

Hitachi-GE Nuclear Energy, Ltd.
UK ABWR GENERIC DESIGN ASSESSMENT
Resolution Plan for RO-ABWR-0069
HMI: Strategy, Application and Cognitive Issues

RO TITLE:	HMI: Strategy, Application and Cognitive Issues
REVISION:	<u>1</u>
Overall RO Closure Date (Planned):	31 <u>March</u> 2017
REFERENCE DOCUMENTATION RELATED TO REGULATORY OBSERVATION	
Regulatory Queries	RQ-ABWR-0861
Linked ROs	N/A
Other Documentation	See Related Deliverables in Description of Work and References

Scope of work:
<p><u>Background</u> ONR issued RO-ABWR-0069 to Hitachi-GE to express concerns regarding the design development activities within the HF topic area related to the intended usage of particular human-machine interfaces (HMIs) within the UK ABWR (see Scope of Work below). Hitachi-GE has prepared this Resolution Plan to outline specific activities of work that either were already planned to be undertaken or will be added to the work plan, that are expected to respond to the RO and ensure that the Regulator’s concerns are addressed and their expectations met.</p> <p><i>Key Resolution Planning Assumptions:</i></p> <ol style="list-style-type: none"> 1. In order to help ensure Hitachi-GE’s submissions meet the Regulator’s expectations, Hitachi-GE request the Regulators sample through the resolution process and provide feedback and advice to ensure alignment with regulatory expectations at appropriate points through written responses to submissions and regular communications via Level 4 Technical Meetings (in the UK and Japan). 2. Hitachi-GE has undertaken its own assessment of the scope of HF activities and level of analysis to be undertaken within GDA, using the concept of proportionality and risk-based assessment. This has been used to estimate a suitable scope of HF work to be undertaken within GDA Step 4, as per its HF Integration (HFI) Programme, including Verification and Validation (V&V), captured in its HFI Plan (HFIP) [Ref-1] and HF V&V Plan (HFVP) [Ref-2]. As an early activity in the delivery of the RO Resolution Plan Hitachi-GE will submit its revised HFIP and HFVP. Whilst Hitachi-GE will endeavour to mitigate the impact of any change to the scope of the HF work required, it should be noted that if there were a significant change to the planned scope of work following Regulatory assessment this may result in a revision to the overall HFI programme and related dates for completion. 3. Much of the scope of this RO, particularly the level of analysis possible and the detail of the results available in each of the deliverables, is entirely dependent on the design maturity of the HMIs (i.e. those which are within scope of the RO) that is expected to be achieved by the proposed resolution date, a date which is dictated by GDA Step 4 assessment timescales. Notably, the proposed resolution date is one full year before the end of GDA; clearly the design and analysis will be less evolved than by the end of GDA, and the design will also continue to evolve beyond GDA through detailed design that is undertaken in the site-specific stage. It is assumed that the ONR expectations for design maturity within the C&I topic area (i.e. that agreed for the HMIs in scope) is agreed and consistent, and therefore that the level of analysis expected to address this RO by the resolution date is aligned with what is achievable by that date, given the expected level of design. <p><u>Scope</u> The following section outlines the scope of activities, in particular the expected limitations to the level of analysis possible (see Assumption 3 above) and Hitachi-GE understanding of the intent of the RO. In particular, in addition to a general statement on the scope of the work, the limitations to the scope of analyses expected within RO resolution plan timescales are listed in the remainder of this section against each RO Action (ROA). Note that detail of the planned activities (i.e. what is considered achievable and the actions that will be taken to address the</p>

Scope of work:

RO) is given in the next section, Description of Work, so is not provided here.

The general scope of the work being/to be undertaken related to this RO is considered to be HMIs used for control of the reactor and balance of plant (BOP) generally within the Main Control Room (MCR), or related alternative control points used as a back-up to certain key MCR actions within fault scenarios, specifically the Remote Shutdown System (RSS) and the Back-up Building (B/B). The specific HMIs considered within scope of each ROA are listed below where applicable. Note that the other control rooms within the plant (e.g. Rad Waste Control Room, Fuel Handling Machine Control Room, SFIS Control Room, etc.), local to plant control panels, and equipment-mounted HMIs are not within scope of this RO and therefore not included in the work related to this Resolution Plan (the overall HFI programme of course includes such other control rooms and HMIs, they are just not considered within scope of this plan because they are not required by ONR to address this RO-69).

The scope (i.e. level of detail) of any analysis or demonstration achievable within the activities listed in the next section (Description of Work) to address the ROAs is aligned to the design maturity of the HMIs within scope that will be achieved by Resolution Plan end date, i.e. 31 December 2016. Note that this design maturity is also the subject of a related RQ, RQ-ABWR-0861. The response to that RQ will detail the level of expected design maturity and should be noted when considering this scope of work. In general, the design in GDA is intended to be generic and the level of HF is proportionately focussed on issues and areas that may have a major impact on the basic design; detailed design, particularly of items that are flexible and can be adapted within the site-specific stage by the future site licensee, will not be undertaken at this project stage. For example, computerised HMIs, also called human-computer interfaces (HCIs), are highly adaptable and therefore the details of each interface screen, for example, are not intended to be complete within GDA. As with other analysis topics, the analysis and demonstration through V&V within the HF topic is iterative and progressive and will continue to be built upon even after GDA is complete.

Remarks and Scope for Each ROA

RO-ABWR-0069 A.2:

For the purposes of this Resolution Plan, because the scope for this action is confined to post-fault operations, the assumed HMIs considered within the scope of this ROA (A.1) are:

- Alarms & key parameter display on WDP
- Class 1 HMIs on the MCC and WDP
- Safety Auxiliary Panel (SAuxP)
- Hardwired Backup Panel (HWBP)
- RSS panels
- B/B control panels

FMEA that will allow identification in detail of the various fault states for HMIs will not be done in time to be considered in GDA, nor will there be sufficient design maturity to provide the final details of functionality or interface features supporting usage and movement between the HMIs. These limitations relate to both which faults mean “move HMI” and how the operators will know. Hitachi-GE will prepare a high-level strategy during GDA that is largely based on UK ABWR basic or concept design, assumption and J-ABWR; detailed, finalised analyst determination of specific HMI failure modes and how those manifest themselves on each HMI is not in scope of GDA.

With regards to item (a) in the RO main body section “Strategy for Use of User Interfaces after an Initiating Event” (covered by RO A.2), the levels of human reliability that will be described are considered to be qualitative only. If numeric reliability of human actions is required, it will be of the same nature as that given by Cat/Class “deterministic” ranges, rather than specific numeric reliability claims on actions taken at the HMI. In other words, detailed derivation of human error rates or probabilities will not be done in support of this document.

RO-ABWR-0069 A.3:

Any human reliability analysis (HRA) will be done in a proportionate way in accordance with the rest of the HRA process, i.e. only those systems and actions that directly impact task failure rate and risk within the PSA or fail to meet the DSA criteria will be analysed in detail; any other HRA will be supported by high-level qualitative analysis only.

Scope of work:

RO-ABWR-0069 A.4:

Much of valid meaningful workload and cognitive evaluation can actually only be achieved through testing and trials (analysis methods have known large uncertainty and questionable validity in “real world” systems). Noting that Hitachi-GE will not have a glass-top or full-scope simulator of any sort during GDA, nor will there be operators with training, experience and knowledge of actual UK ABWR HMIs available, conclusive demonstrably valid workload and cognitive “distraction” or overload demonstration is not considered possible within GDA. Hitachi-GE would like to stress that the workload analysis and simple basic demonstrations (making use of any partial V&V equipment that is available before the planned deliverable dates (i.e. part-task/ laptop-based dynamic mock-up and/or projection-mapping (for the WDP)) that can be undertaken in GDA will give early indicative results only. The conclusiveness of any analysis is considered by Hitachi-GE HF experts to be vulnerable to potentially a large level of uncertainty at this stage of the design, so the benefit is limited to providing early insights only. The ability to validate the analysis will be limited within GDA, and certainly limited by December 2016.

