



Assessing new nuclear power station designs

Generic design assessment of Hitachi-GE's Advanced Boiling Water Reactor

Assessment report - AR08 Generic site description

12 December 2016

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Executive summary

Protective status	This document contains no sensitive nuclear information or commercially confidential information.
Process and Information Document¹	<p>The following section of Table 1 in our process and information document (P&ID) is relevant to this assessment:</p> <p>Item 1: General information relating to the requesting party and the design.</p> <p>Specifically: description and characteristics of the generic site (or sites) that the requesting party will use to provide its dose assessment. Any statement of acceptability we issue after our assessment will be on the basis of these characteristics. A range of generic sites might be chosen with coastal, estuarine and inland characteristics.</p>
Radioactive Substances Regulation Environmental Principles²	<p>The following principle is relevant to this assessment</p> <p>SEDP1 - General RSR siting principle for new facilities</p> <p>When evaluating sites for a new facility, account should be taken of the factors that might affect the protection of people and the environment from radiological hazards and the generation of radioactive waste.</p>
Report author	Dr Paula Atkin

We have carried out an assessment of Hitachi-GE's generic site characteristics used for the generic design assessment (GDA) of the UK Advanced Boiling Water Reactor (ABWR).

We consider that the UK ABWR generic site characteristics are justified and reasonable for the GDA stage and represent a realistic site, although not the most conservative site. We consider the parameters and values that define the UK ABWR generic site are appropriate to use in assessing radiological impact at the GDA stage. We consider the generic site impact assessments in our assessment reports on the radiological impacts on people (Environment Agency, 2016a) and non-human species (Environment Agency, 2016b). Detailed site-specific assessments of the radiological impact from the UK ABWR will be required at the site-specific permitting stage using

¹ Process and Information Document for Generic Assessment of Candidate Nuclear Power Plant Designs, Version 2, Environment Agency, Mar 2013.

<http://webarchive.nationalarchives.gov.uk/20151009003754/https://www.gov.uk/government/publications/assessment-of-candidate-nuclear-power-plant-designs>

² Regulatory Guidance Series, No RSR 1: Radioactive Substances Regulation – Environmental Principles, Version 2), Environment Agency, April 2010.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296388/geho0709bqsb-e-e.pdf

data and information that relates to the specific site at which a UK ABWR reactor is proposed to be constructed and operated.

We conclude that Hitachi-GE's generic site parameters and the values that define its generic site are appropriate to use in its assessment of radiological impact at the GDA stage.

Our findings on the wider environmental impacts and waste management arrangements for the UK ABWR reactor may be found in our consultation document (Environment Agency, 2016c).

Contents

Executive summary	4
Contents	6
1. Introduction	7
2. Assessment	8
2.1. Assessment method	8
2.2. Assessment objectives	8
2.3. Hitachi-GE documentation	8
2.4. Site assumptions	9
2.5. Assessment findings	11
3. Compliance with Environment Agency requirements	11
4. Public comments	12
5. Conclusion	12
References	13
List of abbreviations	15

1. Introduction

In order to assess the potential impact of a particular reactor design on the environment we need to know the characteristics of the generic site proposed by Hitachi-GE. We recognise that at the GDA stage the specific location of the nuclear plant is not known. Therefore, GDA will be followed by a site-specific assessment once the location of the plant and associated receptors are known. However at the GDA stage we need to satisfy ourselves that:

- the reactor design is such that any environmental impacts would be acceptable to the UK
- any particular features of the reactor design that could lead to impacts of a type or scale that could constrain the locations at which such a plant could be located are identified
- any environmental impacts of new build reactors in the UK are as low as reasonable achievable (ALARA), in line with the policy set out in the Energy White Paper (BERR, 2008)

We require a typical (generic) site to be defined in order to assess the environmental impacts of the reactor design. Hitachi-GE must demonstrate that impacts would be consistent with UK dose constraints and limits and other UK environmental constraints and limits.

