

**GENERIC DESIGN ASSESSMENT  
PROGRESS REPORT  
REPORTING PERIOD January to March 2015**

**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 closure phase of the GDA project for the Westinghouse AP1000® reactor design, during the period January to March 2015.
- 2 During this period we have continued our assessment of Hitachi-GE's submissions for the UK ABWR project, and Step 3 remains on schedule for completion at the end of August 2015. There have been particular challenges in the Reactor Chemistry topic area, and the regulators have been working with Hitachi-GE as it seeks to resolve these issues.
- 3 We have continued our tripartite discussions with Hitachi-GE and Horizon Nuclear Power on the potential extended scope of GDA, and we have a clear understanding of what this additional scope entails. This focuses on bringing forward elements of assessment, which are currently considered within site specific licensing, into the GDA. Over the coming period we will be assessing the impact of this on regulatory resources, GDA timescales and our assessment plans.
- 4 At the end of January 2015, the regulators undertook a Remobilisation Review to determine whether the AP1000 project could move from the mobilisation phase into the technical assessment phase. The review concluded that significant progress had been made over the January period by Westinghouse, and therefore the project moved into the technical assessment phase.
- 5 During this period the regulators convened a cross-industry workshop to discuss approach to and experience of GDA Assessment Findings. This focused on identifying post-GDA regulatory milestones that maybe appropriate to link assessment findings to, and sought to learn from the experience of previous GDA Requesting Parties.
- 6 This report includes the performance metrics for January to March for the UK ABWR in Annex 1, and a summary of regulatory opinion on the status of each of the technical topics areas in Annex 2.
- 7 For the first time, this report also includes performance metrics for March, for the Westinghouse AP1000 project. January and February were a trial period for completion of the metrics, hence why we are only publishing those applicable to March.
- 8 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**

- 9 This period marks the half-way point for ONR's Step 3 assessment and we have continued our rigorous appraisal of the safety, security and environment arguments put forward by Hitachi-GE during this time. The Environment Agency's step 3 duration is longer than ONR's as it extends to the beginning of the public consultation phase. Regulators are progressing assessment of technical submissions and continue to undertake detailed engagements. We have increased our technical support in recognition of the fact that increasing levels of assessment scrutiny require additional resource to maintain the programme.

- 10 In the majority of topic areas Hitachi-GE continue to maintain the pace of delivery and communications are good. Hitachi-GE has increased its resource since December 2014 both in-house and through the technical support supply chain and this is aiding its ability to deliver.
- 11 Hitachi-GE has also progressed the development of its safety case organisation and we look forward to seeing the influence of the group on the project going forward.
- 12 During January 2015 it became apparent that the concerns we noted in the Reactor Chemistry topic area in our last quarterly report had increased further. Hitachi-GE's responses to Regulatory Observation 06 did not meet regulatory expectations and we identified a number of significant shortfalls. Dialogue has continued over the period, with Regulators providing clear and constructive advice to Hitachi-GE. Hitachi-GE has responded to our concerns with a robust plan, executive level commitment to resolving the issues and increased resource both in the UK and Japan, and this is to be commended. However at the end of March issues remain in this area and we will report in our next quarterly report the regulatory action taken.
- 13 Related to the issues in Reactor Chemistry, we have concerns around the progress in the Radiation Protection, Radiological Waste and Environmental topic areas, as these are the areas most significantly impacted by the outputs of the Reactor Chemistry issues. During this period however we have been able to continue assessment in other areas in these topics, but the regulatory focus has been on Reactor Chemistry. We will report progress and regulatory intervention in these topic areas in our next quarterly report. Further detail on these areas is provided in Annex 2.
- 14 There are a number of topic areas on the critical path for delivery to maintain current GDA timescales, with significant volumes of work to be delivered. We continue to closely monitor the quality and timeliness of Hitachi-GE's submissions across the programme. At this stage however, the metrics show a largely consistent picture over the period, with the exception of the matters identified above.
- 15 Within this period the regulators:
- Participated in 80 technical meetings and 15 other meetings across the project.
  - Raised 132 Regulatory Queries (RQs).
  - Formally issued 9 Regulatory Observations (ROs), which are matters that require resolution by Hitachi-GE.
- 16 For the ROs 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 RO 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

- 17 Throughout GDA and the closure phase for Westinghouse AP1000, this report will include the GDA Metrics, to provide a clear overview of the status of each project. The metrics at Annex 1 (for UK ABWR) and Annex 3 (for AP1000) 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 (UK ABWR) and Annex 4 (AP1000).

