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**AWE Damaged Window Change and Glovebox Return to Service in Active Glovebox in
Main Production Facility**

**Assessment of AWE Aldermaston Modification Safety Report for Damaged Window
Change in Active Glovebox (Asset Change Request No. [REDACTED]) and Glovebox Return
to Service**

Project Assessment Report ONR-OFP-PAR-16-024
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EXECUTIVE SUMMARY

AWE Glovebox [REDACTED] Window Change and Glovebox Return to Service (Main Production Facility)

This report provides the Office for Nuclear Regulation's (ONR) assessment of the licensee's (i.e. AWE plc) "Modification Safety Report" (MSR), supporting an operation the licensee wishes to conduct to change a cracked glovebox window in an active glovebox [REDACTED] in its Main Production Facility and to return the glovebox to service.

Permission Requested

In accordance with its arrangements, made under Licence Condition 22(1) of Nuclear Site Licence No. 77, AWE has requested an 'Agreement' Licence Instrument (LI) to implement the modification described in the relevant Modification Safety Report - MSR, namely to change the damaged window in glovebox [REDACTED] in AWE Aldermaston's Main Production Facility and to return this glovebox to service.

Background

In April 2016 the licensee reported to ONR that a hairline crack had been detected in the window of active glovebox [REDACTED] in the Main Production Facility at AWE Aldermaston. Glovebox [REDACTED] was promptly surveyed to ensure no activity leakage had/was occurring through the crack from the glovebox interior and hence posed no immediate threat to plant workers and the glovebox was taken out of service and embargoed. The licensee duly conducted an appropriate investigation, adequately identifying the root cause of this incident.

However, in order to continue operations, the licensee wishes to change the cracked window and to return the glovebox to service. The licensee has conducted optioneering to demonstrate that replacing the window is the appropriate option to pursue and has also optioneered potential methods to effect the replacement.

Following on from its optioneering work, the licensee has produced an Asset Change Request (ACR). AWE has given this ACR its highest classification (i.e. 'Red Route'), based upon the safety significance of the window change (and the novelty of the task to AWE). AWE has not to date changed a glovebox window in an active glovebox, although historically window changes have been effected successfully on non-active gloveboxes at AWE. This ACR has successfully passed through the licensee's Asset Change Board (ACB).

According to its own Licence Condition LC 22 ('Modification or Experiment on Existing Plant') arrangements, the licensee has produced an MSR, to support/justify the work from a nuclear safety perspective. The MSR has received advice from the licensee's Nuclear Safety Committee (NSC), which the licensee has addressed and the MSR has then successfully passed through the licensee's Site Governance Meeting (SGM) i.e. the licensee's own due process has been followed and successfully completed. In addition the licensee's own Internal Regulation (IR) team have been closely involved with the project since its inception and have offered advice to the project team, which has been addressed to IR's satisfaction.

Since the window change has been classified as a 'Red Route' modification, then the licensee's processes under its LC 22 arrangements require that permission for the modification be sought from ONR. Accordingly, the licensee has requested an 'Agreement' Licensee Instrument (LI) under its own arrangements made under LC 22(1). The 'Agreement' LI will permit the licensee to change the glovebox window (on glovebox [REDACTED]), as described in the MSR and to return the glovebox to active service.

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Assessment and Inspection Work Carried out by ONR in Consideration of this Request

In assessing the licensee's request to conduct the glovebox window change, ONR has:-

- Conducted an early engagement with the licensee's engineering personnel to understand their proposals for effecting the window change.
- Conducted a mechanical engineering assessment of the MSR.
- Conducted a fault analysis assessment of the MSR.
- Conducted two readiness inspections at AWE, during which ONR has engaged with key licensee personnel (examining a range of topics pertinent to the planned work) and has witnessed a 'dummy run' of the window change under representative operational conditions.
- Engaged with the licensee's Internal Regulation (IR) personnel to seek their views of the planned work and its conduct.

Based upon the totality of the work conducted by ONR's inspectors, ONR is satisfied that the licensee has produced an adequate and robust safety justification to conduct the window change in active glovebox [REDACTED] and to return the glovebox to service as described in the MSR.

