



# Assessing new nuclear power station designs

Generic design assessment of Hitachi-GE Nuclear Energy Limited's UK Advanced Boiling Water Reactor

Consultation document - Addendum

12 December 2016

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We operate at the place where environmental change has its greatest impact on people's lives. We reduce the risks to people and properties from flooding; make sure there is enough water for people and wildlife; protect and improve air, land and water quality and apply the environmental standards within which industry can operate.

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- Regulator: protecting people and the environment, including marine, forest and waste industries, and prosecuting those who breach the regulations that we are responsible for
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# 1. Introduction

This addendum updates our consultation document for the UK Advanced Boiling Water Reactor (ABWR), which is based on information submitted by Hitachi-GE up to the 8 July 2016 (Environment Agency, 2016a to 2016l).

The generic design assessment (GDA) of the UK ABWR continues and this addendum summarises the significant developments that have taken place since that date and how these affect our assessment reports and our preliminary conclusions. The addendum is based on information available up to 24 November 2016 and should be read alongside our other consultation documents.

## 2. Updated information requirements

We set out the information required from a requesting party in our process and information document (P&ID). Throughout the GDA process, the requesting party (Hitachi-GE) has followed the P&ID Version 2, issued in March 2013 (Environment Agency, 2013).

In October 2016, we issued an updated version of our P&ID, Version 3 (Environment Agency, 2016m). While the current version of the P&ID on GOV.UK is not the one referenced in our consultation document, our assessment reports or in Hitachi-GE's GDA submission to us, we have made no changes to the information requirements.

The updates to the P&ID reflects:

- legislative changes
- the creation of Natural Resources Wales
- changes to references and hyperlinks

Therefore, the recent issue of the P&ID will have no impact on Hitachi-GE's GDA submissions or our preliminary conclusions.

## 3. Management arrangements

There are no changes that affect our preliminary conclusions on the assessment of management arrangements.

## 4. Integrated waste strategy

The integrated waste strategy (IWS) assessment report (Environment Agency, 2016c) contains a potential GDA Issue on decommissioning:

### **Potential GDA Issue 1 – Decommissioning of the UK ABWR.**

**We require Hitachi-GE to: Provide sufficient evidence to demonstrate that the UK ABWR has been designed to facilitate decommissioning and hence to minimise associated waste and impacts on people and the environment from decommissioning operations.**

### 4.1. Decommissioning

This potential GDA Issue was identified, as the scheduled GDA submissions relating to decommissioning were not fully complete in July 2016. Since July:

- we have received an updated UK ABWR decommissioning topic report for 'Design for decommissioning', Revision 1, in September 2016 (Hitachi-GE, 2016a)
- we have reviewed the updated topic report and held discussions with Hitachi-GE
- we raised a Regulatory Query (RQ) jointly with the Office for Nuclear Regulation (ONR) on the sensitivity of the underlying assumptions for decommissioning - we have now received a full response and are assessing this
- we raised a RQ jointly with ONR on inconsistencies between decommissioning submissions and reactor chemistry submissions - we are currently awaiting the response
- there are still 2 expected document updates to complete the decommissioning case for GDA

Therefore, this potential GDA Issue will remain until the issue is addressed, when we have reviewed all documentation due and are content with the RQ responses. However, through discussions with Hitachi-GE, we are confident that this potential GDA Issue can be closed before we make our final decision following consultation.

## 5. Best available techniques

The best available techniques (BAT) assessment report (Environment Agency, 2016d) contains 2 potential GDA Issues; on the UK ABWR source term and consideration of BAT and ALARP (as low as reasonably practicable) in optimisation.

**Potential GDA Issue 2 - Source Terms for the UK ABWR. We require Hitachi-GE to provide a suitable and sufficient definition and justification for the radioactive source terms in the UK ABWR during normal operations.**

**Potential GDA Issue 3 – Consideration of BAT and ALARP in optimisation. We require Hitachi-GE to demonstrate that appropriate consideration has been given to both environmental and safety aspects, in order to achieve an optimised design.**

### 5.1. Source term

The UK ABWR source term was the subject of a Regulatory Issue (RI), RI-ABWR-0001. The regulators formally closed this RI on the 17 October 2016, but noted that there are 18 minor 'residual matters' still to be addressed. ONR will be publishing a report relating to the closure of RI-ABWR-0001 on its website in the near future.

The closure of this RI means that we are now confident that the expected discharges and solid wastes from the UK ABWR are appropriately quantified and justified. This information also supports Hitachi-GE's proposed discharge limits and the associated impact assessments.

With the closure of this RI, we are content that this is no longer a potential GDA Issue.

### 5.2. Considering BAT and ALARP

Hitachi-GE has presented the BAT case to us while ALARP assessments are still ongoing. Ideally, we would expect a single optimisation process to be used to consider BAT and ALARP simultaneously. This enables any conflicting demands to be resolved appropriately. This difference in timing has resulted in an inherent risk that design changes may be required to support the ALARP justification and any such design change may require a change to the existing BAT case. This would be particularly likely if waste management processes are affected.

