REGULATORY ISSUE

REGULATOR TO COMPLETE

RI unique no.:	RI-ABWR-0002
Date sent:	3rd July 2015
Acknowledgement required by:	10th July 2015
Agreement of Resolution Plan Required by:	*To Be Determined By The Hitachi-GE Resolution Plan.*
Resolution of Regulatory Issue required by:	*To Be Determined By The Hitachi-GE Resolution Plan.*
TRIM Ref.:	2015/248197
Related RQ / RI No. and TRIM Ref. (if any)**:**	
Issue title:	UK ABWR Probabilistic Safety Analysis: Project Plan and Delivery
Technical area(s) 4. PSA	**Related technical area(s)** 1. Internal Hazards 2. Civil Engineering 5. Fault Studies 6. Control & Instrumentation 10. Radiation Protection & (Level 3 PSA) 13. Human Factors 14. MoS & QA

Regulatory Issue

SUMMARY

The objective of this Regulatory Issue (RI) is to state ONR's expectations with respect to Hitachi-GE developing and delivering a suitable and sufficient Probabilistic Safety Analysis (PSA) for the UK ABWR fault analysis as part of the GDA submission.

A suitable and sufficient scope PSA for GDA developed in line with UK requirements is required, in order for ONR to undertake a meaningful assessment against regulatory expectations, including:

- SAP FA.10 (Need for PSA): *"Suitable and sufficient PSA should be developed as part of the fault analysis and design development and analyses …The PSA should assist the designers in achieving a balanced and optimised design…The PSA should enable a judgement to be made of the acceptability or otherwise of the overall risks against Numerical Targets 5 to 9 and should help to demonstrate that the risks are, and remain,* as low as reasonable practicable (ALARP)*…"*
- SAP FA.11 (Validity): *"The PSA should reflect the current design and operation of the facility."*
- SAP FA.12 (Scope and extent): *"The PSA should cover all significant sources of radioactivity, all permitted operating states and all relevant initiating faults."*
- SAP FA.13 (Adequate representation): *"The PSA model should provide an adequate representation of the facility".*
- SAP FA.14 (Use of PSA): *"The PSA should be used to inform the design process".* As noted above the PSA should be used to support the demonstration that risks are tolerable and ALARP."

In addition to SAPs FA.10 to 14, the regulatory expectations on PSA are summarised in SAPs Targets 7 to 9 and ONR's PSA Technical Assessment Guide (TAG) (Ref.2).

The GDA Guidance to Requesting Parties (Ref.1) indicates that the submission for design acceptance should include a full scope Level 1 and Level 2 PSA and that the PSA should be used to help show that the design satisfies the ALARP requirement. The GDA Guidance to Requesting Parties also indicates that it is expected that at the start of Step 3 the Requesting Party (RP) provide a PSA.

BACKGROUND

ONR's assessment during Step 2 of GDA of the PSA aspects of the UK ABWR safety submission concluded

that the information provided in Step 2 was insufficient to present an overall picture and thus, a reasonable understanding of the UK ABWR risk. Hitachi-GE indicated its intention to develop, within GDA timescales, a modern standards full-scope PSA to demonstrate that the risk associated with the UK ABWR is ALARP and to support the design change decision-making process. In this regard, Hitachi-GE submitted, in GDA Step 2, a high level plan to develop the UK ABWR PSA; according to this plan the Level 1 and Level 2 PSA for internal initiating events during operation at power would be submitted at the end of 2014. The remaining parts of the PSA would follow later in GDA in a staggered approach, including delivery of the hazards PSA in Step 4.

In the Step 2 PSA Assessment Report (Ref.3) paragraph 132 ONR highlighted;

"The timely delivery by the RP of the level 1 and level 2 PSA for internal initiating events during operation at power (proposed for December 2014), and the quality of this part of the PSA, will be key to providing me with confidence of the RP's ability to deliver a full scope PSA which:

- *Meets ONR's expectations.*
- *Provides a clear understanding of the UK ABWR risk.*
- *Supports the demonstration that the level of risk is ALARP.*

Should the RP not deliver the analyses as per the programme, or the quality be lacking, ONR has additional regulatory options."

In August 2014 ONR raised RO-ABWR-0013 (Ref.4) to state ONR's expectations related to the development and delivery of the PSA for the UK ABWR as part of the GDA submission and to gain early confidence that Hitachi-GE was able to deliver a modern standards full-scope PSA within the GDA timeframes.