The types of parameters that may be included in the site descriptions are:

- physical aspects of the location
- distance to nearest occupied buildings and centres of population
- habits of local population
- impacts on humans and non-human biota
- local presence of designated or protected sites for example, Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSIs³), Special Protection Areas (SPAs⁴) or Ramsar sites⁵
- physical parameters such as meteorological dispersion parameters, liquid and atmospheric discharge parameters

Hitachi-GE has derived its UK ABWR generic site characteristics assuming the UK ABWR will be located at a coastal site. The generic site characteristics have been chosen to represent typical data for sites where a new UK ABWR reactor might be located.

During the assessment we identified that, in some cases, we needed existing information clarified or further information provided. We dealt with this using the system of Regulatory Queries (RQs), Regulatory Observations (ROs), Regulatory Issues (RIs) and technical discussion. Our overall assessment process is set out in our consultation document (Environment Agency, 2016c).

Scope of interim statement of design acceptability (iSoDA) or statement of design acceptability (SoDA)

³ Site of Special Scientific Interest Identified/notified by English Nature or Natural Resources Wales under the Wildlife and Countryside Act 1981 for its importance to nature conservation.

⁴ Special Protection Areas. An area classified as such under the EC Birds Directive to provide protection to birds, their nests, eggs and habitats: areas that are internationally important sites designated under the EEC Wild Birds Directive.

⁵ A site of international conservation importance classified at the 'Convention on Wetlands of International Importance' 1971, ratified by the UK Government in 1976.

It should be noted that the coastal nature of the generic site and the assumption of once-through direct cooling will limit the applicability of any future iSoDA or SoDA to a site with these characteristics.

2. Assessment

We assessed the generic site in detail during our initial assessment (Environment Agency, 2014). This assessment is a review and continuation of that initial assessment and considers the generic site described by Hitachi-GE, which it has used in the assessment of the potential impact of a UK ABWR on members of the public and non-human species.

2.1. Assessment method

The basis of our assessment was to:

- consider the generic environmental permit (GEP) submissions Hitachi-GE made, in particular the 'Generic site description' document (Hitachi-GE, 2016)
- use technical meetings with Hitachi-GE to clarify our understanding of the information presented and explain any concerns we had with that information
- raise RIs or ROs where we believed information Hitachi-GE provided was insufficient
- raise RQs to clarify information Hitachi-GE supplied
- assess the generic site characteristics Hitachi-GE proposed and decide if they were reasonable
- decide on any potential GDA Issues or other issues to carry forward from GDA

2.2. Assessment objectives

Important questions we asked during our assessment were:

- Are the generic site characteristics reasonable and justified?
- Are there any aspects of the generic site that would preclude any location at site-specific permitting?

2.3. Hitachi-GE documentation

We reviewed the following documents Hitachi-GE submitted (Table 1):

Table 1. Hitachi-GE documentation reviewed for this assessment

Document No	Title
GA91-9901-0020-00001_Rev A	Generic site description
GA91-9901-0020-00001_Rev B	Generic site description
GA91-9901-0020-00001_Rev C	Generic site description
GA91-9901-0020-00001_Rev D	Generic site description
GA91-9901-0020-00001_Rev E	Generic site description
GA91-9901-0019-00001_Rev E	Summary of the generic environmental permit applications

Document No	Title
GA91-9901-0026-00001_Rev E	Prospective dose modelling
GA91-9901-0026-00001_Rev F	Prospective dose modelling
GA91-9901-0028-00001_Rev E	Alignment with the Radioactive Substances Regulation Environmental Principles (REPs)
GA91-9101-0101-09000_Rev B	Generic PCSR* Chapter 9: General description of the unit (facility)

*PCSR = Pre-construction safety report

2.4. Site assumptions

Throughout the generic site description Revisions A to E, Hitachi-GE has maintained consistent underlying assumptions for the generic site:

The site is a flat coastal plain, with no large buildings other than the UK ABWR reactor and associated service buildings.

- The site has no underlying active geological faults.
- The site is not located on an aquifer from which water is extracted.
- There is no standing water on the site.
- There are no freshwater bodies or water courses on the site.
- There are no discharges to rivers or streams adjacent to the site.
- There is no ground or groundwater contamination present.
- There are no designated wildlife sites nearby.

