project and so provide a complete solution for FHP gamma gate shine faults rather than a partial one. However, this argument appears to have arisen through a misunderstanding of what improvements lie within the scope of Phase III. While Phase III does indeed build on the earlier two phases of improvements, it is intended to plug a weakness in the quality of the protection measures already provided for these faults rather than provide further measures.

12. The Phase III proposals turned out to be limited to adding a further hardwired interlock to each Decanner gamma gate to guard against a scenario that SL has not been able to dismiss through analysis. The scenario arises because the flask doors (which slide open and closed horizontally) have a sloped upper surface. When a flask is lowered onto the top of a cell, the flask door and cell gate lock together so that the two can only slide across (i.e. open and close horizontally) in tandem. When the door and gate are in the shut position, locking pins can be lowered to secure them into position. These pins are part of the interlock system and are designed to provide high confidence that the door and gate are indeed closed. Unfortunately, the sloped upper surface of the doors makes possible a scenario in which the door and gate can be fully open and yet there is still room above the door (due to its slope) for the locking pins to fully insert. In



this scenario, a door which is in fact fully open would appear to the system as being fully closed. SL is not confident that this can actually happen (as it is a matter of very fine margins), but nor can it dismiss the possibility.

13. In consequence, SL's engineers proposed an additional interlock system: proximity switches were proposed to be fitted to each of the seven FHP Decanner gamma gates that would be used to confirm beyond doubt that the gates (and by inference the doors) were fully closed. It is the inclusion of this additional system that comprises Phase III. As already stated, Phase III is designed to plug a weakness in the quality of the existing protection measures rather than provide a further measure.
14. However, SL believes Phase III would not be a minor undertaking. Though it can build on the work of Phases I and II (e.g. in adopting similar project principles and taking learning) the equipment needed, the design of the gamma gates and the substantiation work required are all significantly different. As such Phase III would need to be an entirely separate project, and considered on its own merits rather than as an extension to Phases I and II.
15. Moreover, the scope of Phase III is narrower than ONR had previously believed – I was advised that improvements we had been seeking under Phase III are in fact part of Phase II (see below) and will be completed by SL. In view of these arguments, I am satisfied that seeking the Phase III improvements because these are a simple extension to the Phases I and II project is not reasonable.

***Though SL has claimed that completing Phase III will divert it from higher priority activities, no specific examples have been provided***

16. As noted already, Phase III has been ranked by SL at about 200<sup>th</sup> in its "batting order" of improvements at Magnox Reprocessing. Though I did not review the detail of the list, the principles underpinning ordering aspects of in NACCI seemed broadly reasonable and have not been challenged by ONR in other areas where NACCI has been to the fore. As such, I am satisfied that this point is suitably addressed.

***SL's own safety standards identify two independent lines of protection are needed in these circumstances***

17. This concern appears to have arisen as part of the above-mentioned misunderstanding over what is actually included in Phase III. SL has confirmed that once the Phase II improvements are complete, there will be two lines of protection available in accordance with its own safety standards. One of these lines is an administrative measure based on a required Operating Instruction (rOI) for the operators to confirm (check an indicator lamp) that the gate and door are fully closed before the flask is permitted to be lifted away from the cell. The second is an interlock system which prevents the flask being lifted unless the above-described door locking pins are properly inserted. There is also a third line of protection that SL does not claim as a Design Basis measure as it cannot be fully substantiated, but which further reduces the risks from the scenario in question (this is described below).
18. Prior to completion of Phase II, neither of the formal lines of protection was ideal. For example, Control and Instrumentation shortfalls are identified at paragraph 35 of Reference 6. However, I was advised that SL's ongoing Phase II work will result in all of ONR's issues being addressed.
19. The third line also appears to offer a reasonable level of protection, even though it cannot be substantiated within SL's safety case arrangements and so has not been claimed as a Design Basis measure. Were the door/gate be open to an extent that the locking pins could insert (by virtue of the slope; giving a false indication of door/gate

closure), the door and gate would have to be inside the recess within the cell roof structure provided to accommodate the door/gate when retracted. Attempting to lift the flask from this position would then cause the crane to also attempt to wrench the cell away from its foundations (as the recessed door and gate would, in effect, lock the flask and cell together). Such a scenario clearly presents other dangers, so SL has fitted lift overload protection to the crane. However, it has not been able to substantiate that this interlock would halt the lift before components failed. Despite this, it seems reasonable that the noise etc generated by an attempt to lift a flask still attached to the gamma cell by virtue of a retracted door would attract sufficient attention to halt the lift.

20. When discussing this scenario with our inspectors, concerns were expressed that even if a lift was stopped in this manner, there might still be a gamma shine path to the operators who would necessarily be adjacent to the cell in order to check the indicator lamps. SL advised me that this has been considered and in their assessment a flask would need to be lifted by ~50cm before a shine path could open up. As flask lifts are conducted at creep speeds, it would appear that there is sufficient margin here.
21. ONR's own standards do not prescribe how many lines of protection there should be. Instead our Safety Assessment Principles (Reference 7) include the Single Failure Criterion (principle EDR.4, which seeks redundancy in the delivery of any safety function) and assessment against the Numerical Targets (principle NT.1). In regard to single failures, there appear to be multiple means of ensuring the shielding safety function will continue to be delivered in all circumstances. Compliance with relevant Numerical Targets is considered below, where I conclude ONR's standards appear to be met.
22. In conclusion, the protection available here already appears to meet relevant standards before implementing the improvements proposed in Phase III.

***SL's determination of reasonable practicability is based on questionable probabilistic risk assessments***

23. Reference 8 questions technical aspects of SL's risk calculations. At the review meeting SL informed me that it has re-done its calculations in light of ONR's comments, but that the revised results remain broadly the same. SL has also looked at whether more detailed Human Reliability Analysis (another ONR concern) might be warranted since one of the claimed Design Basis lines of protection is administrative, but has concluded that the results are insensitive to such refinement.
24. As a former Fault Analysis specialist inspector, I also performed some rudimentary probabilistic analysis of this fault sequence (Reference 9). My analysis yielded similar results to SL's more sophisticated approach. In view of this, and SL's statements at the meeting, I do not consider further Probabilistic Safety Analysis would be helpful in judging the reasonable practicability of Phase III.

***Application of ONR's Numerical Targets indicates an ALARP justification is needed before we can accept SL's case***

25. My rudimentary analysis in Reference 9 was performed before the meeting applying the (now acknowledged false) assumption that without Phase III, SL's protection for these faults was limited to just one line of administrative protection. The analysis indicated that the prevailing risks, when compared to SAPs Targets 4 (Design Basis Analysis) and 6 (probabilistic risk to workers), are in the "ALARP range", i.e. ONR's focus should indeed have been on the validity of SL's ALARP assessment.

26. However, my analysis also concluded that even a modest claim on the reliability of an engineered protection system would be sufficient to meet the Basic Safety Objectives (BSOs) of Targets 4 and 6. Based on the evidence presented to me, I am now satisfied that these BSOs are met and therefore this case falls into the range where “Inspectors therefore need not seek further improvements from the designer/dutyholder” (SAPs para 701), i.e. ONR should not be seeking any further evidence that risks are ALARP in this instance.

***Inspection evidence has drawn the reliability of the existing protection into question***

27. This concern arose in part from the misunderstanding of what improvements are included in Phase III already discussed. Specifically, ONR inspectors were concerned that without Phase III, the continuing protection against this fault relied on an umbilical control system with a very poor reliability record and operators, whose standards of “conduct of operations” appeared to have fallen below reasonable levels.
28. SL confirmed that it too had judged the reliability of the umbilical system to be unacceptable and through application of its Technical Basis of Maintenance (TBoM) process, had made the necessary improvements. Importantly however, reliance on this system will cease once Phase II is implemented; so any continuing concerns over this system are irrelevant to consideration of Phase III.
29. Conduct of operations in parts of Magnox Reprocessing continues to be an ONR concern and at the time of writing, formal enforcement measures were being considered at another plant in this Operating Unit. More generally, ONR has expressed concerns at SL’s management of conduct of operations site-wide, leading to an enforcement letter in January 2015 (Reference 10), and the generation of an improvement programme (Reference 11).
30. However, for the Fuel Handling Plant, SL advised that Decanner Cell operations had not been a problem area for conduct of operations, with just one event in the past two years (a paperwork error, with activities nevertheless remaining in accordance with the safety case) from more than 100 operations. Furthermore, SL expects the frequency of such errors to reduce as the various improvement plans it has ongoing are rolled-out.
31. The reliability levels suggested by SL’s statistics accord broadly with the estimate I used in Reference 9 ( $10^{-2}$  failures per demand). As noted in the previous section, fault analysis of the protection being installed in Phases I and II suggests, at even modest levels of claim, a high overall reliability of protection commensurate with BSO levels will be achieved. In other words, even if SL is unsuccessful at improving its conduct of operations above recent levels, the risks of the fault under consideration here will still remain very small even if Phase III is not implemented.
32. Overall therefore I am satisfied that our inspection concerns are not a driver for proceeding with Phase III. Concerns over the umbilical systems will be made redundant through the completion of Phase II while concerns over conduct of operations do not materially affect the reliability of the protection SL is providing.

***SL has previously committed to doing this work and then not delivered on its promises***

33. This concern was raised because of the importance ONR attaches to good quality Periodic Safety Reviews (PSRs) and an apparent link between Phase III and a recommendation from a past PSR carried out by SL. Not completing PSR recommendations in a timely fashion was one of the factors that led to ONR issuing

the Improvement Notice on improvements to other gamma gates at FHP (Reference 1). As such, we advised SL that its arguments for not proceeding with Phase III would have to be highly convincing, especially given the time that has elapsed since these improvements were first proposed.

34. SL however considers that any link to a past PSR recommendation has been superseded by subsequent improvements, and not least those being progressed in Phases I and II. I agree with SL's position here; with these improvements, Phase III is not reasonably practicable and any links to past PSR recommendations have become irrelevant.

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

35. There is a single matter arising from this review, namely whether SL's NACCI process is sufficient to meet the company's duties under health and safety law. More specifically, I was concerned that placing improvements that SL considers to be reasonably practicable (and hence has a legal duty to resource) far down a prioritised list and then not having a mechanism for allocating sufficient resources to address them in the medium to long term does not appear to fulfil SL's duties under HSWA Sections 2 and 3. Resource constraints restricting the implementation of improvements that would otherwise be reasonably practicable can only be legitimate in the short to medium term. The fact that an improvement has a lower priority than other improvements does not change the necessity of its implementation. In short SL needs to use NACCI to help inform its future resource needs so that all reasonably practicable improvements are implemented within reasonable timescales.
36. This matter was discussed during my meeting with SL (Reference 5) at which SL agreed to consider this concern and review its process. These discussions have continued in the meantime, primarily through our regulation of SL's Long Term Periodic Review (LTPR) programme, and have led to the development of ONR "Lines to Take" guidance for inspectors regulating NACCI improvements at Sellafield (Reference 12). Changes to SL's NACCI process are, at the time of writing, still being considered by the licensee; this matter is being tracked by ONR under Regulatory Issue 3740.

#### **5 CONCLUSIONS**

37. This report presents the findings of my management review of whether it is reasonably practicable for SL to make further improvements to decanner gamma gates at FHP and in consequence, whether ONR should now require SL to make these improvements.
38. SL was able to provide good and convincing evidence to satisfy all eight areas of concern raised by ONR. In particular, I am satisfied that the Phase III work would do little to reduce risks which, by virtue of improvements already achieved or imminent, are already at very low levels (i.e. below ONR BSOs). As such I do not consider the Phase III improvements to be reasonably practicable.
39. SL needs to improve its NACCI process so that this informs its ongoing resourcing requirements.

#### **6 RECOMMENDATIONS**

40. ONR should not require SL to make the Phase III improvements to its decanner gamma gates at FHP.

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