## GDA CLOSURE PHASE – AP1000

- 18 In our last quarterly report we reported that the December Remobilisation Review meeting concluded that insufficient progress had been made by Westinghouse to move

into the technical assessment phase, and that a further review would be undertaken at the end of January 2015.

- 19 Over the January period Westinghouse invested significant time, resource and effort to address regulatory issues, and made significant progress. Its approach over January was a marked shift in pace, and Westinghouse was able to deliver credible resolution plans across all of the GDA Issues with associated schedules, and a fully integrated, resource loaded schedule. In addition, Westinghouse secured executive level commitment to the integrated schedule, which helps to build regulatory confidence in its ability to deliver against the programme.
- 20 The Remobilisation Review at the end of January 2015 confirmed that the project was now ready to move into the technical assessment phase, and indeed assessment work has been taking place over the period. All of the GDA Issue resolution plans and associated schedules were published on our website on 12 March 2015.
- 21 The integrated schedule shows the indicative completion date of January 2017. However there are several GDA Issues on the critical path that will require sustained and enhanced attention from Westinghouse, and right first-time delivery.
- 22 There are also GDA Issues that are technically complex and challenging, and although we have clear scopes of work to address the Issues via the resolution plans, Westinghouse will need to ensure that solutions are ALARP and recognise linkages between topic areas.
- 23 The cross-cutting GDA Issue on the safety case (Pre-Construction Safety Case (PCSR)) is particularly challenging and is the main driver of the programme. Westinghouse will need to ensure that the safety case work (including the Safety, Security and Environment Report, the Master Submission List and the design reference document) is prioritised from the outset and retains focus throughout the programme.
- 24 Westinghouse have progressed work in the Design Reference Point and we expect to have a final position in May 2015.
- 25 There have been 78 technical meetings and seven other meetings in the period. Seventeen RQs have been issued in the period. ROs are not typically used in the closure phase of GDA projects.

### **TRIPARTITE DISCUSSIONS**

- 26 A tripartite workshop (regulators, Hitachi-GE and Horizon Nuclear Power) was held in February 2015 to review additional items that Hitachi-GE is considering requesting inclusion in the optimised scope of the UK ABWR GDA.
- 27 The additional scope items under consideration include physical design features (tunnels, service building, and other ancillary buildings) as well as chapters of the PCSR originally planned to be developed (or fully developed) at the site-specific phase.
- 28 Horizon Nuclear Power's interest in the GDA scope optimisation is to minimise the delta between GDA and the Wylfa-Newydd project PCSR, and therefore the amount of regulatory assessment required in the site-specific phase.
- 29 The regulators need to understand the function and safety/security/environmental contribution of the proposed additional scope items, and to understand how Hitachi-GE will develop the claims and arguments required within ONR's Step 3 timescales. This information has not yet been made available to us, therefore progress has been limited. Until such information is made available we are not able to consider the impact on regulatory resource and the GDA programme.

## ASSESSMENT FINDINGS WORKSHOP

- 30 Assessment Findings (AFs) are safety, security, and environmental matters that are required to be addressed post GDA, as routine business. They are distinguished from GDA Issues in that they do not require resolution prior to ONR consent for first nuclear concrete construction.
- 31 During the first GDAs, we specified 17 milestones against which the AFs should be resolved. As part of our learning from experience we convened a cross-industry workshop in March 2015 to discuss whether the 17 milestones remain appropriate, or whether an alternative approach would be more useful to the licensee organisations that are required to address them.
- 32 The discussion highlighted that there would be benefit in revising the approach to AF, and a number of recommendations were proposed by the meeting, which are being taken forward by the regulators.