Work continues on the ALARP assessments and the regulators are seeking further information. We have closed the Regulatory Observation (RO), RO-ABWR-0071, but other queries remain open, including:

- RO-ABWR-0073 on the off-gas (OG) system
- RQ-ABWR-1049 on the BAT and ALARP considerations of the spent fuel pool (SFP)

Therefore, the current misalignment of the BAT and ALARP cases and associated risk for design change remains. However, we are confident that this potential GDA Issue can be resolved before we make our final decision following consultation. We expect an update of the pre-construction safety report (PCSR) containing the completed ALARP case in August 2017.

## 6. Gaseous radioactive waste

The gaseous radioactive waste assessment report (Environment Agency, 2016e) contains a potential GDA Issue on the UK ABWR source term.

**Potential GDA Issue 2 - Source Terms for the UK ABWR. We require Hitachi-GE to provide a suitable and sufficient definition and justification for the radioactive source terms in the UK ABWR during normal operations.**

As discussed in Section 5.1, with the closure of RI-ABWR-0001, we are content that this is no longer a potential GDA Issue.

The assessment report for gaseous radioactive waste note that we had an open RO relating to gaseous discharges from the turbine gland steam system (TGS) (RO-ABWR-0071). We requested additional information on the process used to identify all discharge routes and justification of both BAT and ALARP for this system. We closed this RO in early November 2016 as Hitachi-GE provided the required information.

The gaseous assessment report (Environment Agency, 2016e) compares expected discharges from the UK ABWR with those from existing BWRs. This shows that the gaseous discharges appear to be greater from the UK ABWR for carbon-14 and tritium (Environment Agency 2016e, Figures 1 and 5). We have raised a RQ (RQ-ABWR1117) asking for more clarification to allow us to understand why this appears to be higher than other existing stations. This may be a feature of the reactor or it may be a result of the calculation and presentation of the data. For example, figures were derived assuming an operation for 100% of the time for the ABWR, whereas existing reactors may not have operated at maximum capacity. We will consider Hitachi-GE's response to this RQ when we make our final decision.

## 7. Aqueous radioactive waste

The aqueous radioactive waste assessment report (Environment Agency, 2016f) contains a potential GDA Issue on the UK ABWR source term.

**Potential GDA Issue 2 - Source Terms for the UK ABWR. We require Hitachi-GE to provide a suitable and sufficient definition and justification for the radioactive source terms in the UK ABWR during normal operations.**

As discussed in Section 5.1, with the closure of RI-ABWR-0001, we are content that this is no longer a potential GDA Issue.

## 8. Solid radioactive waste

The solid radioactive waste and disposability assessment report (Environment Agency, 2016g) contains a potential GDA Issue on decommissioning:

**Potential GDA Issue 1 – Decommissioning of the UK ABWR.**

**We require Hitachi-GE to: Provide sufficient evidence to demonstrate that the UK ABWR has been designed to facilitate decommissioning and hence to minimise associated waste and impacts on people and the environment from decommissioning operations.**

As discussed in Section 4.1, this potential GDA Issue will remain until we are content with the RQ responses. However, through discussions with Hitachi-GE, we are confident that this potential GDA Issue can be closed before we make our final decision following consultation.

## 9. Monitoring

There are no changes that affect our preliminary conclusions on the assessment of monitoring and sampling arrangements.

## 10. Generic site description

There are no changes that affect our preliminary conclusions on the assessment of the generic site.

## 11. Human impact

There are no changes that affect our preliminary conclusions on the assessment of the radiological impact on humans.

## 12. Non-human impact

There are no changes that affect our preliminary conclusions on the assessment of the radiological impact on non-humans.

## 13. Other environmental regulations

The other environmental regulations assessment report (Environment Agency, 2016l) was written with an open RO on surface water discharges (RO-ABWR-0070). We closed this RO in October 2016.

Hitachi-GE has provided updated information in a topic report in response to RO-ABWR-0070 relating to discharges to surface water (Hitachi-GE, 2016b). Therefore, Chapter 16 of the consultation document 'Discharges to surface waters and groundwater' requires updating as follows.

In respect of the 'Radioactive area discharges' section, Hitachi-GE has now provided information on the main chemicals present in the waste waters which feed into the high chemical impurity

waste (HCW). These include small quantities of phosphoric acid, hydrochloric acid, sodium bicarbonate, potassium permanganate, silver nitrate as well as cation and anion eluents from chromatography analyses. A full list of the chemicals identified from analyses has been included. These are based on a Japanese ABWR, therefore a future operator should review the chemicals used in the UK ABWR at the site-specific stage. Hitachi-GE states that the volumes of the chemicals discharged each year to the HCW are typically < 100 ml, with a maximum of 2 litres. Acidic solutions will be neutralised with sodium hydroxide as part of the HCW treatment.

In respect of the 'Boiler blow-down and purified water treatment facility effluent' section, Hitachi-GE states that hydrazine will be degraded in the presence of dissolved oxygen to water and nitrogen. Decomposition of hydrazine to ammonia and water, as initially stated by Hitachi-GE, occurs at higher temperatures. Hitachi-GE has stated that these temperatures will not be experienced in the boiler water system, therefore, ammonia will not be present in the boiler blow-down. We accept the updated information provided by Hitachi-GE, which means that the information included in the 'Impact assessment' section relating to ammonia is no longer relevant. We conclude that the environmental impact of discharges of boiler blow-down is likely to be acceptable for permitting.

## 14. Conclusions

As stated in Section 19 of our consultation document (Environment Agency, 2016a), our preliminary conclusion remains that we could issue an interim statement of design acceptability (iSoDA) for the UK ABWR. This would now be subject to the 2 remaining potential GDA Issues (decommissioning and the consideration of BAT and ALARP) and the Assessment Findings identified previously (Environment Agency, 2016a). In particular, it would be valid only for a site meeting the identified generic site characteristics.

We will not make a final decision on whether to issue an iSoDA until we have considered all relevant responses to this consultation. If there are no outstanding GDA Issues at the end of the GDA process then a statement of design acceptability (SoDA) could be issued.

# References

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Reference	Details
Environment Agency, 2013	Process and Information Document for Generic Assessment of Candidate Nuclear Power Plant Designs, Version 2, Environment Agency, March 2013. <a href="http://webarchive.nationalarchives.gov.uk/20151009003754/https://www.gov.uk/government/publications/assessment-of-candidate-nuclear-power-plant-designs">http://webarchive.nationalarchives.gov.uk/20151009003754/https://www.gov.uk/government/publications/assessment-of-candidate-nuclear-power-plant-designs</a>
Environment Agency, 2016a	Generic design assessment of new nuclear power plant. Consultation document. <a href="https://www.gov.uk/government/consultations/gda-of-hitachi-ge-nuclear-energy-ltds-uk-advanced-boiling-water-reactor">https://www.gov.uk/government/consultations/gda-of-hitachi-ge-nuclear-energy-ltds-uk-advanced-boiling-water-reactor</a>
Environment Agency, 2016b	Generic design assessment of new nuclear power plant. Assessment of management arrangements for Hitachi-GE UK ABWR design. AR01.
Environment Agency, 2016c	Generic design assessment of new nuclear power plant. Assessment of the integrated waste strategy for Hitachi-GE UK ABWR design. AR02.
Environment Agency, 2016d	Generic design assessment of new nuclear power plant. Assessment of best available techniques for Hitachi-GE UK ABWR design. AR03.
Environment Agency, 2016e	Generic design assessment of new nuclear power plant. Assessment of gaseous radioactive waste for Hitachi-GE UK ABWR design. AR04.
Environment Agency, 2016f	Generic design assessment of new nuclear power plant. Assessment of aqueous radioactive waste for Hitachi-GE UK ABWR design. AR05
Environment Agency, 2016g	Generic design assessment of new nuclear power plant. Assessment of solid radioactive waste and disposability for Hitachi-GE UK ABWR design. AR06.
Environment Agency, 2016h	Generic design assessment of new nuclear power plant. Assessment of monitoring arrangements for Hitachi-GE UK ABWR design. AR07.
Environment Agency, 2016i	Generic design assessment of new nuclear power plant. Assessment of the generic site for Hitachi-GE UK ABWR design. AR08.
Environment Agency, 2016j	Generic design assessment of new nuclear power plant. Assessment of radiological impacts on members of the public for Hitachi-GE UK ABWR design. AR09.
Environment Agency, 2016k	Generic design assessment of new nuclear power plant. Assessment of radiological impacts on non-human species for Hitachi-GE UK ABWR design. AR10.

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Reference	Details
Environment Agency, 2016l	Generic design assessment of new nuclear power plant. Assessment of other environmental regulations for Hitachi-GE UK ABWR design. AR11.
Environment Agency, 2016m	Process and Information Document for Generic Assessment of Candidate Nuclear Power Plant Designs, Version 3, Environment Agency, October 2016. <a href="https://www.gov.uk/government/publications/assessment-of-candidate-nuclear-power-plant-designs">https://www.gov.uk/government/publications/assessment-of-candidate-nuclear-power-plant-designs</a>
Hitachi-GE, 2016a	Topic Report for Decommissioning 2: Design for decommissioning. GA91-9201-0001-000172, Revision 1. October 2016.
Hitachi-GE, 2016b	Chemical Discharges to Surface Waters. GA91-9201-0003-01368. Revision 1. 16 September 2016

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# List of abbreviations

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Abbreviation	Details
ABWR	Advance Boiling Water Reactor
ALARP	As low as reasonably practicable
BAT	Best available techniques
GDA	Generic design assessment
HCW	High chemical impurity waste
iSoDA	Interim statement of design acceptability
IWS	Integrated waste strategy
ONR	Office for Nuclear Regulation
P&ID	Process and information document
PCSR	Pre-construction safety report
RI	Regulatory Issue
RO	Regulatory Observation
RQ	Regulatory Query
SFP	Spent fuel pool
SoDA	Statement of design acceptability
TGS	Turbine gland steam system
UK	United Kingdom

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- water quality permit applications
- permit applications for installations
- marine licence applications
- planning applications
- publications

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