Matters Arising from ONR's Work

All matters that ONR has raised with the licensee, during the conduct of its assessment work and during its inspections, have been resolved to ONR's satisfaction and there are no outstanding matters arising.

Conclusions

In accord with its LC 22 arrangements, the licensee has submitted a detailed Modification Safety Report, MSR, justifying the nuclear safety aspects of its proposed methodology, to effect changing of a damaged glovebox window in an active glovebox [REDACTED] in its Main Production Facility at AWE Aldermaston and to return this glovebox to service.

The licensee's MSR has successfully completed its own due process. The MSR has been subjected to detailed scrutiny by ONR Specialists in mechanical engineering and fault analysis, the key disciplines in the context of the licensee's intended work. ONR has also engaged directly with the licensee via two 'readiness' inspections, on a range of topics associated with the planned work methodology and has witnessed a 'dummy run' of the window change under representative operational conditions. ONR has also engaged with the licensee's own IR team, who have been involved with this project since its inception to seek their views on the nuclear safety aspects of the project.

Based upon the totality of the work conducted by ONR's inspectors, ONR is satisfied that the licensee has produced an adequate and robust safety justification to conduct the window change in active glovebox [REDACTED] and to return the glovebox to service (as described in the MSR). There are no technical or regulatory reasons to prevent ONR agreement being given to the licensee's proposal to change the damaged window in glovebox [REDACTED] and to return this glovebox to service.

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Recommendation

Permission should be granted to the licensee (AWE plc), via the issue of 'Agreement' LI No. 535, to conduct the window change in active glovebox [REDACTED] and to return the glovebox to service.

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LIST OF ABBREVIATIONS

| | |
|-------|--|
| ALARP | As Low As Reasonably Practicable |
| AR | Assessment Report |
| BSO | Basic Safety Objective |
| CR | Contact Record |
| DAP | Duly Authorised Person |
| DNSR | Defence Nuclear Safety Regulator |
| EA | Environment Agency |
| HOW2 | (Office for Nuclear Regulation) Business Management System |
| IR | Internal Regulation |
| LC | Licence Condition |
| LI | Licence Instrument |
| MSR | Modification Safety Report |
| ONR | Office for Nuclear Regulation |
| PAR | Project Assessment Report |
| PSA | Probabilistic Safety Assessment |
| RGP | Relevant Good Practice |
| SAP | Safety Assessment Principle(s) |
| TAG | Technical Assessment Guide (ONR) |
| VTE | Ventilated Tented Enclosure |

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1 PERMISSION REQUESTED

1. In accordance with its arrangements, made under Licence Condition LC 22(1), the licensee (i.e. AWE plc) has requested (Reference 1) 'Agreement' from the Office for Nuclear Regulation (ONR) to conduct a change of the damaged window in active glovebox [REDACTED] and to return this glovebox to service (as described in Reference 2).