RO-ABWR-0069 A.5:

This is directly impacted by the maintenance strategy which won't be completed in GDA, and HNP's final arrangements for operator and maintenance technician role definition and task assignments – Hitachi-GE can outline our expectation in the COR but ultimately it is up to HNP. This cannot be completed in GDA.

In addition to specific alarms being justified through alarm rationalisation activities (see RO-ABWR-0069 A.8), the justification that the other information presented is appropriate will be summarised in the HF DER, which will refer to the individual supporting HF design documents as appropriate.

RO-ABWR-0069 A.6:

The assumed scope of HMIs for this ROA is any computer generated reconfigurable displays (i.e. HCIs ONLY) within the MCR, as it is understood that the ONR concern in this instance is cognitive errors introduced by “modern” complex computerised interfaces. Other cognitive error analysis is being progressed separately through the EOC analysis activities.

Hitachi-GE understands that ONR is interested in the details of the HCI design. However, the details of HCI design that most likely impact on the cognitive errors of relevance to this RO will be done as a part of detailed design i.e. not in GDA (as agreed between the ONR C&I assessor and the Hitachi-GE C&I team). This is because although the GDA design intent for HCIs is based on the reference KK6/7 design, the system is flexible enough to be re-designed in site specific detail design activities. In GDA, the HF team will of necessity base their analysis on the J-ABWR navigation and other relevant design features (e.g. levels of hierarchy, lack of “hotlinking”, direct access through hardware pushbuttons, etc.) of the FDs/PFDs. If necessary any HF recommendation will be made to ensure ALARP solutions are implemented in the HMI design. In other words, the expected design maturity (which is NOT detailed design,) has a significant impact in terms of how much valid cognitive error analysis we can do. We note that although the ROA is actually more about the analytical processes (plural), these processes for cognitive error demonstration are assumed to include both analysis and actual demonstration through testing (i.e. validation of the analysis); much of the necessary analysis and validation therefore cannot be completed within GDA. The methods for identification and analysis that will be on-going as the design develops and that will not be carried out within GDA nor by Hitachi-GE cannot be included in the scope of this RO nor this Resolution Plan. Note also that ALARP justification can only be given regarding the current design but because so much of the design could potentially change during detailed design phase, it is of limited value and necessarily caveated appropriately.

It is noted that whilst cognition is a potential concern for other new user interfaces, as they are implemented by means of conventional controls and displays, the cognitive issues are far more readily addressed by means of well-established Human Factors guidelines. Nevertheless, information will be submitted outside of the scope of this RO (through the design HF and V&V programme) to demonstrate that these new interfaces are unlikely to induce cognitive error.

Although Hitachi-GE recognise that the ROA says “processes”, we note that the main body says “We would expect a demonstration of cognitive workload minimisation in an HCI to rely on HCI trials that specifically attend to cognitive elements and consider the following:

Scope of work:

- a. Observation methods and measurements that address the concept of cognitive workload induced by HCI; measures include, for example, attention to ease of use and interface transparency. *These measures would be obtained by observational measures of behaviour that may be symptomatic uncertainty or other cognitive challenges for users and by debriefing methods that explore trial subject experiences of cognitive challenge.*

This cannot be done in GDA and is considered not within the scope of this action or this RO Resolution Plan.