## COMMUNICATIONS AND STAKEHOLDER ENGAGEMENT

- 33 Within the period there were no comments posted on the Hitachi-GE comments website bringing the total number submitted to 37 until the end of March 2015.
- 34 The Westinghouse comments website is live, and there have been no public comments submitted at the end of March 2015.
- 35 A 'Sciencewise' public dialogue project to inform the regulators' approach to public engagement and consultation is underway. Three workshops were undertaken with members of the public on 17 January 2015, 31 January 2015 and 21 March 2015. In our last quarterly report we noted that a survey had been undertaken to inform the design of the workshops. A report is being developed to capture both the outcomes of the workshops and the findings from the survey and this is expected to be published in September 2015.
- 36 The regulators will consider the findings and recommendations resulting from the workshop report to help inform our future work.
- 37 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>

## TECHNICAL SUPPORT CONTRACTS

- 38 Between January and March 2015 ONR have let five technical support contracts relating to the UK ABWR project:

Topic Area	Contractor Organisation	Value
Radioactive Waste Management Embedded Radwaste, Spent Fuel and Decommissioning support to New Build	Quintessa Ltd	£324,000
Internal Hazards Support on Internal Hazards Safety Assessment for Step 3 of GDA for the UK ABWR	GRS	£131,880
Reactor Chemistry Support on Operating Chemistry Choices for GDA of UK ABWR	Studsvik UK Ltd	£34,320
Reactor Chemistry Support on Operating Chemistry Choices for GDA of UK ABWR	Amec Foster Wheeler	£21,953
Reactor Chemistry	NNL	£26,400

## FORWARD LOOK

39 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.
- Resolution of the issues in the UK ABWR Reactor Chemistry through increased regulatory oversight.
- Consideration of the GDA scope optimisation proposed by Hitachi-GE and Horizon Nuclear Power, and further tripartite engagements.
- Continued assessment of the submissions relating to the GDA Issues for the AP1000.

## WORKING WITH OVERSEAS REGULATORS

40 In January 2015 ONR's GDA management team met the Japanese Nuclear Regulatory Authority (NRA) in Japan to exchange information on ABWR assessment. Also in January 2015, ONR's reactor chemistry team met a number of NRA specialists to discuss in detail technical topics pertinent to the ABWR reactor chemistry assessment.

41 In relation to ABWR Multinational Design Evaluation Programme (MDEP) activities, ONR's UK ABWR GDA team have prepared the first draft of the ABWR common position paper on lessons learnt from the Fukushima accident, which will be reviewed by the ABWR Working Group (ABWRWG) during its 3rd meeting to be held in April 2015 in Stockholm. During this quarter we have also worked closely with specialists on C&I and severe accident from the MDEP ABWRWG member states to undertake technical preparations for the meetings of the two ABWRWG expert subgroups that will be held in April 2015 also.

42 During this quarter we have continued engagement with the US NRC in relation to the AP1000, in particular to discuss matters related to the AP1000 squib valves, human factors and fuel code.

## 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

### UK ABWR

#### Office for Nuclear Regulation:

▪ Charges for the quarter January – March 2015	£2,037,749
▪ Cumulative charges:	£9,314,318

**Environment Agency:**

▪ Charges for the quarter January – March 2015	£269,708
▪ Cumulative charges:	£2,196,310

**AP1000**

**Office for Nuclear Regulation:**

▪ Charges for the quarter January – March 2015:	£768,880
▪ Cumulative charges:	£24,704,973

**Environment Agency:**

▪ Charges for the quarter January – March 2015	£32,712
▪ Cumulative charges:	£2,422,070

**Annex 1 – UK ABWR Progress Metrics – January – March 2015**

<b>GDA Metrics Definitions</b>	
<b>Category 1 (Programme)</b>	<b>Category 2 (Quality of submissions)</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> <p><b>Grey</b> – No submissions received during the period.</p>
<b>Category 3 (Quality of interactions)</b>	<b>Category 4 (Regulatory Observations/Issues progress)</b>
<p><b>Red</b> – Communications and interactions have been significantly below expectations, in terms of clarity, openness, or technical content. This has resulted</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</p>

<p>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>Amber</b> - 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</p> <p><b>Green</b> - Communications and interactions have met expectations, resulting in confidence in the other parties' intentions.</p> <p><b>Blue</b> – Communications and interactions have exceeded expectations, resulting in a high degree of confidence in the other parties' intentions</p>	<p>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> <p style="text-align: center;">OR</p> <p>The draft RO/RI Res Plan cannot be agreed even after several discussions and revisions of drafts</p> <p><b>Amber</b> - Submissions are not fully addressing the RO/RI and action may be required to ensure the successful completion of the RO/RI.</p> <p>There is a risk that further RO/RI or associated Actions may be raised or transferred to a GDA Issue(s)</p> <p style="text-align: center;">OR</p> <p>The draft RO/RI Res Plan is under development but will require further revisions to enable agreement</p> <p><b>Green</b> - The RO/RI is likely to be closed; Submissions are addressing the RO/RI</p> <p style="text-align: center;">OR</p> <p>The draft RO/RI Res Plan is under development and is on track to be agreed</p>
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<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



Blue - No RO/RI Issued

OR

The RO/RI has been closed



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

### **Civil Engineering**

Civil Engineering continues to make good progress during Step 3. Deliverables are being submitted according to the schedule, and regular, open communications between ONR and Hitachi-GE are being maintained. Principal civil structures have been defined and a GDA generic site layout developed. Design changes from the reference plant (KK7) have been identified (including additional buildings) and are being progressed.

### **External Hazards**

Following a slow start, significant progress has been made during this period regarding the definition of the Generic Site Envelope and hazards definition. Hitachi-GE and Horizon Nuclear Power are working jointly on hazards definition, and we are confident that, with the exception of seismic, the Step 3 submission programme will be met. Issues with the seismic hazard definition were identified and Hitachi-GE has developed a resolution plan. However, significant risks remain until all issues are resolved. This may have an effect on the assessment programme. Regular, open communications between ONR and Hitachi-GE are being maintained.

### **Internal Hazards**

Internal Hazards continues to make good progress during Step 3. Deliverables are being submitted according to the schedule, and interactions with Hitachi-GE's Internal Hazards team (including other cross-cutting technical disciplines) continue to be positive and constructive. Hitachi-GE has demonstrated commitment to deliver the scope of Step 3 including work relating to relevant ROs (RO-ABWR-00012, RO-ABWR-0020). Given the extent of scope of work expected to be delivered by the end of May 2015, ONR expressed a concern whether the documents will be suitable and sufficient for Step 3. Hitachi-GE demonstrated that they fully understood the work involved, and ONR's expectations, and it remains confident that it can deliver the full Step 3 scope.

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

ONR has continued Step 3 assessment of Hitachi-GE's December 2014 UK ABWR PSA, focusing on its completeness and the methodologies used for internal events at power and screening of internal and external hazards. The UK ABWR PSA provides a number of the key elements needed for a comprehensive, modern standard PSA. However, ONR's review so far has identified that some enhancement is needed for the PSA to fully meet regulatory expectations and international good practice. Review findings have been summarised in a number of ROs relating to the identification of internal events at power, applicable internal hazards and external hazards, and additional ROs will be issued later in Step 3. Resolution of these ROs will require update of the PSA model and documentation early in Step 4. Hitachi-GE's key Step 3 submissions for shutdown, fuel route, internal fire and flooding PSA, and seismic margin analyses methodologies were submitted to ONR at the end of this reporting period.

### **Severe Accident Analysis**

Interactions with Hitachi-GE's severe accident analysis team continue to be positive. ONR provided Hitachi-GE with an RO outlining UK regulatory expectations for a severe accidents safety case (RO-ABWR-23) early in Step 3. Hitachi-GE is continuing to work hard to deliver a complete severe accidents safety case in line with this RO. During this period Hitachi-GE has demonstrated that it has a strong technical understanding of the severe accident performance of the ABWR plant.

ONR is currently progressing the following key topics with Hitachi-GE:

- Hitachi-GE has not yet delivered a complete severe accident safety case for all modes of operation or all facilities (including the spent fuel pool). This work is planned to be delivered early in Step 4 of GDA.
- Hitachi-GE is aiming to demonstrate that the UK ABWR severe accident design is in line with international relevant good practice.
- ONR is considering whether the proposed severe accident filtered containment vent strategy for the UK ABWR is in line with national requirements and international good practice.

### **Fault Studies**

Interactions with Hitachi-GE's fault studies team continue to be positive as it works hard to deliver new work to supplement the extant safety case, and to address ROs. During the period, Hitachi-GE demonstrated that it understood and was addressing a subtle difference in approach between Japanese practice and UK expectations for design basis analysis (on the assumptions made on the performance of control systems).

Against a backdrop of a generally strong position, we have concerns about progress with two specific ROs:

- At the start of this period Hitachi-GE delivered analysis considering the consequences of a prolonged loss of off-site power (RO-ABWR-0009). While the numerical analysis was of a good standard, further work is required from Hitachi-GE to clarify the design provisions and the safety case claims for such events.
- Hitachi-GE was not scheduled to deliver a safety case for the UK ABWR fuel route during this period for RO-ABWR-0011, however we have not had sufficient visibility of the progress being made with this large piece of work.

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

Communications with Hitachi-GE continue to be positive, however there have been some document quality issues in the period, which Hitachi-GE are addressing. Two emerging technical issues have been identified and discussed with Hitachi-GE. These are the method for testing and maintaining safety systems with the reactor at power, and the use of common instrumentation connection lines to the reactor pressure vessel. ONR is developing two cross-cutting ROs on these issues which will be submitted to Hitachi-GE during the next period. Hitachi-GE recognise the importance to the overall UK ABWR design in addressing the common instrumentation connection line issue, and will undertake an optioneering study to identify an ALARP solution. Progress with Hitachi's response to the seven C & I ROs issued in the last quarter of 2014 remains on schedule, with the exception of one of the actions. ONR has reviewed the proposed UK ABWR design changes, and has identified additional changes which were not included in Hitachi-GE's Design Change List. Hitachi-GE has committed to update the list to reflect all C & I design changes. It was noted that the majority of design changes had an effect on the C & I design.

### **Electrical Engineering**

Hitachi-GE is developing its Basis of Safety Case taking account of concerns raised by ONR on the proposed structure of the safety claims for the electrical systems, and a draft submission to ONR is planned by the end of April 2015. Hitachi-GE has recognised the need for a detailed requirements specification and programme for conducting electrical system studies. This will be completed during Step 3 such that the detailed studies can be conducted in Step 4. Other documents are continuing to be submitted in accordance with the Hitachi-GE schedule. Interactions between ONR and Hitachi-GE are positive with a good level of understanding between the parties.

## **Fuel and Core Design**

Information on modelling methods continues to be provided and is generally in an advanced state. Much of the information needed to start Step 4 is already available in this area. Further information is currently being sought on fuel criticality, and confirmatory analysis for the core physics is progressing well.

Good progress has been made on the quantification of fuel design limits for spent fuel storage, and ONR is encouraged by the analysis of cladding performance. The analysis of cooling after a fuel-assembly drop event remains outstanding, and will inform discussions on reasonably practical safety measures for the transfer of fuel from the storage pond.

Further discussions have taken place on control rod life and we believe that an understanding has been reached.

## **Reactor Chemistry**

This quarter has been an intense period of assessment as a large number of submissions were received from Hitachi-GE in early January. ONR's assessment has revealed that the majority do not meet regulatory expectations. As a consequence, Hitachi-GE has a substantial amount of work to do to revise and re-submit numerous deliverables relating to a number of ROs. In addition, progress in reactor chemistry is still being hampered by the lack of a visible, revised programme of deliverables for Step 3. Reactor chemistry is proving to be a very challenging topic for Hitachi-GE, and project risks have been identified during the quarter which challenge whether a meaningful assessment of reactor chemistry during Step 3 can be achieved.

## **Radiation Protection**

Hitachi-GE has delivered all submissions to schedule. The quality of the documents is variable, although there has been improvement in the breadth of operating experience being referenced in more recent submissions. In general communications have continued to be good, although there has been an agreed temporary cessation in routine meetings during March to allow Hitachi-GE to focus on the delivery of submissions.

Due to the lack of progress on the reactor chemistry led RO on source terms, radiation protection reports lack information relating to defined source terms. This is becoming more of an issue as Step 3 progresses.

## **Mechanical Engineering**

Interactions with Hitachi-GE are progressing well and our assessment is making steady progress. However, recent ROs issued to Hitachi-GE relate to its design process, or they are of a cross-cutting nature involving several disciplines other than mechanical engineering. These ROs mean that Hitachi-GE will need to consider its resolution in a more rounded way involving other subject matter experts as needed.

## **Structural Integrity**

Communications remain strong, and Hitachi-GE's understanding of the UK ALARP process has developed positively during this period. However document quality remains a concern in this area; there has been good progress with the Materials Selection Report, however, Structural Integrity Categorisation and Classification will require an RO to improve quality. It appears that whilst document delivery is good, document quality is suffering in order to meet delivery dates. This presents a threat to the successful completion of Step 3.

## **Human Factors**

Hitachi-GE has made useful progress during this period. It has deployed a substantial capability within the Human Factors discipline in support of GDA Step 3 both internally and through the use of, UK specific, contracted resource. The quality of submissions from Hitachi-GE is adequate in this area and we have received most of the key submissions required to support Step 3. Programmes of work to address specific ROs have been agreed and are progressing to plan.

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

In this period we have focused on two areas where arrangements will be needed for Step 4:

- The development of the process for controlling changes to the reference design after the Design Reference Point has been confirmed is progressing well.
- Early in Step 4 Hitachi-GE will need to submit arrangements to move the safety case into the operating regime. The key to achieving this is to clearly identify the requirements, assumptions and limits and conditions of the safety case, such that they can be transposed into construction and operational documentation. At present the safety case does not clearly show this information and we will raise an RO to clarify ONR's expectations.

Hitachi-GE has reported a small number of non-conformities in its submissions. These have been appropriately controlled by Hitachi-GE's non-conformity reporting system and corrective actions have been taken to resolve the issues.

## **Radioactive Waste Management, Decommissioning & Spent Fuel Management**

Hitachi-GE has not demonstrated that it understands the importance of the ALARP principle in developing the safety case for radioactive waste and spent fuel. In particular it is important that operating experience from outside of Japan is applied to the optioneering process, which is a key part of the ALARP justification.

The safety cases for radioactive waste and, to a lesser degree decommissioning, are affected by the lack of a credible source term for the UK ABWR.

A further issue for the radioactive waste topic area that has emerged during March is that of the UK ABWR having several kilometres of pipework embedded into concrete. This will also be of relevance to other topic areas.

## **Security**

Engagement with Hitachi-GE has continued with progress being made on the identification of those areas of plant requiring protection. The first security technical workshop was held, focussing on defining and identifying Computer Based Systems Important to Safety and Hitachi-GE's Concept of Security Operations for the UK ABWR. A first draft of the Conceptual Security Arrangements document was presented to ONR in March for review and comment. One key area that Hitachi-GE will be required to develop further, is the level of detail of the security arrangements. However, overall the progress in this area has been satisfactory.

## **Environmental (GEP)**

Hitachi-GE provided several submissions in December 2014, consistent with the programme, which have been assessed by the Environment Agency during this quarter. Hitachi-GE has made significant progress in the area of sampling and monitoring, taking on board previous regulatory advice and comments on this topic. Hitachi-GE has also responded adequately to a number of RQs raised in the area of 'Best Available Techniques'.

### **Conventional Safety**

Hitachi-GE has demonstrated good progress during the period. Two meetings have been held in the period, focused on work at height and confined space hazards, and a further meeting is planned in April on health risks. Hitachi-GE is demonstrating that it understands UK legislation and standards in this area.

### **Fire Safety**

In January 2015 ONR assessed the Hitachi-GE report on 'Departures from Conventional Fire Regulation'. We noted a number of issues in the proposed fire engineered solutions for areas of the building that do not meet UK expectations for fire safe design. In a number of cases, the justifications were not ALARP due to insufficient optioneering, or inadequate challenge of the requirements of other safety considerations such as security, internal hazards and radiological protection. In response, Hitachi-GE provided examples of how it proposes to address the regulatory concerns, which broadly meet our expectations. Further examples are now required for assessment before ONR has evidence that adequate fire safety measures are in place.

