



**National Nuclear Laboratory B\*\*\* Area 400 Commissioning  
Agreement to Commence Active Commissioning of B\*\*\* Area 400 (Phase 2)**

Project Assessment Report ONR-SEL-PAR-15-013  
Revision 0  
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## EXECUTIVE SUMMARY

### **National Nuclear Laboratory B\*\*\* Area 400 Commissioning Agreement to Commence Active Commissioning of B\*\*\* Area 400 (Phase 2)**

This report details the assessment and inspection work performed and the judgements made in making a regulatory decision regarding the issue of a licence instrument for agreement to commence active commissioning of B\*\*\* Area 400 (also known as Phase 2).

#### **Permission Requested**

In accordance with its arrangements made under Licence Condition 22(1), Sellafield Ltd (the licensee) has requested (on behalf of its tenant, National Nuclear Laboratory, NNL) the Office for Nuclear Regulation's agreement to commence active commissioning of Area 400 of the Central Laboratory on the Sellafield nuclear licensed site. The principal (controlling) document of the submission is the category 'B' plant modification proposal, B\*\*\*/2015/837, issue 1, 'Commencement of active commissioning within Area 400, B\*\*\* Central Laboratory'.

#### **Background**

Area 400 is a suite of several laboratories, with the majority containing large glove boxes serving a variety of purposes. The number of glove boxes in each room varies from one up to larger numbers; some of these combine to form suites many metres in length. In addition to the glove boxes, there are other ancillary rooms and a special nuclear material store.

Area 400 is intended to provide a generic research and development capability; its initial purpose is to characterise plutonium packages and gather data supporting long-term plutonium storage, thereby enabling Sellafield Ltd to reduce the risks and liabilities on the Sellafield nuclear licensed site. There are a significant number of packages within Sellafield stores that are reaching the end of their notional design life in around five years, it is imperative that information on the status of the packages is obtained promptly. It is expected that Area 400 will support commercial opportunities for NNL in the future.

NNL plans to perform active Commissioning of Area 400 in a stage-wise manner; this includes so-called 'Cat IV' commissioning (performed with gram quantities of active material) and 'Cat I' commissioning (performed with kilogram quantities of active material). There is also a period proposed following licence instrument receipt but prior to Cat IV commissioning where pre-active commissioning activities of relatively low hazard would be undertaken.

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

In order to make this regulatory decision, ONR has:

- Undertaken several engagements utilising multiple specialist technical disciplines for the purposes of familiarisation and challenge,
- Undertaken a readiness inspection of people, plant and processes at the facility, which included a licence condition 21 (commissioning) compliance inspection,
- Observed an emergency exercise focused on a hypothetical incident within Area 400,
- Completed proportional and targeted specialist inspectorial assessments of SL's submission, across human factors, mechanical engineering, fault studies, control & instrumentation and criticality technical disciplines

- Provided robust challenge to SL's submission, resulting in changes to controlling documentation.

## ■ Matters arising from ONR's work

All specialist inspectors (mechanical engineering, fault studies, control & instrumentation, internal hazards, criticality and human factors) support the issue of the licence instrument. However, two inspectors (criticality and human factors), have recommended further interaction with NNL.

The criticality specialist inspector has identified four areas for improvement that they consider must be assessed for adequacy prior to Cat I commissioning. The inspector has supported the issuing of the licence instrument on the basis of an additional hold point that has been put in place by NNL prior to Cat I commissioning and the length of time NNL has until that point to implement these improvements.

The human factors specialist inspector has reviewed NNL's programme of improvements to resolve their outstanding issues and considers that more work is needed. Some of these improvements are needed prior Cat IV commissioning whilst others are needed prior to Cat I commissioning. The inspector has nevertheless supported the issuing of the licence instrument on the basis of the adequacy of NNL's programme (once completed) and in view of the aforementioned hold point together with an additional hold point put in place by NNL prior to Cat IV commissioning.

I have considered the pros and cons of withholding the present licence instrument until our issues are fully resolved, rather than issuing the instrument but continuing to exert regulatory control of the active commissioning through hold points. I am satisfied that taking the former option would not be in the best interests of nuclear safety, would entail significant administrative effort and would be detrimental to hazard and risk reduction at Sellafield. I therefore support the issuing of this licence instrument.

To ensure appropriate regulatory ownership of these hold points, ONR regulatory issues (#4207 and #4031) have been raised to capture our remaining issues. Under SL's nuclear site licence arrangements NNL's hold points for controlling the progress of the active commissioning can only be lifted under the authority of an ONR Superintending Inspector.

The Environment Agency, ONR Civil Nuclear Security and ONR Safeguards have all confirmed that they have no objections to the issuing of this licence instrument.

## Conclusions

As a result of the criticality and human factors specialist inspectors' findings NNL has put two hold points in place, one prior to Cat IV commissioning and the other prior to Cat I commissioning. These hold points enable ONR to confirm the safety of the active commissioning before significant quantities of radioactive material are introduced.

With these hold points in place, I judge that the safety detriment to issuing an LI whilst the outstanding issues remain unresolved is small, when compared with the significant administrative effort and detriment to the programme schedule (and therefore hazard and risk reduction) that would arise should ONR either require an amended resubmission or wait until all our issues are resolved.

## Recommendations

This project assessment report makes three recommendations:

- ONR should perform an appropriate balance of assessment and inspection work to determine if it is appropriate to release the hold point prior to the introduction of gram quantities of active material in to Area 400 (Cat IV commissioning).
- ONR should perform an appropriate balance of assessment and inspection work to determine if it is appropriate to release the hold point prior to the introduction of kilogram quantities of active material in to Area 400 (Cat I commissioning).
- ONR should agree to NNL commencing active commissioning of B\*\*\* Area 400 (Phase 2), via licence instrument 893.