The UK ABWR PSA for internal events at power was submitted to ONR at the end of December 2014, on time in line with the programme provided as part of the response to RO-ABWR-0013. ONR's Step 3 review assessed this PSA and other PSA documentation with a focus on the arguments supporting the PSA safety claims, these are interpreted by ONR as being:

- The PSA methods and techniques (and task procedures provided in response to RO-ABWR-0013) and their application in practice against ONR's SAPs, PSA TAG and international good practice.
- The basis and the scope of the UK ABWR PSA against the regulatory expectation that it should cover all the relevant sources of radioactivity, all relevant initiating events, and all operation modes.
- The processes used to support the development of the UK ABWR PSA and PSA applications and justification that these processes and their implementation by the RP meet modern standards and international good practice.

ONR's Step 3 review (reported to Hitachi-GE between February 2015 and May 2015) identified the need for further work in order to fully meet UK regulatory expectations. The outcomes of the review are captured in a series of related Regulatory Observations (ROs) Ref.5 to Ref.10, Regulatory Queries (RQs) Ref.11 and Ref.12 and other regulatory feedback provided during formal engagements or in assessment reports:

- RO-ABWR-0040 and RO-ABWR-0041 (Identification and prioritization of hazards for the PSA) .
- RO-ABWR-0042 (Identification of internal initiating events at power).
- RO-ABWR-0046 (Containment performance analyses).
- RO-ABWR-0048 (Level 2 PSA for internal initiating events at power).
- RO-ABWR-0053 (System analyses).
- Regulatory feedback provided on data analyses.
- RQ-AWBR-0559 (Accident Sequences Analyses and Success Criteria).
- RQ-ABWR-0560 (PSA Quantification, Identification of Assumptions, Uncertainty and Sensitivity Analyses, Interpretation of Results and Use of the PSA).
- Regulatory feedback regarding response to RO-ABWR-0013 provided in formal engagements (e.g. limitations regarding Hitachi-GE allocation of PSA resources and internal review process).

These ROs, RQs and feedback highlight that the arguments supporting the PSA safety claims do not meet the relevant expectations in ONR's PSA TAG which captures our PSA SAPs and international good practice. On this basis, it was considered that the PSA submission did not meet the expectations defined in the Step 2 PSA

Assessment Report (Ref.3) such as paragraph 132 (see above).

The regulators consider a suitable and sufficient PSA to be an integral aspect of the UK ABWR's safety analysis within GDA. Overall, the UK ABWR PSA information received so far does not provide ONR with confidence that Hitachi-GE, without further work and changes, will be able to deliver a modern standards full-scope PSA for the UK ABWR, which is suitable and sufficient for ONR to carry out a meaningful assessment within the project timescales. This is considered a serious regulatory shortfall which ONR, in line with our Guidance to Requesting Parties (paragraphs 159 and 160), are now escalating to a Regulatory Issue.

REGULATORY EXPECTATIONS

The regulatory expectations are the same as those defined under RO-ABWR-00013 (Ref.3). Overall, ONR expects Hitachi-GE to provide:

- **Project plan**: A project plan that ensures that the PSA's purpose and objectives and hence its scope are clearly understood at the outset of the project. As many of the future applications as possible should be identified, as these will affect the approach to be used in the individual tasks. It should also identify the requisite level of QA, and the various reports and procedures which will be produced during the course of the development of the PSA. It is essential to identify the required documentation at the beginning of the project, and develop it throughout the course of the work, as much more effort would be required to generate the technical documents after the models have been developed.
- **Resources:** The allocation of sufficient Suitably Qualified and Experienced PSA resources required to complete each of the PSA tasks identified in the project plan.
- **Quality Assurance:** The development of the PSA must be based on a secure and traceable process in which all details of the PSA, including explicit and implicit assumptions, modelling techniques. etc., are fully checked, documented and recorded. The purpose of the QA plan and procedures is to ensure that the necessary documentation is developed and the review process for all work products is clearly specified. The QA practices and procedures in use at in the development of the design should be considered when QA is planned for the development of the PSA.
- **PSA model and technical documentation**: Comprising the UK ABWR PSA model and all the technical documentation covering the development of each of the tasks and the recording and reporting of the work performed.

ONR's expectation is that the UK ABWR PSA is updated as necessary to address the shortfalls identified in Step 3 (regulatory feedback given in Ref. 5 to Ref 12, assessments reports and formal engagements) and ONR's expectations in relevant sections of the SAPs and the PSA TAG.

