

REGULATORY OBSERVATION	
REGULATOR TO COMPLETE	
RO unique no.:	RO-ABWR-0013
Date sent:	20 August 2014
Acknowledgement required by:	11 September 2014
Agreement of Resolution Plan required by:	24 September 2014
Resolution of Regulatory Observation required by:	<i>To be determined by the Hitachi-GE Resolution Plan</i>
TRIM Ref.:	2014/241720
Related RQ / RO No. and TRIM Ref. (if any):	
Observation title:	UK ABWR Probabilistic Safety Analysis: Project Plan and Delivery
Technical area(s) 4. PSA	Related technical area(s) 1. Internal Hazards 3. External Hazards 5. Fault Studies 13. Human Factors 10. Radiation Protection & (Level 3 PSA) 6. Control & Instrumentation 14. MoS & QA
Regulatory Observation	
Summary	
<p>The objective of this Regulatory Observation (RO) is 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 will be able to deliver a full scope modern standards Probabilistic Safety Analysis (PSA) within the GDA timeframes. Hitachi-GE should develop and deliver the UK ABWR PSA in accordance with a detailed programme, which should be reflected in the Project Plan requested in Action A1 of this RO, outlining specific PSA tasks required to be completed and providing clarity on, and timings for, the deliverables (including any required task procedures, task analysis files, models and databases as agreed with ONR). In response to the RO Hitachi-GE are requested to phase the delivery of the UK ABWR PSA and documentation in a logical manner, in accordance with the Project Plan.</p>	
Background	
<p>ONR's assessment during Step 2 of GDA of the PSA aspects of the UK ABWR safety submission (including bounding evaluations of the Core Damage Frequency) concluded that the information provided was insufficient to present an overall picture and thus, a reasonable understanding, of the UK ABWR risk.</p> <p>Hitachi-GE indicated its intention to develop, within GDA timescales, a full-scope modern-standards 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 finalised at the end of 2014. The remaining parts of the PSA would follow later in GDA, including delivery of the hazards PSA well into Step 4, which may present risks to the completion of GDA within expected timescales.</p>	

Regulatory Expectations

ONR considers that a good quality PSA project plan is key to timely deliver a high quality full scope PSA for the UK ABWR, which is essential for the completion of GDA. The objective of this RO is to state ONR's expectations related to the development and delivery of the PSA for the UK ABWR as part of the GDA submission. Hitachi-GE should develop and deliver the UK ABWR PSA in accordance with a detailed programme, which should be reflected in the Project Plan requested in Action A1 of this RO, outlining specific PSA tasks required to be completed and clarity on, and timings for, the deliverables (including any required task procedures, task analysis files, models and databases, as agreed with ONR).

In response to this RO Hitachi-GE are requested to provide the UK ABWR PSA and documentation in a phased but logical fashion, in accordance with the Project Plan; the staggered submission to ONR of information (documentation and computer models and / or data bases, as appropriate) related to individual PSA tasks will facilitate both ONR's assessment and early identification of any technical concerns, and Hitachi-GE's ability to address such concerns in a timely manner.

The programme to develop this PSA should cover all the stages of the development, including any planned updates, up to the delivery of the full scope, fully documented, PSA model, which must be representative of the UK ABWR design reflected in the Design Reference Point.

The guidance provided in this RO is based on IAEA's TecDoc on Living PSA (Ref. 1), ONR SAPs (Ref. 2) and PSA TAG (Ref. 3). The following paragraphs have been extracted from Ref. 1, considered by ONR to represent relevant good practice, and adapted for the purposes of this RO.

The following aspects are to be considered in planning the development of the UK ABWR PSA, each of which will contribute to its successful completion. These are the documentation, the quality assurance (QA), and the organization and resources required to perform the analysis. Each of these topics is explained briefly below.

- **Project plan, quality assurance plan and quality assurance procedures:** The primary function of the project plan is to ensure 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 also identifies 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.
- **Technical documentation:** The technical documentation covers the development of each of the tasks and the recording and reporting of the work performed. The following sets of documents are recommended:
 - o **Work plan (task procedure) for each of the UK ABWR PSA tasks:** procedures are understood in this context as a detailed set of steps that give guidance on how to perform the tasks, the techniques to be used and general assumptions to be made. Each task procedure should clearly identify the interfaces with other tasks and the information/data to be exchanged between tasks. The real purpose of these documents is to ensure that all analysts working in a task develop a consistent set of models which interface without overlap or omission. Future revisions to the PSA will use the same procedures in order to ensure consistency with the original model.
 - o **Analysis Files for each of the tasks or sub-tasks within tasks,** (for example it is recommended to develop analysis files for each individual system in the systems analysis task): The analysis files are a crucial part of the PSA. Such files include reports, input data, relevant calculations, and computer model and database files containing input parameters, task results, etc. The PSA task reports describe clearly the analyses performed, particularly specific modelling assumptions, identify interfaces and information or data exchanged between PSA tasks, and provide all the references used. The model and / or database files (including, when appropriate task result files) contain, for example, event tree models, fault tree models, basic event probabilities, etc. The analysis files will be controlled documents which are maintained for the life of the plant. They enable any PSA analyst familiar with the particular task to either recreate or modify the particular part of the model covered in the analysis file. Only if there is a complete set of such files is it possible to define and understand each element of the computer model and the results of its quantification. The development of the PSA will require the use of documents generated by other technical departments in the

company and / or by outside bodies.