### Annex 3 – AP1000 Progress Metrics – March 2015

<b>GDA Metrics Definitions</b>	
<b>Category 1 (Programme)</b>	<b>Category 2 (Quality of submissions)</b>
<p><b>Red</b> – Significant slippage against the baseline programme has occurred, with delays highly unlikely to be recoverable. Successful completion of the closure phase 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 closure phase in accordance with the Regulators Baseline Programme.</p> <p><b>Green</b> – Activities are generally on plan to successfully deliver the closure phase in accordance with the Regulators Baseline Programme.</p> <p><b>Blue</b> – Activities are ahead of plan to successfully deliver the closure phase in accordance with the Regulators Baseline Programme.</p>	<p><b>Red</b> - For the closure phase, 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><b>Amber</b> - For the closure phase, 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><b>Green</b> - For the closure phase, submissions have generally met the expected scope and quality.</p> <p><b>Blue</b> - For the closure phase, submissions have exceeded the expected scope and quality.</p> <p><b>Grey</b> – No submissions received during the period.</p>
<b>Category 3 (Quality of interactions)</b>	<b>Category 4 (GDA Issues progress)</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 RNIP have been compromised.</p> <p><b>Amber</b> - 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</p> <p><b>Green</b> - Communications and interactions have met expectations, resulting in</p>	<p><b>Red</b> - Submissions are not addressing the GDA Issue and immediate action is required to enable closure. There is a high risk that further GDA Issue Actions or GDA Issues may be raised.</p> <p><b>Amber</b> - Submissions are not fully addressing the GDA Issue and action may be required to enable closure. There is a risk that further GDA Issue Actions or GDA Issues may be raised.</p> <p><b>Green</b> - Submissions are addressing the GDA Issue and closure appears likely.</p> <p><b>Blue</b> - Submissions have addressed the GDA Issue and the GDA Issue has been</p>



<p>confidence in the other parties' intentions.</p> <p><b>Blue</b> – Communications and interactions have exceeded expectations, resulting in a high degree of confidence in the other parties' intentions</p>	<p>closed.</p>
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## **Annex 4 – AP1000 Topic-by-Topic Summary**

### **Control & Instrumentation**

During this period communications between Westinghouse and ONR were effective. In January, both organisations effectively cooperated to develop workable resolution plans and schedules to progress the 10 C&I GDA Issues. The progress of Westinghouse's activities against the schedule was closely monitored, and it delivered the first submissions on time.

### **Fault Studies**

The resolution plans for the eight fault studies GDA Issues were finalised by Westinghouse during this period and technical interactions have commenced. At this early stage, we remain confident that Westinghouse can successfully address the GDA Issues. However, ONR has requested additional information from Westinghouse to demonstrate that design modifications identified during Step 4 of GDA have been incorporated into the AP1000 design and safety case.

### **Structural Integrity**

In this period we have largely focused on clarifying the scope of work for the six GDA Issues in this area. We have also commenced our assessment of the 'avoidance of fracture' issue (SI01) for the highest reliability components, which is the most challenging Structural Integrity issue, and prepared TSC specifications to progress the 'fatigue' issue (SI02). ONR resource in this area is limited and we are working to secure the effort we need to maintain the schedule.

### **Internal Hazards**

This period has focused on the finalisation of the resolution plans and associated schedules, establishing a communications strategy and starting technical meetings. Interactions to date with Westinghouse's Internal Hazards team has been positive and constructive. The programme of work is proceeding according to the agreed schedules, and submissions have been on time.

### **Civil Engineering**

In this period we have focused on finalising the assessment plan and preparing technical support contract (TSC) specifications. Westinghouse have also engaged UK TSCs to assist in its resolution of the GDA Issues and this may limit the TSC resource available to ONR due to the limited pool of expertise and the need to avoid conflicts of interest.

We have concerns over Westinghouse's proposal to use US codes, standards, materials and dimensions on the key nuclear structures, both during detailed design and construction and during future plant modifications. This will be explore further during the next period.

### **Fuel & Core**

Westinghouse has provided a submission on the updated fuel performance modelling, which resolves shortcomings related to modelling high burn-up fuel identified in issue GI-AP1000-FD-01. Technical discussions have taken place and significant issues have been resolved. The application of the method to determine safety limits for the UK will follow after formal resolution of GI-AP1000-FD-01.