REFERENCES

1. New nuclear reactors: Generic Design Assessment Guidance to Requesting Parties, ONR-GDA-GD-001 Revision 1, August 2014. www.onr.org.uk/new-reactors/ngn03.pdf
2. Technical Assessment Guides. Probabilistic Safety Analysis NS-TAST-GD-030 Revision 4 ONR June 2016.
3. Assessment Report ONR-GDA.-AR-14-003. Step 2 Assessment of the Probabilistic Safety Analysis (PSA) and Severe Accident Analysis (SAA) of Hitachi-GE's UK Advanced Boiling Water Reactor (UK ABWR). Revision 0. 28 August 2014.
4. RO-ABWR-013. UK ABWR PSA Project Plan and Delivery. TRIM 2015/241720.
5. RO-ABWR-040. UK ABWR Probabilistic Safety Analysis: Identification of Applicable Internal Hazards. TRIM 2015/60355.
6. RO-ABWR-041. UK ABWR Probabilistic Safety Analysis: Identification of Applicable External Hazards. TRIM 2015/30525.
7. RO-ABWR-0042. Probabilistic Safety Analysis (PSA) internal initiating events at power. TRIM 2015/99947.
8. RO-ABWR-0046. Containment Performance Analyses. TRIM 2015/79125.

9. RO-ABWR-0048. Level 2 PSA methodology. TRIM 2015/136397.
10. RO-ABWR-0053. UK ABWR Probabilistic Safety Analysis (PSA) – level 1 and level 2 PSA for internal events during operation at power - System Analyses. TRIM 2015/155573
11. RQ-AWBR-0559 UK ABWR Level 1 PSA Accident Sequences Analyses and Success Criteria
12. RQ-ABWR-0560 UK ABWR PSA Quantification, Identification of Assumptions, Uncertainty and Sensitivity Analyses, Interpretation of Results and Use of the PSA

Regulatory Issue Actions

RI-ABWR-002.A1: UK ABWR PSA Project Plan

The scope of this action is similar to that defined under RO-ABWR-0013.A1.

Hitachi-GE is requested to provide the UK ABWR project plan. This should include the following:

- A complete list of the PSA objectives, applications and definition of the requirements of the PSA to fulfil these.
- Definition of the PSA tasks required to be completed during GDA (including the tasks already completed or on-going).
- Identification of the various procedures and reports which will be produced or updated during the development of the UK ABWR PSA, for all the PSA tasks and PSA applications.
- A detailed work programme including all planned deliverables. This programme should propose a resolution to the regulatory feedback given in Ref. 5 to Ref 12, assessments reports and formal engagements and meet the regulatory expectations set out in the RI.

Resolution required by: *To be determined by the Hitachi-GE Resolution Plan*

RI-ABWR-002.A2: Allocation of Suitably Qualified and Experienced PSA Resources to Develop the UK ABWR PSA

The scope of this action is the same as that defined under RO-ABWR-0013.A2.

The response to this Action should:

- meet the regulatory expectation defined in this RI;
- address the relevant regulatory expectations of RO-ABWR-0013.A2; and
- address the regulatory feedback given in Ref. 5 to Ref 12, assessments reports and formal engagements.

Resolution required by: *To be determined by the Hitachi-GE Resolution Plan.*

RI-ABWR-002.A3 : PSA Quality Assurance Plan and Quality Assurance Procedures

The scope of this action is the same as that defined under RO-ABWR-0013.A3.

The response to this Action should:

- meet the regulatory expectation defined in this RI.
- address the relevant regulatory expectations of RO-ABWR-0013.A3, and
- address the regulatory feedback given in Ref. 5 to Ref 12, assessments reports and formal engagements.

Resolution required by: *To be determined by the Hitachi-GE Resolution Plan.*

RI-ABWR-002.A4: PSA Task Analysis Files, Summary Report, Document Database and Task Procedures.

The scope of this action is similar to that defined under RO-ABWR-0013.A4, RO-ABWR-0013.A5 and RO-ABWR-0013.A6.

Hitachi-GE is requested to provide a modern-standards full-scope PSA fully documented, including:

- individual reports for each of the UK ABWR PSA tasks (or sub-tasks, when appropriate, e.g., individual systems);
- a UK ABWR PSA summary report;
- the UK ABWR PSA computer model (including input parameter data bases, result files, etc.);
- the complete task files, including relevant references, should be made available to ONR upon request;
- an updated Document Database in line with the relevant expectation in RO-ABWR-0013.A6 and regulatory feedback given in Ref. 5 to Ref 12, assessments reports and formal engagements; and
- updated Task Procedures in line with the relevant expectations in RO-ABWR-0013.A4 and regulatory feedback given in Ref. 5 to Ref 12, assessments reports and formal engagements.

The full scope PSA and documentation should meet the regulatory expectations set out in the RI and the regulatory feedback given in Ref. 5 to Ref 12, assessments reports and formal engagements.

Resolution required by: *To be determined by the work programme provided in response to action A1.*

REQUESTING PARTY TO COMPLETE

Actual Acknowledgement date:	
RP stated Resolution Plan agreement date:	