2 BACKGROUND

2. In April 2016 the licensee reported to ONR, Reference 3 that a hairline crack had been detected in the window of an active glovebox at work-station [REDACTED] in the Main Production Facility at AWE Aldermaston. Glovebox [REDACTED] was promptly surveyed to ensure no activity leakage had/was occurring through the crack from the glovebox interior and hence that it posed no immediate threat to plant workers and the glovebox was taken out of service and embargoed. The licensee duly conducted an appropriate investigation (Reference 4), which ONR judged to adequately identify the root cause of this incident.
3. However, since glovebox [REDACTED] is important for the conduct of the licensee's operations in its Main Production Facility, then the licensee wishes to change the cracked window i.e. to effect a glovebox window change on glovebox [REDACTED] which is an active ([REDACTED]) glovebox and to return the glovebox to service. The licensee has duly conducted optioneering to demonstrate that changing the window is the appropriate option to pursue and has also optioneered potential methods to effect the replacement. This optioneering has been reported in the licensee's Modification Safety Report – MSR, Reference 2 (see below).
4. Following on from its optioneering work, the licensee has produced an Asset Change Request, ACR No. [REDACTED] (Reference 5) as per its arrangements made under LC 22 ('Modification or Experiment on Existing Plant'). AWE has given this ACR its highest classification (i.e. 'Red Route'), based upon the safety significance of the window change (and the novelty of the task to AWE). AWE has not to date changed a glovebox window in an active glovebox, although historically window changes have been effected successfully on non-active gloveboxes at AWE. This ACR has successfully passed through the licensee's Asset Change Board (ACB).
5. According to its own procedural requirements, the licensee has also produced an MSR (Reference 2), to support/justify the work from a nuclear safety perspective. The MSR has successfully passed through both the licensee's Nuclear Safety Committee (NSC) and its Site Governance Meeting (SGM), References 6 and 7, i.e. the licensee's own due process has been followed and successfully completed. In addition the licensee's own Internal Regulation (IR) team have been closely involved with the project since its inception and have offered advice to the project team, which has been addressed to IR's satisfaction (References 8 and 9).
6. Since the window change has been classified as a 'Red Route' modification, then the licensee's processes under its LC 22 arrangements require that permission for the modification be sought from ONR. Accordingly, the licensee has requested an 'Agreement' Licensee Instrument (LI) – Reference 1. The 'Agreement' LI will permit the licensee to change the damaged glovebox window on glovebox [REDACTED] as described in the MSR (Reference 2) and to return this glovebox to active service.

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

3.1 INITIAL WORK

7. ONR has engaged with the licensee since the first report in April 2016 (i.e. Reference 3) of the identification of the crack in the window of active glovebox [REDACTED] in AWE Aldermaston's Main Production Facility. In the first instance, ONR wished to ensure that the root cause of the crack in the glovebox window was adequately investigated and determined (to ensure that there was no underlying mechanism that had the potential to threaten other active gloveboxes in the facility). In ONR's opinion Reference 4 presents an adequate investigation by the licensee, which identifies a plausible root cause.
8. Following on from the investigation, the licensee identified that it wished to return glovebox [REDACTED] to service, since the operations conducted within the glovebox are important to the licensee's production in its Main Production Facility. The licensee hence embarked on optioneering, initially to confirm that changing the damaged glovebox window was an appropriate course of action and represents the As Low As Reasonably Practicable, ALARP, option, but further optioneering work was then conducted to look at the most appropriate method to effect the window change in active glovebox [REDACTED]. The totality of the licensee's optioneering work is reported in Reference 2 and was studied by the ONR site inspector for the Main Production Facility as well as ONR specialists in mechanical engineering and fault analysis (see below).
9. Once the licensee had determined a methodology for effecting the window change, an initial ONR engagement was conducted with the licensee (Reference 10) in order to obtain information as to what the licensee was proposing and to provide regulatory advice on these proposals i.e. ONR provided advice to the licensee at an early stage of the project.
10. The licensee duly produced both an Asset Change Request (Reference 5) and a Modification Safety Report (Reference 2), to support its proposals for changing the window in active glovebox [REDACTED] and for returning this glovebox to service. These documents have been assessed by ONR specialists in mechanical engineering and fault analysis.

3.2 FAULT ANALYSIS ASSESSMENT

11. The findings of an ONR fault analysis assessment of the licensee's MSR, Reference 2, for the glovebox window change are presented in Reference 11. The ONR assessment was conducted against the appropriate ONR Safety Assessment Principles (SAP) – Reference 12 and ONR advice as presented in its Technical Assessment Guides (TAG) – Reference 13. Further information on the SAPs and TAGs utilised within this assessment can be obtained from Reference 11.
12. The key findings from Reference 11 are:-
 - AWE's fault analysis approach was found to be in line with the guidance provided by ONR SAP FA.1.
 - AWE's hazard and fault identification was considered to be comprehensive and to provide a firm basis to support AWE's fault analysis (which was conducted in line with ONR's guidance in SAPs FA.2 and FA.5).