- **Document database**, identifying all the externally (with respect to the project) and internally generated documents used in the study and their relationship to each other. A significant amount of new material is generated during the development of the PSA, for example, records of information exchange between tasks, minutes of meetings, procedures, calculation notes, reports, etc. In the future there may be changes to the input documents which will bear on the assumptions and models in the PSA. In order to facilitate the updating process, it is highly advantageous to have a document database which cross references the input, output, and internal usage of the various documents.
- **Summary report**: The purpose of the summary report is to communicate the project motivations, objectives and scope, as well as the essential results, methods and conclusions of the study, to interested users. The summary report should provide an overview of the contents and organization of the documentation of the study, as well as summaries and highlights for each PSA task.
- **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 plan and procedures is to ensure that the necessary documentation is developed and the review process for all work products 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.
- **Organization**: The development of the model, its scope and the end uses, has to be an integrated with the development of the UK ABWR design, with the co-operation and assistance of several departments. However, the PSA itself can only be performed by a team of analysts who are trained in the methods and techniques needed to develop the model. The wide diversity of expertise on which the team will have to call is reflected in all the areas which have to be considered, such as, thermal-hydraulic response under off-normal conditions, construction of the risk model (fault trees, event trees and quantification of the results), analysis of human performance, structural analysis of the containment response under severe accident conditions, hazard analyses (seismic, fires, floods), source term and radiological analysis, etc. The selection of qualified support teams and the interfaces with them are very important (e.g. clear definition of expected output, review/validation of the work externally performed, etc.) and it is necessary to allow for close monitoring of any required external work and to ensure good technology transfer. Hitachi-GE's PSA team must hold responsibility for ensuring that their PSA model accurately represents the UK ABWR design. Therefore, the composition of the team and its interaction with technical teams in other departments is a fundamental part of the success of the project and the provision of results which will be fully recognized by these departments.
- **Resources**: The allocation of resources required to develop the PSA depends on a number of factors which determine the distribution of the work between the Hitachi-GE's teams and other support organizations. Examples of these factors are:
 - starting point (i.e. whether an earlier model already exists);
 - required level of technology transfer; and
 - review to be performed by other technical areas.

The key to establishing the credibility of the UK ABWR PSA for GDA is to involve other technical areas such as system engineers, human factors, etc. Thus, in setting up the project schedule, provision of information and review activities by other technical areas need to be included. This will ensure that all hypotheses and assumptions made in the development of the model conform to the information available on the design.

References:

[1] IAEA-TECDOC-1106. Living Probabilistic Safety Assessment (LPSA). August 1999.
[2] Safety Assessment Principles for Nuclear Facilities. 2006 Edition Revision 1. HSE. January 2008. www.onr.gov.uk/SAPS/index.htm
[3] Technical Assessment Guides. Probabilistic Safety Analysis NS-TAST-GD-030 Revision 4 ONR June 2016.

Regulatory Observation Actions

RO-ABWR-0013.A1: UK ABWR PSA Project Plan

Hitachi-GE are 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.
- The identification and justification of the computer code(s) that will be used for the Level 1 and Level 2 UK ABWR PSA (model and database).
- Definition of the PSA tasks required to be completed during GDA (including the tasks already completed or ongoing).
- 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.

Resolution required by: 31 October 2014.

RO-ABWR-0013.A2: Allocation of Suitably Qualified and Experienced PSA Resources to Develop the UK ABWR PSA

Hitachi-GE are requested to provide information on the resources allocated to develop the UK ABWR PSA in terms of manpower and qualifications and experience (Hitachi-GE staff and, if relevant, technical support contractors) required to complete each of the PSA tasks identified in action 1.

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

RO-ABWR-0013.A3 : PSA Quality Assurance Plan and Quality Assurance Procedures

Hitachi-GE are requested to provide the UK ABWR PSA QA plan and procedures, including the requisite level of QA for each PSA task and PSA tasks that require involvement of other departments.

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

RO-ABWR-0013.A4: PSA Task Procedures

Hitachi-GE are requested to provide a task procedure (or equivalent as long as it achieves the same aim) for each of the UK ABWR PSA tasks.

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

RO-ABWR-0013.A5: PSA Task Analysis Files and Summary Report

A5.1 Hitachi-GE are requested to:

- Provide individual reports for each of the UK ABWR PSA tasks (or sub-tasks, when appropriate, eg, individual systems).
- Provide a UK ABWR PSA summary report.
- Provide the UK ABWR PSA computer model (including input parameter data bases, result files, etc).
- Make the complete task files, including relevant references, available to ONR upon request.

NOT PROTECTIVELY MARKED

A5.2 Hitachi-GE are requested to provide a plan of updates of the tasks analysis files, including PSA model and documentation during GDA.

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

RO-ABWR-0013.A6: Document Database

Hitachi-GE are requested to provide a Document Database and a plan of updates during GDA. As a minimum, the document database should be updated to support the UK ABWR Pre-Construction Safety Report (PCSR).

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

REQUESTING PARTY TO COMPLETE

Actual Acknowledgement date:

RP stated Resolution Plan agreement date: