

**GENERIC DESIGN ASSESSMENT**  
**PROGRESS REPORT**  
**REPORTING PERIOD October - December 2014**

**INTRODUCTION AND BACKGROUND**

- 1 This report provides information on the work that we have been carrying out on the Generic Design Assessment (GDA) of Hitachi-GE's UK Advanced Boiling Water Reactor (UK ABWR), and the re-mobilisation of the GDA project for the Westinghouse AP1000® reactor design, during the period October – December 2014.
- 2 This has been a period of continued and intensive assessment on the UK ABWR project; and Step 3 is progressing as we expect. Hitachi-GE has made a good start to Step 3 and continues to make progress with the challenges and matters arising. In addition, both the Regulators and Hitachi-GE have completed the improvement actions resulting from the Step 2 to Step 3 Gateway Review.
- 3 During this period we undertook a tripartite meeting with Hitachi-GE and Horizon Nuclear Power, which focused on continuing the discussions around GDA and site specific scope, early procurement of long lead items and future collaboration on licensing, permitting and regulation issues between Hitachi-GE and Horizon Nuclear Power.
- 4 For the Westinghouse AP1000 project, the Regulators undertook a Remobilisation Review meeting in December 2014 to consider whether the project could move from the remobilisation phase into technical assessment, and it was concluded that more progress from Westinghouse was required before the project could move into technical assessment. The Regulators will conduct a further Remobilisation Review at the end of January 2015.
- 5 Once again this report includes the performance metrics for UK ABWR project. If we progress the AP1000 into technical assessment in early 2015 we will pilot the metrics for this project between January and March 2015, and will publish the metrics for March in the next GDA progress report.
- 6 We welcome comments on this report. Please send them to us at [new.reactor.build@onr.gsi.gov.uk](mailto:new.reactor.build@onr.gsi.gov.uk).

**GDA STEP 3 - UK ABWR**

- 7 During the period the Regulators were focused on the assessment of the Step 3 submissions, which have largely been delivered on time, against the programme plan to date. In addition, Hitachi-GE has continued to address regulatory concerns around its capability and capacity, and has increased its resources in a number of areas. Of particular note is its creation of a new safety case organisation, which includes highly experienced personnel with knowledge and experience of the UK safety case regime.
- 8 Technical issues remain in the areas of reactor chemistry, probabilistic safety analysis (PSA), external hazards and radioactive waste management. These areas require continued and enhanced focus by Hitachi-GE. This has been made clear to Hitachi GE, and they have committed to meet this need. Further information on these issues is provided in Annex 2.
- 9 Within this period the regulators:
  - Participated in 75 technical meetings and 15 other meetings across the project.
  - Raised 118 Regulatory Queries (RQs).

- Formally issued 15 Regulatory Observations (ROs), which are matters that require resolution by Hitachi-GE.
- 10 For the Regulatory Observations that have been raised during the period, Hitachi-GE will be required to produce a resolution plan. The resolution plan sets out the work that Hitachi-GE will do, to address the matters raised by the Regulators and identify how long this will take. Following the agreement of the resolution plan, the Regulatory Observation and associated resolution plan will be published on the Joint Regulators Website (<http://www.onr.org.uk/new-reactors/uk-abwr/ro-res-plan.htm>)

### Metrics

- 11 Throughout Step 3 this report will include the GDA Metrics, to provide a clear overview of the status. The metrics at Annex 1 provide a red, amber, green & blue 'traffic light' indication for current and predicted progress, quality of interactions / submissions and areas of risk for each of the GDA topic areas. A topic-by-topic overview is provided in Annex 2.

### GDA CLOSURE PHASE – AP1000

- 12 In our last progress report we stated that the remobilisation of the project was expected to be completed during this period. However between September and December Westinghouse progress was insufficient to move out of the mobilisation phase; resolution plans and associated schedules require revision and an integrated schedule is required to show linkage between the GDA Issues.
- 13 Through the month of December activity increased on the project, and a number of technical documents were submitted for regulatory assessment. In addition, a number of project meetings were held to understand the status of the project and Westinghouse's focus for the UK.
- 14 The Regulators noted that at the end of December, Westinghouse was still in the process of recruiting for the UK project team. However, the USA licensing and technical teams were fully committed.
- 15 At the end of December, the Regulators also did not have clarity on the Design Reference Point (DRP) for the closure phase of GDA. The DRP is the detail of the design to form the assessment basis. Westinghouse informed the Regulators that the AP1000 design has undergone substantial change since 2011; hence clarity on the design reference to be used for our assessment is crucial.
- 16 The Regulators note that the Pre-Construction Safety Report (PCSR) submitted at the end of Step 4 in 2011 is based on the historic European Design Control Document (EDCD), and that Westinghouse proposed to remove it from the PCSR to either include in the revised PCSR or as standalone documents. Therefore the (re)development of a holistic, integrated PCSR relevant to the DRP and modern standards will be a significant undertaking.
- 17 There have been 20 technical meetings and 9 other meetings in the period. 15 RQs have been issued in the period. ROs are not typically used in the closure phase of GDA projects; however the Regulators are considering the benefit of introducing this option.
- 18 A Remobilisation Review meeting was held on December 18<sup>th</sup> 2014 to consider Westinghouse's progress, its readiness to commence technical assessment in earnest, its capability and capacity and the readiness of the regulators to proceed. The meeting concluded that insufficient progress had been made between October and December and therefore the project should continue in the remobilisation phase, and this will be reviewed again at the end of January 2015. This decision was presented to and subsequently ratified at the ONR and EA Programme Boards.

### TRIPARTITE DISCUSSIONS

- 19 The second tripartite meeting between the Regulators, Hitachi-GE and Horizon Nuclear Power was held on 20th November 2014.
- 20 Further discussions were held on the scope of GDA and the site specific safety submissions, and the regulatory assessment of long lead items (that will be ordered by Horizon Nuclear Power prior to the conclusion of GDA).
- 21 Hitachi-GE and Horizon Nuclear Power have agreed to 'enhanced collaborative working' (ECW); and have put infrastructure and processes in place to enable them to increase their cooperation on technical (design and safety case) matters, further strengthen the relationship between the parties and increase the visibility of the project as a whole to all parties.
- 22 ECW is supported by both Horizon Nuclear Power and Hitachi GE, as it brings significant potential project benefits. However it also has the potential to significantly improve GDA outcomes and bring appropriate efficiencies to regulation for the project as a whole, and as such is supported by the Regulators.
- 23 A further aspect of the ECW is the proposal for a joint safety case office to deliver the GDA safety case and the site specific safety case. The Regulators welcomed this.
- 24 The Regulators intend to convene tri-partite discussions with Westinghouse and NuGen at an appropriate point in the future.

## **COMMUNICATIONS AND STAKEHOLDER ENGAGEMENT**

- 25 Within the period there were 3 comments posted on the Hitachi-GE public comments website bringing the total number submitted to 37 until the end of December 2014. Hitachi-GE responded to all questions within the required timeframe, and there have been no repeat questions.
- 26 The Westinghouse public comments website is live, and, since remobilisation began the number of public comments submitted at the end of December was 0.
- 27 A 'Sciencewise' public dialogue project to inform the Regulators' approach to public engagement and consultation is underway. The project will include three workshops with members of the public, and an initial survey has been undertaken to inform the workshops. The survey will produce a summary of national attitudes to the regulation of nuclear power and the assessment of a new reactor design. Specifically the survey questioned:
- The level of awareness of the various nuclear regulators.
  - Attitudes to new nuclear power stations.
  - Level of awareness about new reactor build and of regulation.
  - Level of trust in the regulators.
  - Public interest points (e.g. safety, environment, security etc.)
  - Level of interest of future involvement in the GDA consultation process.
- 28 Further information is available on the Sciencewise website: <http://www.sciencewise-erc.org.uk/cms/new-nuclear-power-stations-reviewing-how-to-engage-with-members-of-the-public-in-reactor-design-assessments-known-as-the-generic-design-assessment-or-gda>
- 29 Regulators attended a number of events to discuss GDA and raise awareness of the comments process. These included the NDA's national stakeholder event and the Marketforce Nuclear New Build Forum. ONR and EA also took part in the IAEA's technical meeting on 'Effective techniques and messages to engage with decision makers and the public'

## TECHNICAL SUPPORT CONTRACTS

30 Between October and December 2014 ONR have let 6 technical support contracts and EA has let 1 relating to the UK ABWR project:

Topic Area	Contractor Organisation	Value
Reactor Chemistry and Internal Hazards – technical support on iodine behaviour for the UK ABWR.	National Nuclear Laboratory (NNL)	£52,753
Probabilistic Safety Analysis - technical support on PSA of the UK ABWR.	ERIN Engineering	£732,253
Reactor chemistry - technical support on materials selection and degradation for the UK ABWR.	AMEC	£58,360
Reactor chemistry – technical support on chemistry modelling for the UK ABWR	National Nuclear Laboratory (NNL)	£146,373
Reactor chemistry – technical support on radioactive source terms for the UK ABWR	Studsvik UK Ltd	£90,000
Mechanical Engineering – technical support to the review of UK ABWR Step 3 & 4	AMEC	£710,367
Probabilistic Safety Analysis Electric Power Research Institute (EPRI) Risk and Reliability Users Group Membership in order to have access to CAFTA 6.0 specialist software for PSA.	Electric Power Research Institute (EPRI)	£21,600
Independent Dose Assessment for public and non-human species (contract value dependent on future developments).	Quintessa	£58,464

31 Between October and December 2014 ONR have let 1 technical support contract relating to the AP1000 project:

Topic Area	Contractor Organisation	Value
Control & Instrumentation - technical support to the close-out of AP1000 C&I GDA Issues	Altran UK Limited	£65,916

## FORWARD LOOK

32 The next quarter will include:

- Continued assessment of the UK ABWR Step 3 submissions, and progression of design, analysis and safety case, security and environmental issues.
- The Westinghouse Remobilisation Review at the end of January 2015, and subsequent engagement dependent on the outcome.
- A bi-lateral meeting with the Japan Nuclear Regulatory Authority.

## WORKING WITH OVERSEAS REGULATORS

33 In November 2014 the Regulators met the Swedish nuclear safety regulator (SSM) during two days to discuss matters related to the chemistry of boiling water reactors (BWR). Sweden has decades of experience in operating and regulating BWRs, therefore the information we were provided with during these meetings (some of which were also attended by representatives from Swedish utilities) is valuable for our assessment of the UK ABWR reactor chemistry, as well as our assessment of some aspects of the UK ABWR structural integrity and radiation protection.

34 In December 2014 we held a video conference with the US NRC to discuss matters related to the AP1000 squib valves. During this exchange US NRC provided us with an update of developments on this topic during the last three years (i.e. since the AP1000 GDA Step 4 concluded); in particular squib valve design modifications, test results and

regulatory assessment and inspection. ONR and US NRC agreed to maintain further cooperation in this area.

- 35 In addition, during this quarter we also had initial discussions with US NRC where we agreed to further cooperation in the areas of AP1000 Control and Instrumentation, and lessons learnt from the Fukushima accident.

### **MORE INFORMATION ON GDA**

To find out more about GDA visit <http://www.onr.org.uk/new-reactors/>

To receive the latest news and information on GDA, subscribe to our eBulletin by visiting [www.onr.org.uk/newreactors/ebulletin.htm](http://www.onr.org.uk/newreactors/ebulletin.htm)

### **SUMMARY OF REGULATOR CHARGES**

[AWAITING INFORMATION]

### **UK ABWR**

#### **Office for Nuclear Regulation:**

- |  |            |
|--|------------|
| ▪ Charges for the quarter October - December 2014: | £1,638,505 |
| ▪ Cumulative charges:                              | £7,276,569 |

#### **Environment Agency:**

- |  |            |
|--|------------|
| ▪ Charges for the quarter October - December 2014: | £347,076   |
| ▪ Cumulative charges:                              | £1,832,043 |

### **AP1000**

#### **Office for Nuclear Regulation:**

- |   |             |
|---|-------------|
| ▪ Charges for the quarter October – December 2014 : | £456,093    |
| ▪ Cumulative charges:                               | £23,944,879 |

#### **Environment Agency:**

- |  |            |
|--|------------|
| ▪ Charges for the quarter October - December 2014: | £24,708    |
| ▪ Cumulative charges:                              | £2,389,358 |

**Annex 1 – UK ABWR Progress Metrics – October – December 2014**

<b>GDA Metrics Definitions</b>	
<b>Category 1</b>	<b>Category 2</b>
<p><b>Red</b> – Significant slippage against the baseline programme has occurred, with delays highly unlikely to be recoverable. Successful completion of the step in accordance with the Regulators Baseline Programme will require the programme to be re-baselined and the target dates changed (via Change Control).</p> <p><b>Amber</b> – Some slippage against the baseline programme has occurred, with delays capable of being recovered. Prompt action is required to ensure that there is an improvement in delivery in order to successfully complete the step in accordance with the Regulators Baseline Programme.</p> <p><b>Green</b> – Activities are generally on plan to successfully deliver the current step in accordance with the Regulators Baseline Programme.</p> <p><b>Blue</b> – Activities are ahead of plan to successfully deliver the current step in accordance with the Regulators Baseline Programme.</p>	<p><b>Red</b> - For the current Step, submissions are significantly below expectations in terms of scope and/or quality. The Regulators will require significantly improved submissions to support their assessment.</p> <p>The Regulators should explain what is required to meet their expectations.</p> <p><b>Amber</b> - For the current Step, submissions are below expectations in terms of scope and/or quality. The Regulators will require submissions to be updated/revised to support their assessment.</p> <p>The Regulators should explain what is required to meet their expectations.</p> <p><b>Green</b> - For the current Step, submissions have generally met the expected scope and quality.</p> <p><b>Blue</b> - For the current Step, submissions have exceeded the expected scope and quality.</p>
<b>Category 3</b>	<b>Category 4</b>
<p><b>Red</b> – Communications and interactions have been significantly below expectations, in terms of clarity, openness, or technical content. This has resulted in a high degree of ambiguity and/or a lack of confidence in the other parties' intentions. The values in the Regulatory Nuclear Interface Protocol (RNIP)<sup>1</sup> have been compromised.</p>	<p><b>Red</b> - Submissions are not addressing the Regulatory Observation / Regulatory Issue (RO/RI) and immediate action is required to ensure the successful completion of the RO/RI.</p> <p>There is a high risk that further RO/RI or associated Actions may be raised or transferred to a GDA Issue(s)</p>

<sup>1</sup> The Regulatory Nuclear Interface Protocol (RNIP) and the associated ways of working, is a standard protocol that has been introduced to maximise the effectiveness of ONR, Environment Agency, licensee, and requesting party relationships

**Amber** - Communications and interactions have been below expectations in terms of clarity, openness, timeliness or technical content, This has resulted in a degree of ambiguity and a lack of confidence in the other parties' intentions. Some aspects of the RNIP have been challenged

**Green** - Communications and interactions have met expectations, resulting in confidence in the other parties' intentions.

**Blue** – Communications and interactions have exceeded expectations, resulting in a high degree of confidence in the other parties' intentions

OR

The draft RO/RI Res Plan cannot be agreed even after several discussions and revisions of drafts

**Amber** - Submissions are not fully addressing the RO/RI and action may be required to ensure the successful completion of the RO/RI.

There is a risk that further RO/RI or associated Actions may be raised or transferred to a GDA Issue(s)

OR

The draft RO/RI Res Plan is under development but will require further revisions to enable agreement

**Green** - The RO/RI is likely to be closed; Submissions are addressing the RO/RI

OR

The draft RO/RI Res Plan is under development and is on track to be agreed

**Blue** - No RO/RI Issued

OR

The RO/RI has been closed





## **Annex 2 – UK ABWR Topic-by-Topic Summary**

### **Civil Engineering / External Hazards**

During this period good progress has been made on meeting the civil engineering submission schedule. A large amount of information is now being supplied, for example, Hitachi-GE submitted 10 civil engineering reports to ONR in December 2014. The programme of deliverables should provide the required information for Step 3. There is however a risk that changes due to developments in other technical areas may impact on the civil engineering programme due to potential changes in layout; discussions are under way to develop cross discipline working to mitigate this. Communications are being successfully maintained.

Progress is also being made regarding external hazards assessment, but this is slower than we had anticipated. A concern for us is the delivery of the external hazards generic site envelope and the seismic hazard assessment in particular, which are being developed slower than expected. This may have consequential knock-on effects on other disciplines that rely on definition of these generic site envelope values; discussions are under way to develop cross discipline working to mitigate this.

### **Internal Hazards**

Hitachi-GE's current activities have been delivered in accordance with Hitachi-GE's programme of submissions, and the work is progressing in line with the baseline programme.

Hitachi-GE has submitted a number of internal hazards topic reports which we are currently assessing; we will be able to provide some information on its technical adequacy in the next quarterly report.

Hitachi-GE has made reasonable progress in addressing ONR's RO-ABWR-0012 (presence of single doors on class 1 nuclear safety barriers) in line with the agreed resolution plan. The progress made with RO-ABWR-0020 (internal hazards safety case for the main steam tunnel room) is slower; we are discussing with Hitachi-GE our technical concerns in this area and clarifying our expectations.

### **Probabilistic Safety Analysis (PSA)**

In response to the lack of any PSA for the UK ABWR at the end of GDA Step 2, Hitachi-GE developed a strategy and programme to deliver the UK ABWR full scope PSA. These were provided as part of the response to RO-ABWR-0013.

The first key PSA deliverable, 'UK ABWR PSA for internal events at power', and most of its supporting submissions were provided according to programme at the end of December 2014. Initial assessment by ONR of some of the PSA submissions has identified a number of gaps for which additional information is needed; RQs and ROs are being raised, as appropriate, to address these.

Currently there are no specific issues that would prevent Hitachi-GE completing Step 3 to the agreed timescales; however a large amount of work is still required and the timescales for delivering a fully documented full scope PSA, within GDA, are tight. Therefore, the UK ABWR PSA remains an area of concern.

### **Severe Accident Analysis**

Hitachi-GE has delivered a resolution plan for RO-ABWR-0023 (UK ABWR severe accident safety case) which sets out the timescales for the provision of the major pieces of work. In addition Hitachi-GE delivered an updated version of the severe accident topic report at the end of December 2014, which is currently being assessed.

## **Fault Studies**

Progress is as expected and we judge that Hitachi-GE understand regulatory requirements in this technical area. However the safety case and its supporting transient analysis at the end of Step 3 could be significantly changed and broader than what it was at the start of Step 3. Hitachi-GE needs to consider how the new work will be incorporated and consolidated in the PCSR and supporting references.

Three areas were chosen from the PCSR / topic report for detailed assessment during early Step 3. Our conclusion is that the analyses submitted in two out of these areas do not meet ONRs expectations; thus the amber metric on the quality of the fault studies submissions. However, we have confidence that Hitachi-GE can address the issues we have raised.

## **Control and Instrumentation (C&I)**

Seven Regulatory Observations (RO-ABWR-0026 to 0032) have been raised in December 2014 covering a wide range of C&I topics to establish our expectations and ensure that Hitachi-GE develops the necessary documentation to enable progress of our assessment.

During this quarter progress has been as expected; there have been no quality or delivery issues to report. We judge that Hitachi-GE understand regulatory requirements in this technical area.

## **Electrical Engineering**

Progress is as expected and there are no quality or delivery issues to report during this quarter. We judge that Hitachi-GE understand regulatory requirements in this technical area.

## **Fuel and Core Design**

Progress is as expected and there are no quality or delivery issues to report during this quarter. We judge that Hitachi-GE understand regulatory requirements in this technical area. The quality of some deliverables has been exemplary. We had some issues and delays with the provision of some information to our technical support contractors which triggered a red metric in November; these matters are now resolved.

## **Reactor Chemistry**

The Step 3 programme of work for reactor chemistry still remains uncertain. Reactor chemistry is currently being hampered by the lack of an up-to-date plan of deliverables for Step 3 as required to be submitted in response to RO-ABWR-0019 (safety case strategy and plan). We have received a report which answers some of what RO-ABWR-0019 asks for, but still not a fully developed plan that meets our expectations.

In December 2014 we received a large number of submissions in reactor chemistry and have started our assessment. Early indications are that some of the documents may not meet their intended purpose of providing supporting arguments and evidence. A more informed view on the adequacy of the reactor chemistry submissions will be reported in the next quarterly report.

Another concern in this quarter was that the objectives of the technical meetings held in December were not fully met; in particular Hitachi-GE did not provide a satisfactory explanation of its approach to iodine chemistry and chemistry modelling in making the safety case for UK ABWR.

## **Radiation Protection**

The first set of submissions for Step 3 was received at the end of December 2014 and we now have more confidence that it may be possible to complete this Step in accordance with the baseline programme. We are now starting the assessment of those reports and will be able to provide some information on its technical adequacy in the next quarter.

ONR raised RO-ABWR-014 UK ABWR on radiological protection safety case project plan and delivery to clarify regulatory expectations; Hitachi-GE has presented a resolution plan which is broadly acceptable to us.

There has been a significant improvement recently in the communications between ONR and Hitachi-GE radiological protection subject matter expert and team, which is very encouraging.

## **Mechanical Engineering**

During this quarter progress has been as expected; there are no quality or delivery issues to report. We judge that Hitachi-GE understand regulatory requirements in this technical area.

## **Structural Integrity**

Communications are strong in this area with set protocols working well. Leadership from Hitachi-GE is strong, but, due to report quality issues, the green status of the metric that reflects ability to complete Step 3 by the agreed date is under threat.

There are on-going issues with document quality and content. This is evidenced by the report on materials selection and the report on categorisation and classification. In addition, there are technical issues with the defect tolerance assessment, where the verification process has produced results significantly different from the in-house analysis. Whilst this has reduced confidence in the quality of analysis, it has increased confidence that appropriate validation and verification processes are in place.

## **Human Factors**

Good progress has been made in this area. The establishment of Hitachi-GE's Human Factors Engineering Centre, their recognition of the extent of cross-cutting issues and the programme of activities / agreed submissions, provide confidence at this stage that Step 3 will be completed on programme.

The Step 3 submissions are generally adequate in terms of structure; however there is insufficient detail and inadequacies in some areas, against which RQs and ROs have been issued. The responses to RQs to date have been adequate and the proposed resolution of ROs appears satisfactory. However until submissions related to RO closure are received and assessed the metric reflecting quality of submissions remains amber.

## **Management of Safety and Quality Assurance Arrangements (MSQA)**

During this quarter progress has been as expected; there are no quality or delivery issues to report. We judge that Hitachi-GE understand regulatory requirements in this technical area.

Currently we are focusing efforts to ensure that Hitachi-GE understand our expectations regarding moving the safety and environmental case to the operating regime and develop robust arrangements for this purpose.

## **Radioactive Waste Management**

Hitachi-GE delivered a number of documents in December 2014 in this topic area which we are currently assessing; we will be able to provide some information on their technical adequacy in the next quarterly report.

ONR have raised concerns about the completeness of Hitachi-GE safety case addressing potential faults that do not affect the reactor, in particular faults associated with radioactive waste areas; an RO will be raised next quarter.

ONR are concerned that, in relation to radioactive waste, Hitachi-GE appear to be unclear on what information should be included in the PCSR and the requirements to demonstrate ALARP. An RO will be raised next quarter providing clear expectations, and requesting an ALARP demonstration for the UK ABWR radioactive waste facilities.

### **Decommissioning**

The PCSR chapter on Decommissioning has been developing broadly in line with our expectations; however there are some issues that will need addressing for the next issue of the document. Also, how decommissioning is being considered in the construction sequencing and the decision making process for modularisation is currently unclear.

### **Spent Fuel Management**

During this quarter progress has been as expected and there are no quality or delivery issues to report. We judge that Hitachi-GE understand regulatory requirements in this technical area.

### **Security**

During this quarter progress has been as expected and there are no quality or delivery issues to report. We judge that Hitachi-GE understand regulatory requirements in this technical area.

### **Environmental (GEP)**

During this quarter progress has been as expected. Submissions have been provided in accordance with the programme and have been of sufficient quality. We judge that Hitachi-GE understand regulatory requirements in this technical area. Our interactions with Hitachi-GE have been timely and productive.

### **Conventional Safety**

During this quarter progress has been as expected and there are no quality or delivery issues to report. We judge that Hitachi-GE understand regulatory requirements in this technical area.

### **Fire Safety**

During this quarter progress has been as expected and there are no quality or delivery issues to report. We judge that Hitachi-GE understand regulatory requirements in this technical area.