RO-ABWR-0069 A.7:

HRA for any cognitive errors identified as part of the planned HF analysis for RO A.6 (or any other source) will be considered in the evolving HRA Report (HRAR) at Rev. E [Ref-3]. These will then be reflected into the update to the PSA schedule at the final update (June 2017 (TBC)). Note that this approach, not any other separate direct activity, is the appropriate vehicle for incorporating such errors into the PSA as it aligns with the HFI programme of activities. In general, cognitive errors using the HCI are not expected at the level of base HFE within the PSA; they tend to be at a level that would be included within the TTA/HEA for a specific HFE within the HRAR (i.e. part of a HFE, not their own HFE). However, Hitachi-GE will incorporate any such errors at the correct level and in accordance with the HRA methods chosen.

The assumed scope of HMIs for this ROA is any computer generated reconfigurable displays (i.e. HCIs only) used for post-fault actions within the MCR. Also, see Remarks for RO A.6 – “reasonably foreseeable” must be bounded by what is in scope/can be undertaken within the planned design maturity for GDA.

RO-ABWR-0069 A.8:

Regarding point (b), Hitachi-GE is not responsible for designing “administrative management processes” that might be used to manage alarms through operational arrangements. There are however design features that are intended to reduce the arrival of alarms relative to particular operations that should reduce alarm burden. Item (b) within the scope of GDA is considered by Hitachi-GE to mean “the means by which the system design reduces the number of alarms presented, including any required actions by the MCR personnel to enable or initiate those means”. Hitachi-GE will not be developing, on behalf of the future operator, any administrative management processes that might further reduce the alarm burden.

Any V&V activities for the alarm system (i.e. “demonstration” or illustration) that can be undertaken in GDA are not specifically detailed within this Resolution Plan because they will be detailed within the HF V&V plan; appropriate reference is made to that plan. The amount of “illustration” (final point of this ROA) that can be achieved in GDA is limited due to expected design maturity; the scope of demonstration through V&V that the rationalisation methods are suitable and sufficient will only be what can be achieved by December 2016.

Description of work:

This section describes the activities and deliverables that Hitachi-GE have planned to use or develop to address the ROAs.

RO-ABWR-0069.A1:

Hitachi-GE will prepare a Resolution Plan (this document) to outline the work they will undertake and deliverables they will submit to address this RO. Note that the activities and submitted deliverables includes HF work already planned and/or documents already submitted.

Action/Deliverable:

A1-1: Prepare “RO Resolution Plan” (this document + attachments, if applicable).

Planned Submission Date: 15 July 2016

RO-ABWR-0069.A2:

Hitachi-GE will provide a new level 3 document “Strategy of Use for HMIs” to address the items (a) through (e) in the RO main body section “ Strategy for Use of User Interfaces after an Initiating Event”. This document will

Description of work:

be produced in two stages to allow for early submission of existing information. The Rev. A will address ONR expectation (a) and provide an “adequate documented explanation of the strategy to be employed in managing interface systems” and Rev. B of the document will address other expectations (b) to (e), giving the required explanation that the proposed usage is supported by the design. A final revision is proposed in order to update content of Rev. B, only if required to reflect changes (if any) due to:

- further design development,
- HRA or PSA developments, and/or
- the results of activities undertaken as part of this RO resolution plan.

Actions/Deliverables:

A2-1: Prepare “Strategy of Use for HMIs” document (Rev. A) – covering items (a) through (e) of RO main body section “Strategy for Use of User Interfaces after an Initiating Event”

Planned Submission Date: 31 October 2016

A2-2: Revise “Strategy of Use for HMIs” (Rev. B) – only if required.

Planned Submission Date: 31 March 2017 (Only if required)

RO-ABWR-0069.A3:

Hitachi-GE will provide a summary list of interface systems in the current TTAs within the HRAR [Ref-3] (i.e. Revision D). The summary list will be attached in the “Strategy of Use for HMIs Rev. A (A2-1)”. Although the transfer from one HMI to another for any applicable actions/scenarios claimed within the PSA is already modelled within the HRA (HRAR Rev. C onwards), the HF team will ensure that the modelled fault detection and movement to back-up HMIs is clearly and correctly modelled in the HRA, aligning with the “Strategy of Use for HMIs” document (RO A.2).

Actions/Deliverables:

A3-1: Prepare a summary list of interface systems currently claimed within the PSA and within HRAR Rev. D; part of “Strategy of Use for HMIs” Rev. A (see A2-1).

Planned Submission Date: N/A/ (Included as part of A2-1, 31 October 2016)

A3-2: Ensure the required reliability of fault detection and HMI transfer required within the applicable actions currently claimed within the PSA, is clearly detailed in the TTA/HEAs and derivation of HEPs within the HRAR Rev. E

Planned Submission Date: Included in HRAR Rev. E planned submission, 11 January 2017

RO-ABWR-0069.A4:

Hitachi-GE will complete the already-in-progress development of the method of analysis for predicting cognitive workload and distraction, and execute the assessment of them in general. The method will be agreed with ONR. The level of detail for analysis will be qualitative and high level, as it depends on the design maturity of HMI and test equipment available for V&V (see Scope of Work section above).

Actions/Deliverables:

A4-1: Finalise the current planned analysis method(s) for predicting cognitive workload and distraction for MCR personnel. The draft version of the method will be issued as a letter to discuss and agree with ONR. The agreed method will be submitted in revised HFMP.

Planned Submission Date: Draft in letter, 15 July 2016;

Final agreed in HFMP Rev. E, 10 January 2017

A4-2: Conduct analysis on a representative sample of routine operations, using the agreed method.

Planned Submission Date: Verbal report at L4, approx. 27 October 2016

A4-3: Conduct analysis on a representative sample of post initiating event operations, using the agreed method.

Planned Submission Date: Verbal report at L4, approx. 23 November 2016

A4-4: Develop and submit the full (scope of analysis for GDA to be defined within the methodology) predictive

Description of work:

cognitive workload analysis report (Rev. A) – to include A4-2 and A4-3 results.
Planned Submission Date: 31 January 2017

RO-ABWR-0069.A5:

It is assumed that any system “out of tolerance” or fault condition will be alarmed; if it is alarmed at a local panel (including MCR back panel and panels in other buildings, such as the RadWaste Building (Rw/B) or Spent Fuel Interim Store (SFIS)) then a system alarm would normally appear in the MCR. (Note that any other information that may arise from plant equipment signals that does not appear as an alarm somewhere is indeterminate at this point, so will be handled as part of the normal C&I design process of the UK ABWR. Hence the response to this RO action is focussed on specifically equipment fault alarms.)

As part of RO A8 (see below), Hitachi-GE will develop a new “UK ABWR Alarm Philosophy” document (a supporting reference to the Alarm System Design Description (SDD)) that describes the alarm population and rationalisation strategies and basic design principles. In addition, Hitachi-GE HF team will ensure that what is assumed to be the MCR personnel competence or responsibility for equipment status information is clarified as necessary within the Human Factors Concept of Operations Report (COR) [Ref-4]. Finally, also Hitachi-GE will conduct their already-planned initial high-level rationalisation of the current J-ABWR set of alarms in various conditions as applicable, and show either that the current level is ALARP or make recommendations to reduce the number. This combined set of activities is intended to clearly demonstrate that any information (plant or equipment fault, abnormal plant conditions, etc.) not related to the MCR personnel competence or responsibility will not be provided as alarms or other indicators for the MCR personnel to respond to.

Actions/Deliverables:

A5-1: Describe the design criteria and design principles for how non-alarm related information is intended to be routed effectively to the MCR or elsewhere as appropriate to reduce MCR personnel distraction.

Planned Submission Date: Verbal report at L4, approx. 31 January 2017

A5-2: Describe the design criteria for determining the optimal control room/panel location to which each alarm should be allocated (i.e. MCR, back panel room, RSS, B/B, other locations such as Maintenance Building, etc.). This action is the same as the activity and deliverable A8-1.