## LIST OF ABBREVIATIONS

ALARP	As Low As Reasonably Practicable
BET	Brunauer–Emmett–Teller
BNFL	British Nuclear Fuels Ltd
C&I	Control & Instrumentation
CIDAS	Criticality Incident Detection and Alarm System
DAP	Duly Authorised Person
DJR	Design Justification Report
FMU	Fissile Material Unit(s)
FOB	Fault OBServation
HF	Human Factors
HOW2	(Office for Nuclear Regulation's) Business Management System
IH	Internal Hazards
IIS	Integrated Intervention Strategy
L3RIM	Level 3 Regulatory Interface Meeting
LC	Licence Condition
LI	Licence Instrument
mSv	millisievert
NNL	National Nuclear Laboratory
O <sub>2</sub>	Oxygen
ONR	Office for Nuclear Regulation
PAR	Project Assessment Report
pdf	Probability of Failure on Demand
PMP	Plant Modification Proposal
R&D	Research & Development
RGP	Relevant Good Practice
SAP	Safety Assessment Principle(s)
SL	Sellafield Ltd.
SM	Safety Mechanism
SNM	Special Nuclear Material
SQEP	Suitable Qualified and Experience Person(s)
TCA	Temporary Commissioning Aid

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## 1 PERMISSION REQUESTED

1. In accordance with its arrangements made under Licence Condition 22(1)<sup>a</sup>, Sellafield Ltd (SL) (the licensee) has requested <sup>[1]</sup> the Office for Nuclear Regulation's (ONR) 'agreement'<sup>b</sup> to commence active commissioning of Area 400 of the Central Laboratory on the Sellafield nuclear licensed site. The principal (controlling) document of the submission is the category 'B'<sup>c</sup> Plant Modification Proposal (PMP), B<sup>\*\*\*</sup>/2015/837, issue 1, 'Commencement of active commissioning within Area 400, B<sup>\*\*\*</sup> Central Laboratory' <sup>[2]</sup>.
2. This Project Assessment Report (PAR) has been written to capture ONR's regulatory judgement and support a recommendation to issue an 'agreement'<sup>b</sup> in the form of a Licence Instrument (LI) <sup>[3]</sup>.

## 2 BACKGROUND

3. National Nuclear Laboratory (NNL) is the primary occupant of the Central Laboratory, which is located on the Sellafield nuclear licensed site. NNL is a tenant on the licensed site, not a licensee. Therefore, NNL has only prepared the safety case submission. SL has reviewed and accepted the documentation and submitted it to ONR under its own arrangements, made under Licence Condition (LC) 22(1).
4. The Central Laboratory consists of:
  - Inactive laboratories (Phase 1),
  - Low/medium plutonium active laboratories (Phase 1),
  - Uranium active rig hall (Phase 1),
  - High plutonium active laboratories (Phase 2),
  - Highly active cells (Phase 3).
5. The active items in Phase 1 have been actively commissioned and are now currently in 'extended active commissioning'. NNL now wishes to take the high plutonium active laboratories (Phase 2) into active commissioning. Active Commissioning of Area 400 is to be performed in a stage-wise manner; 'Cat IV' commissioning is performed with gram quantities of active material and 'Cat I' commissioning is performed with kilogram quantities of active material. NNL also proposes a period following licence instrument receipt but prior to Cat IV commissioning where pre-commissioning activities of relatively low hazard would be undertaken.
6. Area 400 is a suite of several laboratories, with the majority containing large glove boxes serving a variety of purposes. The number of glove boxes in each room varies from one up to larger numbers; some of these combine to form suites many metres in length. In addition to the glove boxes, there are other ancillary rooms and a special nuclear material (SNM) store.

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<sup>a</sup> SL's arrangements for LC22 have not been 'Approved' by ONR; that is, ONR has not frozen them. SL's LC22 arrangements were last examined in October 2014 and found to be adequate <sup>[4]</sup>.

<sup>b</sup> In this instance, 'agreement' is a use of a derived power (i.e. one given to ONR through the licensee's arrangements), rather than a primary power (i.e. one given to ONR through law).

<sup>c</sup> On a scale of 'A' to 'D', where 'A' is the most safety significant and 'D' the least. 'B' implies a high consequence to a worker, and minimal consequence to the public.

7. Area 400 is intended to provide a generic Research & Development (R&D) capability; its initial purpose is to characterise plutonium packages and gather data supporting long-term plutonium storage. Many of the SL plutonium/residue packages and storage facilities are aging and are not designed to modern standards. As such, the SL strategy is to empty the older stores progressively and replace the plutonium/residue packaging where necessary. Area 400 capabilities will support the required R&D to enable SL to reduce these risks and liabilities on the Sellafield nuclear licensed site. It is expected that Area 400 will support commercial opportunities for NNL in the future.
8. Area 400 operations will also contribute to hazard and risk reduction both directly (through the processing and repacking of the packages subjected to experiment) and indirectly (through the underpinning design information it will generate for a future retreatment plant).
9. This report has been written in accordance with the requirements of the relevant guides in HOW2 <sup>[5]</sup>.