Initial discussions have taken place on the fault study implications of using the BEACON computer code to justify relaxing safety limits. Westinghouse has provided a preliminary list of faults that they consider implicated, and some potential mitigation of the consequences of postulated monitoring

failure. They also acknowledge that this work is not complete. Initial indications are that Westinghouse has assembled a suitable cross-function team for addressing the Issues in this area.

### **Mechanical Engineering**

Westinghouse has made two key submissions in this period;

- A draft screening process for isolation techniques relating to GI-AP1000-ME-03; and
- The latest revision of the Metrication report in relation to GI-AP1000-ME-02, which is being assessed by a number of ONR inspectors due to the cross-cutting nature of the subject.

In January 2015 a concern was raised with Westinghouse in relation to the status of certain documents that may prevent ONR accessing the material and data regarding squib valve actuator design and qualification (GI-AP1000-ME-01). This has subsequently led to further concerns as Westinghouse has not managed to arrange for ONR to receive a license under US ITAR (International Traffic in Arms) Regulations, to enable us to witness certain tests and component trials in the US. Westinghouse is working hard on the provision of an export license to allow ONR to receive the necessary information to allow us to complete the assessment.

### **Reactor Chemistry**

Interactions are taking place between Westinghouse and ONR as planned. No areas of concern that could impact on the successful resolution of the GDA Issues have been identified.

### **PSA**

This period has primarily been concerned with negotiating the detail of the PSA resolution plans and associated schedules, establishing a communications strategy and starting technical meetings. We have held discussions with Westinghouse on the computer codes used to support the PSA and initial technical queries have been raised by ONR on the fire PSA. ONR intends to use TSCs to assist in the technical assessment of the updated Westinghouse PSA and we have issued specifications to a number of potential suppliers.

### **Electrical Engineering**

Regular interactions are taking place between Westinghouse and ONR as the documents to support resolution of the GDA Issue on electrical systems are developed. No areas of concern that could impact on the successful resolution of the GDA Issue have been identified.

### **Radiological Protection**

Westinghouse continues to develop the technical underpinning for their criticality safety case for the fuel-pool, which will feed into their justification for the ALARP option (due early August 2015).

### **Human Factors**

During this period, Westinghouse has improved its understanding of what is required to resolve GDA Issue GI-AP1000-HF-01 and has delivered a credible resolution plan. Westinghouse has recognised that additional Human Factors analysis may be required in support of the closure of other GDA Issues, and has put in place a programme of work to understand the scale of effort required. It has also increased its resource both internally and externally and its input is already proving beneficial to Westinghouse's understanding of UK regulatory expectations for Human Factors.

### **GI-AP1000-CC-01 "Limits and Conditions"**

Westinghouse has submitted its proposals for identifying limits and conditions from the AP1000 safety case such that they can be used by the future operator to ensure that the plant is operated safely and in accordance with the design intent. We have not identified any issues at this stage.

**GI-AP1000-CC-02 “PCSR to support GDA”**

This GDA Issue requires Westinghouse to submit a safety case that reflects the GDA “design reference”. During the “pause” (2011-2014) while Westinghouse was not actively engaged with GDA, the AP1000 design continued to evolve, in part due to challenges identified in building reactors in China and US. A significant pre-requisite for this cross-cutting GDA Issue is to re-establish the AP1000 “design reference point (DRP)” that Westinghouse would like ONR and the Environment Agency to assess, and to identify the impact of any proposed design changes on the conclusions reached by the Regulators during Steps 3 and 4 of GDA, which were based on a different design.

The update to the DRP has proved to be a challenge for Westinghouse during this period. The regulators have stated to Westinghouse the importance of this GDA Issue to all the other GDA Issues, and have requested further information on the process it is following and the amount of resource it is applying to the task.

**GI-AP1000-CC-03 “Consider and Action Plans to Address the Lessons Learned from the Fukushima Event”**

Westinghouse’s Resolution Plan has been finalised for this Issue. ONR has established a working group of specialist ONR inspectors to assist with the assessment of this Issue; in recognition of its cross-cutting nature. ONR attended the IAEA International Experts Meeting on ‘Strengthening Research and Development Effectiveness in light of the accident at the Fukushima Daichi NPP’ in February 2015 to ensure lessons learned by the wide international community are captured in our assessment.