Planned Submission Date: N/A (same as A8-1, approx. 15 December 2016)

A5-3: Develop “UK ABWR Alarm Philosophy” document (a supporting reference to the Alarm SDD) which describes the design criteria for selection of the alarm population. This action is the same as the activity and deliverable A8-2.

Planned Submission Date: N/A (same as A8-2, 31 January 2017)

A5-4: Submit a revision to the COR to make sure the descriptions of the MCR personnel competence or responsibility for equipment status information are suitable and sufficient.

Planned Submission Date: 29 July 2016

A5-5: Provide an “Alarm Design Rationalisation and Justification” report. It will include the justification that any equipment status information that is directed to the MCR operator is suitable and relevant for them to receive. This action is the same as the activity and deliverable A8-3.

Planned Submission Date: N/A (same as A8-3, 31 March 2017)

RO-ABWR-0069.A6:

Hitachi-GE will provide a submission which explains what processes they will use to ensure that cognitive performance is supported by the HCI design, and that challenges to expected performance that might be potentially created by the HCI design, will be reliably identified and addressed within the design activities that are in scope of GDA timescales.

Actions/Deliverables:

A6-1: Develop the predictive method for assessing the cognitive errors potentially induced by the J-ABWR HCI design. The draft version of the method will be issued as a letter to discuss and agree with ONR. The agreed method will be submitted in revised HFMP [Ref-5].

Description of work:

Planned Submission Date: Draft in letter, 15 July 2016;
Final agreed in HFMP Rev. E, 10 January 2017

A6-2: Assess the predicted cognitive errors induced by HCI design using the agreed method (A6-1); report at L4, and provide any feedback to HMI design and HRAR (where applicable to claimed actions; see RO A.7).
Planned Submission Date: Verbal report at L4, approx. 23 November 2016

A6-3: Develop and submit the “HCI-Induced Cognitive Error Analysis” report
Planned Submission Date: 31 January 2017

RO-ABWR-0069.A7:

HF will ensure that the HRAR [Ref-3] includes (a) a summary of the method how to evaluate the cognitive errors induced by HMI design for human reliability (developed in A6-1 and reported in the HFMP), and (b) a summary of the results and how they have been incorporated into the HRAR [Ref-3] where appropriate (i.e. if a HCI-induced cognitive error is identified and evaluated in A6-2 that impacts the currently-analysed HFEs in the HRA, and if that cognitive error is not already identified in the HRA, if/how that HFE has been modified to reflect that cognitive error).

Action/Deliverable:

A7-1: Include suitable text and revised analysis (if necessary) in HRAR Rev. E.
Planned Submission Date: Included in HRAR Rev. E planned submission, 11 January 2017

RO-ABWR-0069.A8:

Hitachi-GE will outline the design process for the alarm system, which will be included in the new document for design process for C&I which includes HMI. Hitachi-GE will develop a new “UK ABWR Alarm Philosophy” document (a supporting reference to the Alarm System Design Description (SDD)) that describes the alarm population and rationalisation strategies and basic design principles. Hitachi-GE will also revise the HFE Spec. to make the current descriptions for the alarm system design, particularly alarm reduction and management strategies for design, clearer if necessary. Finally, Hitachi-GE will finalise the method currently being developed for alarm “rationalisation”; this will allow the HF specialists and designers to assess alarms in order to minimise cognitive burden for MCR personnel during fault scenarios. The team will then apply the method to the J-ABWR set of alarms to provide a preliminary assessment of the alarm system design and feedback to the design team.