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

10. When plutonium is handled in glove boxes, significant worker consequences can arise as a result of a fault. However, the consequences to the public from faults are very low because of the low quantities of material within Area 400 and the protection in place to prevent any aerial release<sup>a</sup>. In contrast, potential worker consequences are potentially significant. I therefore sought advice from specialist inspectors from the following technical disciplines:
  - Human factors (HF),
  - Mechanical engineering,
  - Control & instrumentation (C&I),
  - Fault studies,
  - Criticality, and
  - Internal hazards (IH).
11. Although I am acting as the project inspector for this request, I was previously a chemical engineering specialist within ONR. As a result, I am well placed to understand the adequacy of the NNL commissioning programme.
12. Two early engagements were held <sup>[6, 7]</sup> at the Central Laboratory to familiarise the specialists with the facility, in terms of its history, layout, functionality and key risks to safety. Following the early engagement meetings, the internal hazards inspector and I agreed <sup>[8]</sup> that further assessment in that area was not required, as the inspector had not identified any issues of concern during the plant visit, or in the following discussions. We agreed that the inspector would participate in the readiness inspection (see below).
13. The five remaining specialist inspectors have all assessed the submission on a sampling basis and provided reports <sup>[9-13]</sup> accepted by the relevant professional lead (or nominee). The criticality specialist undertook a further engagement <sup>[14]</sup> at the Central Laboratory to discuss the initial findings of the criticality assessment. The HF specialist also undertook a separate engagement <sup>[15]</sup>, by teleconference, to address the issues found during the assessment process.
14. An ONR readiness inspection <sup>[16]</sup>, attended by the majority of the specialist inspectors, was held at the Central Laboratory in early December. However, the fault studies inspector and I felt it would not be 'value adding' for the inspector to attend, since there were no significant findings in the fault studies assessment report. The criticality specialist was unable to attend. The readiness inspection also gave me an opportunity to undertake a planned LC21 (commissioning) inspection (a planned intervention on ONR's Sellafield Infrastructure Inspection plan).
15. In addition, I observed an emergency exercise held in the Central Laboratory <sup>[17]</sup>, where a facility-wide response to an incident within one of the laboratories in Area 400 was rehearsed.

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<sup>a</sup> This view was later supported by the Fault Studies specialist inspector – see below

### 3.1 CRITICALITY

#### 3.1.1 Assessment

16. The criticality specialist inspector's assessment <sup>[9]</sup> focused on the areas of the facility that present the greatest criticality hazard; i.e. those areas that will contain significant quantities of fissile material. The inspector examined these areas for adequacy against the modern standards and risk criteria presented in the ONR safety assessment principles (SAP) and technical guides.

### 3.2 CONTROL & INSTRUMENTATION

#### 3.2.1 Assessment

17. The C&I specialist inspector's assessment <sup>[10]</sup> looked specifically at two safety mechanisms (SM) designed to prevent and protect against a release of activity from glove box containment. The SMs sampled were high oxygen (O<sub>2</sub>) level detection and detection of glove box depressurisation.

#### 3.2.2 Readiness Inspection

18. The inspector focused on the following areas <sup>[18]</sup>:

- Thoroughness of inactive commissioning,
- Design and testing of two of the most important SMs covering high O<sub>2</sub> level detection and detection of glove box depressurisation (C&I deep slice sample),
- Safety case 'as low as reasonably practicable' (ALARP) arguments relating to C&I safety equipment,
- Alarm annunciation and display.

### 3.3 HUMAN FACTORS

#### 3.3.1 Assessment

19. The human factors specialist inspector's assessment <sup>[11]</sup> focused upon examining whether:
  - NNL has appropriately integrated HF into the project so that the design solution is adequate from a HF perspective,
  - Safety significant claims have been substantiated as achievable and feasible through suitable and sufficient assessment,
  - The inactive commissioning process has demonstrated the above and the functionality and operability of the human system.
20. To achieve the aims above, the inspector examined a sample of operations associated with high consequence faults with significant human interactions and/or safety claims.

#### 3.3.2 Readiness Inspection

21. The inspector looked to see how the inactive commissioning process had been used and how the commissioning schedule demonstrated HF aspects of the project. This included <sup>[19]</sup>:
  - Review and implementation of the recommendations from the HF reports,
  - How NNL is providing assurance that the as-is plant meets HF relevant good practice,

- How NNL has validated that safety case HF claims and assumptions can be met in practice,
- Maturity of procedures and training to support a move to active commissioning including status of Duly Authorised Person (DAP) appointments.

### 3.4 MECHANICAL ENGINEERING

#### 3.4.1 Assessment

22. The mechanical engineering specialist inspector's assessment <sup>[12]</sup> focused on loss of containment as it is the key hazard to the operators. More specifically, the inspector assessed the following topics:

- Codes and standards used for the design and manufacture of the glove boxes and ventilation systems,
- Method of ensuring breach flow into (rather than out of) the glove box in the event of loss of containment (to prevent contamination reaching the operator),
- Protection from over pressurisation of the glove boxes through gas service lines and service line back flow in the event of loss of containment,
- Hydrogen management during SNM package operations within glove boxes
- Operator protection when working within glove boxes,
- Isolation of 'out of scope' glove boxes and service systems ('out of scope' refers to those glove boxes and services that are not being commissioned at this time),
- Use of 'Operational Experience Feedback' and 'Learning From Experience'.

#### 3.4.2 Readiness Inspection

23. The inspector focused <sup>[20]</sup> on the following areas during the inspection:

- Leak testing of glove boxes,
- Service isolations for out of scope items,
- Use of orifice plates and filtration of glove box service lines,
- Liquid nitrogen management in the 'Brunauer–Emmett–Teller' (BET) glove box,
- Testing and commissioning of cut resistant gloves,
- Labelling and protection of alpha-in-air pipework,
- Internal hazards identified as part of the day's discussions.

### 3.5 FAULT STUDIES

#### 3.5.1 Assessment

24. The fault studies inspector's assessment <sup>[13]</sup> focused on loss of containment as it is the key hazard to the operators. More specifically, the inspector assessed the loss of containment faults within the following fault sequences:

- D4.401 (Generic glove box hazards) for 20-1000 mSv faults,
- D4.431 (Thermobalance) for 20-1000 mSv faults,
- D4.460 (Ceramography and residue furnace) for > 1000 mSv faults,
- D4.470 (Residue can opening) for 20-1000 mSv & >1000 mSv faults.

25. The inspector's sampling strategy clearly states that off-site (public) doses are not considered within the report, as described below:

*“It is evident...that the Licensee considers the off-site (public) dose frequencies are not significant compared to the on-site (worker) dose frequencies. Based on my knowledge of the proposed operations within the facility, I am content that the insights from the dose frequency results are reasonable and therefore I have not assessed off-site dose frequencies further.”*

### **3.6 INTERNAL HAZARDS**

#### *3.6.1 Readiness Inspection*

26. The inspector's discussions and walk-down of Area 400 were focused on the following internal hazards <sup>[21]</sup>:

- Nuclear fire and conventional fire hazards,
- Chemotoxic effects,
- Missile generation / impact – Ceramography glove box,
- Internal Flooding – Thermobalance glove box,
- Hydrogen explosion / deflagration,
- Management / Handling of liquid nitrogen in the BET glove box.

### **3.7 PROJECT INSPECTION**

#### *3.7.1 Assessment*

27. I reviewed the following documents as part of my project assessment:

- ‘Area 400 Pre-Active Commissioning Safety Report’ <sup>[22]</sup>,
- ‘Overarching Strategy Paper for Commencement of Active Commissioning’ <sup>[23]</sup>,
- Plant Modification Proposal: ‘Commencement of active commissioning with Area 400, BXXX Central Laboratory’ <sup>[2]</sup>,
- ‘BXXX Area 400 Active Commissioning Strategy’ <sup>[24]</sup>,
- ‘Inactive Safety Commissioning Report’ <sup>[25]</sup>.

#### *3.7.2 Readiness & Compliance Inspection*

28. During the readiness inspection, I conducted an LC21 (commissioning) inspection <sup>[16]</sup> aimed at determining the adequacy of compliance of the Phase 2 commissioning programme with the licensee's arrangements. Using ONR's guidance document on LC21 <sup>[5]</sup> and my previous experience of commissioning projects, I identified the following areas to sample:

- The process by which NNL entered inactive commissioning,
- Demonstration that the commissioning team are Suitably Qualified and Experienced (SQEP),
- The appropriate underpinning of the active commissioning schedule with commissioning worksheets,
- Examination of the Fault Observation (FOB) and Temporary Commissioning Aids (TCA) processes,
- Examination of completed inactive commissioning worksheets.

## 4 MATTERS ARISING FROM ONR'S WORK

29. This section summarises the matters arising from each of the specialist inspectors' reports and participation at the readiness inspection (as appropriate).

### 4.1 CRITICALITY

#### 4.1.1 Assessment

30. The criticality specialist's assessment report <sup>[9]</sup> identified:

*"...four areas where meaningful improvements could be made with little extra cost, effort or disadvantage to operational efficiency."*

31. These areas were:

■ **Notification of breach of limits:**

NNL was unclear as to the requirement for NNL/SL to notify ONR should a breach of an Operating Rule (or required Operating Instruction<sup>a</sup>) occur.

■ **Moderator limits in high-fissile content Fissile Material Units (FMU):**

Relevant good practice would suggest that NNL should derive a limit on type, mass and volume of moderators as appropriate, and develop a means of demonstrating compliance.

■ **Inventory errors – comprehensive assessment of box build up and 'material unaccounted for':**

Relevant good practice would suggest that NNL should develop a process to address assay errors and accounting uncertainties.

■ **[Electronic] Back-up of records (relating to movement of fissile material):**

Record retention is important – items in the paper system proposed could become defaced and lost and a paper system is not the best means to facilitate examination of trends.

32. Responses provided by NNL at the readiness inspection, and later by email <sup>[26]</sup>, proposed acceptable solutions to three of the inspector's concerns. However, NNL's proposal for moderator control is still outstanding as NNL is presently considering how best to introduce a control with minimal operational burden.

33. In the report, the inspector also discusses the fact that although a criticality warning system (known as CIDAS<sup>b</sup>) is installed within Area 400, NNL has submitted an omission case seeking not to utilise this system during Cat IV commissioning on the basis of the small quantities of material used.

34. The inspector notes that the amount of material to be used in Cat IV commissioning is significantly smaller than that generally accepted to produce a criticality and that the omission case does not extend to cover Cat I commissioning. In the inspector's opinion:

*"...it would be difficult for NNL to make an omission case [for Cat I commissioning] that was consistent with ONR's expectations..."*

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<sup>a</sup> SL terminology used; Operating Rules are SL's highest limits & conditions necessary in the interests of safety, with required Operating Instructions being those instructions necessary to comply with Operating Rules.

<sup>b</sup> CIDAS – Criticality Incident Detection and Alarm System ®

35. The inspector notes that NNL cannot introduce kilogram quantities of material into the facility without either extending the omission case or implementing the CIDAS and associated criticality emergency arrangements.
36. The inspector reaches three main conclusions:
- “For Cat IV commissioning:*
- \* the criticality risk to operators meets the Basic Safety Objective. There is no significant criticality risk to members of the public.*
  - \* the arrangements made by SL/NNL to ensure the criticality safety of the Area 400 facilities meets relevant good practice...”*

*“In order for these conclusions to apply to Cat I commissioning, there are four areas...where improvements to safety should be made... These areas need to be assessed for adequacy prior to Cat I commissioning.”*

*“I consider that because:*

    - \* there is sufficient time (a period of several months) for SL/NNL to address these areas; [i.e. the four improvement areas]*
    - \* SL/NNL will have to gain approval from ONR on security issues and the issue of the Criticality Warning System prior to Cat I commissioning;*
    - \* the four areas have been recorded as an ONR Issue No: 4027;*

*it is appropriate to approve this modification”*

37. As suggested above, to give the inspector further confidence that the matter will be pursued, ONR regulatory issue no. 4027 has been created to capture the four areas for improvement needed before Cat I commissioning can proceed.

38. The inspector suggested that much of the submission was deserving of an Integrated Intervention Strategy (IIS) rating of 2, good standard, as it was of high technical quality, and the dutyholder’s staff were ‘alert to and actively pursuing improvements’ and ‘generally proactive and positive’. However, as a result of the areas for improvement, particularly the deficiency in moderator control, the final score assigned was reduced to an IIS rating of 3, adequate.



## 4.2 CONTROL & INSTRUMENTATION

### 4.2.1 Assessment

39. The inspector noted <sup>[10]</sup> some shortfalls within the sampled documentation. These related to some equipment not designed to modern standards and four examples of where the required probability of failure on demand (pfd) was not wholly substantiated. There was also a further issue related to anomalous statements within the C&I Design Justification Report (DJR).
40. With regard to the modern standards shortfall, the inspector states that this is generally due to the long period of time the facility has spent in care and maintenance (approaching 10 years), whilst standards have continued to advance.
41. Through discussion with the fault studies inspector <sup>[27]</sup>, the C&I inspector was satisfied that the shortfalls in pfd substantiation do not compromise the safety case, given the other conservatisms in the case.
42. The inspector noted a number of statements within the appendices of the C&I DJR that appeared to require/demand additional work. However, the inspector was reassured by NNL <sup>[28]</sup> that these statements were legacy items from previous revisions that had not been removed. The work to which they related had been completed.
43. The report concludes:

*“...the overall C&I design was adequate and that the shortfalls identified within this report did not warrant a delay to commencement of active commissioning.”*

*“I have confidence that the C&I design is fit for purpose and I support the release of permission for Active Commissioning.”*
44. The inspector gave the submission an IIS rating of 4, below standard, as a result of the shortfalls initially identified and the late delivery of the submission.

### 4.2.2 Readiness Inspection

45. The inspector found <sup>[18]</sup> several examples of good practice in the areas examined, providing confidence that the risks had been reduced to ALARP. The inspector noted that the alarm annunciation and display panels were non-optimal; however NNL confirmed that there was work already underway to address the issue.
46. Following the inspection, the inspector judged that the risks associated with the active commissioning of NNL Phase 2 are being adequately managed and thus the inspector continues to be supportive of granting this permission.

## 4.3 HUMAN FACTORS

### 4.3.1 Readiness Inspection

47. The inspector noted some positive findings relating to; inclusion of operating assumptions within the clearance certificates relating to Area 400, knowledgeable DAPs, and the inspector's own judgement of the quality of the task environment was more positive than that of NNL's own analysis. However, the inspector concluded <sup>[19]</sup>:

*"Whilst NNL is aware that work needs to be done in order to demonstrate that the human factors aspects of the project are in place to commence active commissioning, it is my view that readiness cannot be demonstrated at this time."*

48. In order to be able to support the permission, the inspector requested that NNL supply a detailed programme of work to identify, justify and demonstrate credible delivery of the tasks required to close out NNL's identified HF-related shortfalls.
49. This programme of work and supporting information is discussed below.

### 4.3.2 Assessment

50. The human factors assessment <sup>[11]</sup> noted several shortfalls with NNL's case, including; the largely desktop nature of the HF assessment, the exclusion of all discretionary elements of SL's HF methodology without justification, the [low] level of substantiation provided by NNL for HF aspects of operations, the lack of explicit HF input into the design following NNL's involvement and the ergonomic standards associated with some of the store operations.
51. After significant ONR-NNL interaction on the matter, NNL supplied a Human Factors Integration Plan that provides an appropriate programme of work (see above, ¶ 49) to address the gaps identified. The programme is staged; work prior to Cat IV commissioning (i.e. prior to the introduction of active material), work during Cat IV commissioning and work during Cat I commissioning. However, the inspector noted that the programme was delivered very late in the schedule and the timescales for its delivery are challenging. NNL also submitted evidence of the competency assessment process that met the inspector's expectations. However, the inspector again thinks that delivery of the programme of training is compressed and will be challenging to achieve.
52. The assessment report concludes:

*"I do not consider that NNL is ready to commence processing of active material. NNL has been unable to satisfy my expectations with the claims, arguments and evidence as laid down within the Licensee's safety case. Significant shortfalls in scope and application of HF have been highlighted by my assessment."*

53. As a result of the conclusion above, the inspector discussed the matter with me and following that discussion, concluded:

*"I have no objection to the commencement of the enabling works which will need to be completed prior to material coming into the facility as they do not have a significant HF component."*

54. However, in order to support the granting of the LI, the inspector made two recommendations, the first of which is immediately relevant to this permission: the requirement for the addition of two hold points; one prior to Cat IV commissioning and the second prior to Cat I commissioning. In both instances, NNL is to confirm (and provide evidence, accepted by SL's Operational Control Management team and the Internal Regulator) that the programme of work to that point is complete and there are no shortfalls outstanding.
55. In order to give the inspector further confidence that the matter will be resolved, ONR regulatory issue no. 4031 has been raised to capture the inspector's concerns.
56. The second recommendation is with regard to raising an issue regarding the shortfalls in NNL's approach to HF, aimed at gaining confidence in NNL's treatment of HF for future PMPs. The inspector is to raise a regulatory issue to cover this. As such, this recommendation is not considered further here.
57. The inspector gave the submission an IIS rating of 5, significantly below standard, in that in the inspector's view NNL's scope and application of HF to this project, has one or more important requirements missed or not delivered. Nevertheless, the inspector supports the granting of this LI subject to resolution of regulatory issue 4031 prior to NNL embarking on the categorised stages of active commissioning.

#### **4.4 MECHANICAL ENGINEERING**

##### **4.4.1 Assessment**

58. The assessment concludes <sup>[12]</sup>:

*"From a mechanical perspective, I consider that the Licensee's proposal to undertake active commissioning operations within Area 400 is justified. I am satisfied the Licensee has followed due process and has provided good justification for operation. I am content that the work has been performed in a conservative manner."*

59. The inspector made a single recommendation as a result of certain documentation not being complete at the time of assessment:

*"The Project Inspector should consider seeking assurance that all isolations associated with out of scope items ... [have] undergone the Licensee's due process prior to permissioning."*

60. The inspector gave the submission an IIS rating of 2, good standard, as a result of the good (and best) practices seen.

#### 4.4.2 Readiness Inspection

61. The inspector's sample <sup>[20]</sup> generally aligned with good practice and the inspector also found some areas of best practice during the plant walk down. However, the inspector also identified a couple of areas for improvement:
  - Labelling and protection of the alpha in air monitoring pipework had not been instituted, despite being raised at a previous ONR plant walk down.
  - Some of the 'ALARP arguments' put forward by NNL are actually 'topics for clarification' rather than alternative means of substantiation.
62. Despite these, the inspector remains supportive of the permissioning of the move of NNL Phase 2 in to active commissioning.

### 4.5 FAULT STUDIES

#### 4.5.1 Assessment

63. The inspector was content that the relevant SAPs (FA.1-8 & EKP.5) have been met when reasonable practicability is considered. The inspector raised no significant concerns with the submission.
64. The inspector did however note a number of minor issues (e.g. reliance on personnel evacuation, lack of segregation of safety equipment, small discrepancies between claimed and target reliabilities for some items) but did not feel it necessary to pursue these further.
65. The assessment <sup>[13]</sup> concludes:

*“From a fault studies perspective, I consider that the Licensees proposal to undertake active commissioning operations within Area 400 is justified. I am content that the Licensee has satisfied the design basis analysis (DBA) principles and has provided a good justification for operation. I am satisfied that the Licensee’s analysis has been performed in a conservative manner and that the risks arising from active commissioning operations in Area 400 are ALARP.”*
66. Only one recommendation was made, which was to say that ONR should agree to the proposal to commence active commissioning.
67. The inspector gave the submission an IIS rating of 2, good standard, as a result of the sound and conservative judgements used.

## 4.6 INTERNAL HAZARDS

### 4.6.1 Readiness Inspection

68. The inspector's sample across the six areas identified above generally returned positive results; the inspector judging that relevant good practice (RGP) and ALARP expectations have been met and all outstanding issues had been closed out <sup>[21]</sup>.
69. Initially NNL was unable to provide all the necessary documentary evidence for the close out of the nine outstanding issues in the conventional fire safety assessment; however it did so after the inspection <sup>[29]</sup>. The internal hazards inspector has reviewed this documentation and is satisfied that the issues are now closed <sup>[30]</sup>.
70. The inspector was supportive of the permissioning of NNL Phase 2 project to move to active commissioning.

## 4.7 PROJECT INSPECTION

### 4.7.1 Assessment

71. I found no significant issues during my review that had not been raised by the specialist inspectors. I did however raise a number of questions, largely for clarification. NNL supplied responses at the readiness inspection and subsequently followed up by email <sup>[31]</sup>. I requested further details on two aspects:
  - The safety significance of the chloride removal filter in the residue can furnace glove box, and
  - The potential for loss of containment should the plastic water header tanks (located on top of the ceramography suite) run dry for prolonged periods.
72. NNL provided responses <sup>[32]</sup> to these further challenges:
  - The filter is to be replaced after every use (as per the operator instruction) and NNL states there are no acute consequences to a single filter failure; thus the filter is not considered safety significant. Loss of containment from the C5 ventilation system has been addressed and safety measures identified.
  - NNL is to introduce an operating assumption to the safety case that will see the header tanks isolated from the glove box when not in use.
73. I am content with the responses such that permissioning need not be withheld, though I have advised NNL that I consider further improvements (such as management checks on the filter) appear reasonably practicable <sup>[33]</sup>.
74. I consider the 'Route Map to Active Commissioning' (appendix 2, within the Overarching Strategy Paper) to be clear, well thought through and robust. I am confident that the steps presented following 'Receipt of Licence Instrument for Area 400 Active Commissioning' will be undertaken. This is as a result of the positive and confidence building interactions I have had with the NNL and SL teams throughout this project.

75. I am aware nonetheless of potential minor deviations from that route map (for example the potential decision to bring forward one of the more difficult-to-perform active drain tie-ins in order to ensure timely success). I have no concerns that these deviations present detrimental risks to nuclear safety as they are controlled by individual category 'C' PMPs, have thus been subject to oversight in their own right and ONR would not normally be involved with such modifications.
76. In its Pre-Active Commissioning Safety Report (§ F), NNL has stated:
- "No further improvements have been identified and it is concluded that the risks are ALARP for safe active commissioning of Area 400."*
77. The results of ONR's assessment of the case contradict this statement in some respects; the criticality specialist inspector has found reasonably practicable areas for improvement (and NNL has accepted these), whilst the HF specialist inspector has found significant shortfalls with the case made in that discipline (and again, NNL has accepted this and has in place a programme of work <sup>[34]</sup> to address this prior to, and continuing through, the active commissioning phase.)
78. As a result of NNL's acceptance of the areas raised by ONR's specialists, my own assessment of the project documentation, the assessments by other specialists in support of the permission (which raised no concerns) and the reasons further discussed in § 4.8, I believe that although NNL/SL has not yet fully demonstrated that the risks are reduced to ALARP, it is unreasonable to withhold the requested permission at this time.