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- AWE's radiological consequence analysis was found to be appropriate to support the proposed window change activity and to be in line with the guidance presented in SAP FA.3 and FA.7.
 - Appropriate lines of protection for all identified hazards were deemed to have been identified by AWE and to be in line with relevant good practice – RGP and hence appropriate design basis protection was judged to be available for the proposed activity (in line with ONR's guidance presented in SAP FA.4 and FA.8).
 - Suitable contingency arrangements have been identified and documented by AWE, to support the window change activity (in line with SAPs FA.15 and FA.16).
 - Proportionate Probabilistic Safety Assessment (PSA) was judged to have been conducted to support the proposed window change activity and in line with the guidance of ONR SAP FA.10. The derived risk figure from this PSA work shows that the risks from the proposed operation lie below the Basic Safety Objective, BSO.
13. The conclusion of the ONR fault analysis assessment of the licensee's safety case, Reference 2, was that the ONR fault analysis inspector supported the issue of the LI to allow AWE to modify its safety case to undertake the window change operation in active glovebox [REDACTED] and to return this glovebox to active service.

3.3 MECHANICAL ENGINEERING ASSESSMENT

14. The findings of an ONR mechanical engineering assessment of the licensee's MSR (Reference 2) are presented in Reference 14. The ONR assessment was again conducted against appropriate ONR SAPs and TAGs (References 12 and 13) and Reference 14 provides more information on the specific SAPs and TAGs used in the mechanical engineering assessment of the licensee's MSR.
15. The ONR mechanical engineering inspector focused on sampling the following aspects of the licensee's MSR relating to mechanical engineering i.e.
- Ventilated Temporary Enclosure (VTE) and ventilation flows during the glovebox window replacement operations.
 - Controlling documentation for the glovebox window replacement.
 - Inactive trials.
 - Return of the glovebox to service.
16. The key findings from Reference 14 were:-
- AWE's MSR has identified an appropriate methodology for the operations to replace the damaged window in the glovebox, including the use of a VTE to provide containment during the window change operations.
 - AWE has made positive use of inactive trials to develop the window replacement methodology and to train the operators who will be replacing the glovebox window.
 - AWE understands the steps that need to be followed in carrying out the glovebox window replacement and returning the glovebox to normal operations, but there was a lack of clarity in some aspects of the controlling documentation. AWE accepted regulatory advice about this and has amended its documentation accordingly to the satisfaction of the ONR mechanical engineering inspector.
17. ONR's mechanical engineering inspector hence concluded that he was satisfied with the claims/arguments/evidence laid down within AWE's safety case. Consequently,

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from a mechanical engineering perspective, the ONR mechanical engineering assessor supported the issue of the LI agreeing to AWE implementing the modification described in its MSR i.e. to replace the damaged glovebox window and to return the glovebox to service.

3.4 ONR INSPECTIONS

18. Using the information from the licensee's MSR (Reference 2) a set of inspection foci (questions – Reference 15) were constructed to conduct a readiness inspection i.e. of the licensee's readiness to conduct the operations to change the damaged window in active glovebox [REDACTED] and to return this glovebox to service. The focus of this readiness inspection was purpose wide ranging e.g. covering:-

- Training of personnel (for the conduct of the work) and delivery of the training.
- Contingency arrangements and exercising of these arrangements.
- Appointment of Duly Authorised Persons - DAP for supervision of the work.
- Provision of work and emergency instructions and the quality of the supporting documentation.
- Monitoring of the environment local to the work face during work conduct.
- Over-arching quality plan.
- Pre-work check lists and control of these documents.
- Inactive training ('dummy runs' under simulated work conditions).
- Assessment of potential puncture wounds and the provision of mitigating measures.
- Assessment of potential worker doses.
- Testing of the ventilated enclosure and balancing of air flows.
- Etc.

19. An initial readiness inspection was conducted on 31/10/2016 and is reported in Reference 16. The readiness inspection, conducted by the ONR site inspector and ONR specialists in mechanical engineering and fault analysis, included an inactive 'dummy' window change demonstration in simulated work conditions. The readiness inspection, at ONR's invitation, was also accompanied by a member of the licensee's Internal Regulation (IR) staff who had been involved with the project from an early stage. The key findings from this initial readiness inspection were:-

- The licensee provided evidence that good and thorough work had been conducted in proving and trialling the window change methodology.
- ONR advice (provided at the first engagement with the licensee – see Reference 10) regarding the use of inactive trials in as representative conditions as possible had been heeded (with operatives in the demonstration window change being in air-fed suits).
- The demonstration window change was conducted in a careful but efficient manner.
- Good evidence was provided of quality assurance of all equipment involved in the window change.
- Significant work had been conducted to demonstrate that the risks from contaminated wounds, to the operators conducting the work, had been minimised.
- The involvement of the operators (who will ultimately conduct the window change work) in defining the work procedures, was commended by ONR.
- Adequate evidence was presented by the licensee that the training of the personnel, who will conduct the work, was well advanced.
- Contingency arrangements had clearly been given consideration by the licensee and work in this area (although noted to be ongoing at the time) was deemed to meet ONR's expectations.

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20. However, notwithstanding ONR's positive findings from this inspection, some of the key documentation controlling the operation was sampled and was found to be of a level of maturity that fell below the standards expected by ONR.
21. Accordingly a second readiness inspection was conducted by ONR in December 2016 (Reference 17) which focused solely on the licensee's documentation. The key findings from this inspection were:-
- It was clear that the licensee had (since the conduct of the first ONR readiness inspection – Reference 16) expended significant effort in ensuring that the documentation, for the conduct of the window change work, much more closely matched ONR's expectations.
 - The ONR inspectors requested some minor amendments to the documentation (which the licensee readily accepted) but none of the changes were judged to be of a sufficient gravity as to impair the safe and successful conduct of the work.
 - The quality of the licensee's emergency arrangements document was accepted but ONR noted that 'fine tuning' of these arrangements (via a walk-down of them) remained to be conducted.
22. From the totality of the evidence presented by the licensee at both of the two readiness inspections, all the ONR inspectors involved were content that it would be appropriate to permit the licensee to conduct the window change. This view was shared by the licensee's own internal regulator (Reference 8).

4 MATTERS ARISING FROM ONR'S WORK

23. All matters that ONR has raised with the licensee, during the conduct of its assessment work and during its inspections, have been resolved to ONR's satisfaction and there are no outstanding matters arising.

5 OTHER GOVERNMENT AGENCIES

24. Both the Defence Nuclear Safety Regulator (DNSR) and the Environment Agency (EA) have been consulted, regarding ONR's intention to permission the modification described in Reference 2 and have confirmed (References 18 and 19) that they have no objections to ONR issuing a Licence Instrument, permitting the licensee to proceed with the window change inactive glovebox [REDACTED] and to returning this glovebox to service.

6 CONCLUSIONS

25. This report presents the findings of assessment and inspection work, conducted by ONR, of the licensee's safety justification MSR to conduct a glovebox window change in an active glovebox [REDACTED] in the Main Production Facility at AWE Aldermaston and to return this glovebox to service.
26. The licensee's MSR has successfully completed its own due process, with no residual reservations. The MSR has been subjected to detailed scrutiny by ONR specialists i.e. in mechanical engineering and fault analysis (the key disciplines in the context of the licensee's intended work). Additionally, ONR has engaged directly with the licensee via two 'readiness' inspections, on a range of topics associated with the planned work methodology and has witnessed a 'dummy run' of the window change under representative conditions. ONR has also engaged with the licensee's own Internal Regulation (IR) team, who have been involved with this project since its inception and

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who have confirmed that they support the conduct of the work as described in the MSR.

27. Based upon the totality of the work conducted by ONR's inspectors, ONR is satisfied that the licensee has produced an adequate and robust safety justification to conduct the window change in active glovebox [REDACTED] and to return the glovebox to service. There are hence no technical or regulatory reasons to prevent ONR agreement being given to the licensee's proposal to change the damaged window in glovebox [REDACTED] and to return this glovebox to service.

7 RECOMMENDATIONS

28. This Project Assessment Report recommends, based upon the work conducted by ONR inspectors, permission should be granted to the licensee (i.e. AWE plc) via the issue of 'Agreement' Licence Instrument No. 535, to conduct the damaged window change in glovebox [REDACTED] in the Main Production Facility at AWE Aldermaston and to return this glovebox to service.

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