With regards to the final sentence of the action within the RO text, “*Hitachi-GE should also illustrate the effectiveness of their method for assessing alarms in reducing the cognitive burden to ALARP for MCR personnel during fault scenarios.*”, illustration is taken to mean “live” demonstration rather than analysis. As noted in the Scope section, although an appropriate amount of this kind of demonstration is already planned within the V&V programme for GDA, Hitachi-GE only expect to be able to demonstrate this to a limited extent by the end date of this Resolution Plan. Therefore, this is considered to be more suitably addressed in ongoing work that is detailed within the HFVP and its supporting references and follow-on procedures; an action is added to take note of this and make suitable reference to that plan. However, the expectation at this point is that Hitachi-GE will undertake a suitably-scoped comparative study of suitable fidelity to assess alarms in J-ABWR design versus that predicted for UK ABWR design (given the rationalisation criteria) for representative scenario(s).

Actions/Deliverables:

A8-1: Describe the design criteria for determining the optimal control room/panel location to which each alarm should be allocated (i.e. MCR, back panel room, RSS, B/B, other locations such as Rw/B, etc.).
Planned Submission Date: Verbal report at L4, approx. 15 December 2016

A8-2: Develop “UK ABWR Alarm Philosophy” report (a supporting reference to the Alarm SDD) which describes the design criteria for selection of the alarm population at each control location.
Planned Submission Date: 31 January 2017

A8-3: Provide an “Alarm Design Rationalisation and Justification” report.
Planned Submission Date: 31 March 2017

Description of work:

A8-4: Ensure HFVP [Ref-2] and/or its supporting procedures includes suitable demonstration(s) to illustrate the effectiveness of the design criteria and the alarm rationalisation process.

Planned Submission Date: Included in HFVP Rev. A and related procedures planned submission, 31 August 2016

Summary of impact on GDA submissions:

<u>GDA Submission Document</u>		<u>Planned Submission Date to ONR</u>
Strategy of Use for HMIs	<u>GA91-9201-0003-01462</u>	Rev. A <u>31 October 2016</u> , A2-1 A3-1
Strategy of Use for HMIs	<u>GA91-9201-0003-01462</u>	Rev. B <u>31 March 2017</u> , A2-2 (<u>Only if required</u>)
Human Reliability Analysis Report	GA91-9201-0001-00041	Rev. E <u>10 January 2017</u> , A3-2, A7-1
Human Factors Methodology Plan	GA91-9201-0001-00033	Rev. E <u>31 October 2016</u> , A4-1 A6-1
Cognitive Workload Analysis Report	<u>GA91-9201-0003-01727</u>	Rev. A <u>31 January 2017</u> , A4-4
Human Factors Concept of Operations Report	GA91-9201-0001-00034	Rev. D 29 July 2016, A5-3
HCI-Induced Cognitive Error Analysis Report	<u>GA91-9201-0003-01726</u>	Rev. A <u>31 January 2017</u> , A6-3
<u>UK ABWR Alarm Philosophy Report</u>	<u>GA91-9201-0003-01919</u>	Rev. A <u>31 January 2017</u> , A8-2 A5-2
Alarm Design Rationalisation and Justification Report	<u>GA91-9201-0003-01725</u>	Rev. A <u>31 March 2017</u> , A8-3 A5-4
Human Factors Verification & Validation Plan	<u>GA91-9201-0003-01353</u>	Rev. A <u>31 August 2016</u> , A8-4
Human Factors MCR Verification & Validation Procedure(s)	<u>GA91-9201-0003-01724</u>	<u>As required</u> , A8-4

Programme Milestones/ Schedule:

See attached Gantt Chart (Table 1).

Reference:

<u>Document Title</u>	<u>Document ID (Document No.)</u>	<u>Rev.</u>
1. Human Factors Integration Plan	GA32-1501-0007-00001 (3E-UK-0121)	C
2. Human Factors Verification and Validation Plan	<u>GA91-9201-0003-01353 (HFE-GD-0232)</u>	A
3. Human Reliability Analysis Report	GA91-9201-0001-00041 (HFE-GD-0066)	E
4. Human Factors Concept of Operations Report	GA91-9201-0001-00034 (HFE-GD-0060)	D
5. Human Factors Methodology Plan	GA91-9201-0001-00033 (HFE-GD-0059)	E