#### 4.7.2 Completion of ONR & SL Due Process

79. Prior to this assessment, there was only one outstanding ONR regulatory issue in relation to the Central Laboratory Area 400 (#3218); however that is concerned with the completion of the permission at hand. Two new regulatory issues (#4027, see ¶ 37 and #4031, see ¶ 55) have been raised to capture the criticality and human factors specialist inspectors' concerns.
80. ONR (at the time called the Nuclear Installations Inspectorate) has made two previous relevant permissioning decisions with respect to the Central Laboratory, both issued in 1999: LI 269 <sup>[35]</sup> 'Notification of Intent Not to Examine Further the Construction of the BNFL Technology Centre<sup>a</sup>' and LI 270 <sup>[36]</sup> 'Notification of Intent to Examine the Active Commissioning of the BNFL Technology Centre<sup>a</sup>'. The current permissioning decision is made in line with those LIs.
81. I consider the licensee to have completed its own due process (prior to submission of the request) as a result of the signatures seen on the front of the PMP. These include (amongst others) the Operating Unit Engineering Manager (the 'Design Authority'), the Safety Committee Chair and the Independent Member of the Safety Committee. Further evidence of the completion of due process is seen in the relevant minutes of the Safety Committee <sup>[37-39]</sup>, which accepted the PMP and other documentation considered in this PAR.

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<sup>a</sup> The British Nuclear Fuels Ltd (BNFL) Technology Centre is now known as the Central Laboratory.

82. SL has also submitted two signed Independent Nuclear Safety Assessment (INSA) certificates thereby demonstrating independent assessment; #2876<sup>[40]</sup>, relating to the Pre Active Commissioning Safety Report (and its numerous supporting documents) and #2877<sup>[41]</sup>, relating to the PMP. There were no conditions attached to either of the certificates.
83. In addition, the SL Operational Control Management team and the SL internal regulator also conducted an independent readiness review<sup>[42]</sup>. Although still in draft at the time of my review, there was only one significant issue identified, relating to the need to ensure minimum manning safety levels were completed by the end of January. I am confident that, given the time available and the visibility of the issue to the OCM team, this issue will be closed out successfully.

#### 4.7.3 *Readiness & Compliance Inspection*

84. I found no issues significant enough to withhold permission, although there were some minor areas for improvement identified<sup>[16]</sup>. These related to:
- No signage of Temporary Commissioning Aids (TCAs) on the exterior of panels,
  - The high frequency of 'High Priority' FOBs breaching the stated five-day turnaround 'requirement',
  - The delay in witness signatures being applied to inactive commissioning test documentation.
85. I consider these aspects to be minor as, in my opinion, they have no direct safety implications;
- The TCAs were clearly labelled and obvious when examining inside the panel (and NNL corrected the issue before the end of the day),
  - The five-day limit for the 'high priority' FOBs is somewhat arbitrary (and FOBs were being dealt with as quickly as resource would allow), and
  - Following my enquiries, I have no reason to believe that the safety-critical tests were not witnessed contemporaneously by the licensee even though there were small differences in the dates relating to the tester and the witness signatures.

#### 4.7.4 *Emergency Exercise*

86. There were no significant issues arising from my observations<sup>[17]</sup> during the emergency exercise in relation to the active commissioning of Phase 2. I noted several good practice elements.
87. I did however raise a number of potential areas for improvement, relating mainly to the wider Central Laboratory response to incidents. The most significant aspect with respect to Phase 2 was the issue that the handheld radios did not work in the individual laboratories. NNL had already recognised this issue from a previous exercise and is to address it. I did not seek evidence of this – the interim measure in place (relaying messages from locations with good radio coverage) was demonstrated to be effective.

#### 4.8 CONSIDERATION OF SPECIALIST INSPECTORS' RECOMMENDATIONS

88. I have discussed the mechanical engineering specialist inspector's recommendation with the inspector and I have subsequently requested and received the completed signature sheets of the relevant PMPs from NNL/SL <sup>[43]</sup>. Therefore I consider this recommendation is closed out.
89. As a result of the human factors specialist's findings (§ 4.3), NNL has confirmed that <sup>[43]</sup> a further ONR (safety) controlled hold point has been put in place prior to Cat IV active commissioning for the purposes of ensuring that relevant parts of NNL's proposed HF improvement plan has been adequately completed.
90. As a result of the criticality (§ 4.1) and human factors (§ 4.3) specialists' findings, NNL has also confirmed that <sup>[43]</sup> a further ONR (safety) controlled hold point has been put in place prior to Cat I active commissioning, for the purposes of assessment of the criticality detection case (omission or introduction thereof), examining the implementation of the solutions to the four criticality improvement areas and finally, ensuring that NNL's proposed HF improvement plan has been adequately completed.
91. These hold points <sup>[44]</sup> will be released via the L3RIM route (i.e. under the authority of an ONR Superintending Inspector) following completion of an appropriate balance of inspection and assessment activities. Any inspection interventions will be undertaken with the support of a criticality and/or human factors specialist. **RECOMMENDATIONS 1 & 2**
92. I have made these recommendations (human factors and criticality) rather than withhold ONR's permission because I recognise the wider role that the Area 400 facility will have in reducing the hazard and risk presented by ageing plutonium containers and stores across the Sellafield site. This will be done both directly, through the processing and repacking of the packages subjected to experiment, and indirectly, through the underpinning design information it will generate for a future retreatment plant. I am content that the approach of setting additional hold points after LI issue is appropriate, as:
- I have used it successfully in previous permissioning decisions on the site (see Evaporator B Return to Service, ONR-SEL-PAR-13-037 <sup>[45]</sup>), thereby reducing the uncertainties associated with this approach,
  - It supports the Sellafield Programme strategy <sup>[46]</sup> aim of '*Accelerated hazard and risk reduction across the Sellafield site*' and its permissioning strategy that seeks to '*take a positive and enabling approach to the permissioning of activities when legal requirements have been met or the risk/compliance gap is such that it would be disproportionate not to grant permission*',
  - It utilises the now mature 'Hold Pont Control Plan' that is a feature of the monthly L3RIM between ONR and SL (also discussed in the Sellafield Programme strategy),
93. It could be argued that, with the issues outstanding in the HF area, withholding the permission might be a proportionate step. However, I disagree with that approach. At present, SL's submission is unfortunately structured such that some lower hazard activities (see ¶ 94, below) depend on the issuing of an LI, as well as the continuation of the licensee's governance arrangements (i.e. issuing of the LI is not seen by the licensee as a 'green light' to implement the modification without thought; this is welcomed).



94. Having examined NNL's programme of work <sup>[47]</sup>, I believe that withholding the permission at this stage will create unnecessary delays (approximately two months) in the pre-commissioning works where the hazard is relatively low and controlled by Category 'C' PMPs (ONR would not normally be involved in the implementation of Category 'C' PMPs). It is only when active material is introduced to the facility (i.e. in Cat IV commissioning) that the hazard increases significantly (and arguably irreversibly).
95. Creating delays here would obviously impact NNL's overall programme of work. Given that there are a significant number of packages within Sellafield stores that are reaching the end of their notional design life in around five years, it is imperative that sufficient information on the status of the packages is obtained promptly. Area 400 is the only facility on the site with the ability to perform this work, which will inform an ALARP design for a large-scale retreatment plant that needs to be built prior to the packages reaching their design life.
96. An alternative strategy could be to have NNL withdraw the current request and resubmit an amended version that excluded inactive commissioning steps and sought ONR's permission to introduce active material to Area 400 only (the hazard increases significantly only when active material is imported). However, this is not an efficient use of either NNL's, SL's or ONR's time or resources, since the same outcome can be achieved through issuing the LI now and the applying the above hold points prior to Cat IV (and Cat I) commissioning, as suggested above. Therefore the above approach strikes a sensible balance between the risk of permissioning now with outstanding issues and the delay introduced by permissioning once the issues are closed out.
97. I believe that there is sufficient time between issue of the LI and Cat IV commissioning for NNL/SL to resolve the HF issues satisfactorily and demonstrate this to ONR. If ONR determines that our issues have not been resolved, the hold point(s) will not be lifted and under SL's LC22 arrangements, NNL would not be able progress to the next phase.
98. Ultimately, ONR can exercise the powers afforded to it by law (under licence condition 22(5)) to direct the licensee to halt work and not recommence without ONR's consent. Therefore, acknowledging these abilities and also the positive compliance history of the licensee in these matters, I propose that the licence instrument should be issued.

### **RECOMMENDATION 3**

#### 4.9 OTHER GOVERNMENT DEPARTMENTS

99. I liaised with other regulators in order to ensure their objections (if any) to the submission were properly considered. I contacted:
- ONR (Civil Nuclear Security) <sup>[48]</sup>,
  - ONR (Safeguards) <sup>[49]</sup>, and
  - The Environment Agency <sup>[50]</sup>
100. All three responded and no objections were received. I did not consider it necessary to contact ONR (Transport) since no material is to be transported off site as a direct result of the permission.

## 5 CONCLUSIONS

101. This report presents the findings of ONR's regulatory consideration of whether to issue an 'agreement' to NNL/SL's proposals in the form of a Licence Instrument.
102. Following assessment and inspection interventions, specialist inspectors from the mechanical engineering, C&I, fault studies, criticality, internal hazards and human factors disciplines have expressed support for granting the requested permission. However, two inspectors (criticality and human factors), have recommended further interaction with NNL.
103. As a result of the human factors specialist findings, further hold points have been placed closer (and prior) to the time of import of active material (Cat IV commissioning) as this is when the hazard increases significantly (and arguably irreversibly), as well as prior to the introduction of kilogram quantities of active material (Cat I commissioning, see below).
104. The criticality specialist has recommended that the four areas for improvement identified in their criticality assessment are assessed for adequacy prior to Cat I commissioning. As a result, I have agreed with the specialist inspector that the hold point put in place prior to the time of Cat I commissioning will also be used to ensure these matters are suitably addressed.
105. With these hold points in place, I judge that the safety detriment to issuing an LI whilst the outstanding issues remain unresolved is small, when compared with the significant administrative effort and detriment to the programme schedule (and therefore hazard and risk reduction) that would arise should ONR either require an amended resubmission or wait until all our issues are resolved.

## 6 RECOMMENDATIONS

106. This project assessment report makes three recommendations:
  - **RECOMMENDATION 1:**  
ONR should perform an appropriate balance of assessment and inspection work to determine if it is appropriate to release the hold point prior to the introduction of gram quantities of active material in to Area 400 ('Cat IV commissioning').
  - **RECOMMENDATION 2:**  
ONR should perform an appropriate balance of assessment and inspection work to determine if it is appropriate to release the hold point prior to the introduction of kilogram quantities of active material in to Area 400 ('Cat I commissioning').
  - **RECOMMENDATION 3:**  
ONR should agree to NNL commencing active commissioning of B\*\*\* Area 400 (Phase 2), via licence instrument 893.

## 7 REFERENCES

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**8 ANNEX 1: REVIEW, LEARN, IMPROVE**

107. In line with the Review, Learn, Improve (RLI) guidance on HOW2, it is not considered necessary to conduct an RLI event. The prompts given in the HOW2 guidance are shown, along with a comment to its relevance, in the table below.

Prompt	Comment
The task was complex and multi-disciplinary.	The task was multi-disciplinary, but it was not complex.
The task significantly exceeded the estimated effort.	The task did not significantly exceed the original estimated effort.
There were significant issues when interacting with the licensee.	The licensee (and the tenant, NNL) was open and honest in all interactions.
There were significant issues interacting internally.	There were no significant internal issues.
There were differences in professional opinion between inspectors and procedure INS/031 was invoked.	Not applicable.
The recommended routine decision process could not be used – an exception or novel approach had to be taken.	A routine decision has been made.
Issues have arisen which may have wider regulatory implications.	No issues have arisen.
There is a need to inform the corporate memory (Knowledge Management)	This is not likely to be the case.