These assumptions are a simplified representation of a potential UK site, which will have some implications for the impact assessment. However, it should be noted that as a thorough site-specific assessment will be needed for environmental permitting, some simplification is acceptable at the GDA stage.

Some of these assumptions result in a lack of impact assessment related to specific pathways and environments. In particular, groundwater and freshwater exposure pathways, impact on non-human freshwater species via these pathways and impact on any designated sites. However, these will be captured, where relevant, at site-specific environmental permitting.

It is also noted that the assumption that there are no active geological faults beneath the site does not preclude appropriate seismic assessment relating to nuclear safety, which is considered by the Office for Nuclear Regulation (ONR).

2.4.1. Exposed groups

Based on the above assumptions for the site, Hitachi-GE has assumed that the most exposed members of the public for radioactive discharges to air will be a 'local resident family' and for discharges to sea will be a 'fisherman family'. These are consistent with the exposure groups we use in our Initial Radiological Assessment Tool (IRAT) (Environment Agency, 2006a and 2006b). These are appropriate for the GDA stage. Site-specific exposure routes will be assessed during the environmental permitting process.

2.4.2. Habit data

Hitachi-GE has used the Environment Agency IRAT for its Stage 1 and 2 assessments, using the generic habit data contained within that tool. Therefore, we are confident that appropriate parameters have been applied to the generic site for the most conservative assessments. For the Stage 3 impact assessment of discharges to air, the 2 food groups resulting in the highest doses were increased to high consumption rate data from the generic habit data published by the National Radiological Protection Board (NRPB) (NRPB, 2003). The NRPB is a predecessor of Public Health England (PHE) and we are content that the methodology and data are the most appropriate to use for a generic site.

During Step 3, further technical discussion was held on the seaweed consumption exposure pathway and the habit data used to support consumption rates used in the dose assessment. As a result, the data for seaweed consumption was amended in Revision E of the 'Generic site description' (Hitachi-GE, 2016) to a more conservative (higher) figure, based on a wider range of published habit survey data.

2.4.3. Meteorological data

For assessment of continuous releases, Hitachi-GE has used meteorological data based on Pasquill Stability categories, as used in the R-91 aerial dispersion model (NRPB, 1979). For the Stage 1 and Stage 2 assessments Hitachi-GE has used atmospheric conditions of 50% Category D, which is a conservative approach and used in our IRAT methodology (Environment Agency, 2006a and 2006b). For the Stage 3 assessment, Hitachi-GE has selected conditions of 70% Category D, which although it is less conservative it is more representative of coastal conditions (NRPB, 1979) We consider these to be appropriate selections for assessment of a generic site at GDA.

Meteorological data specific to modelling short-term releases are not presented in the 'Generic site description' submission (Hitachi-GE, 2016), but are discussed in Appendix-F of the prospective dose modelling submission. Parameters were derived for the ADMS model that were approximately equivalent atmospheric conditions to the Pasquill stability classes used for continuous discharge assessment, which is considered appropriate for GDA. For site-specific permitting, it is expected that site representative meteorological data will be used.

2.4.4. Marine data

For the Stage 1 assessment default data were taken from IRAT, this is very conservative for a coastal site and is an appropriate upper bound for GDA. For the Stage 2 assessment the embedded IRAT data were used except for the volumetric exchange rate, a parameter that defines the mixing rate between local and regional waters in the marine dispersion model. Hitachi-GE selected a less conservative value for the Stage 2 assessment, based on the existing Wylfa site. The Wylfa data were also used in the Stage 3 assessment.

We raised a concern that the Stage 2 and 3 dose impact assessments used volumetric exchange rate data for the marine dispersion modelling based on the Wylfa site, without supporting text or justification. We requested a demonstration that the selection of this site was either realistic or conservative in relation to the range of potential sites for new nuclear stations in the UK. Hitachi-GE confirmed that it was aware that selecting a specific site could result in a limitation being placed on a SoDA, if granted. It is noted that Revision E of the 'Generic site description' (Hitachi-GE, 2016) now contains a summary of volumetric exchange rate data at existing UK nuclear sites and text to support the selection of that parameter for use in the Stage 3 dose assessment.

It is noted that Hitachi-GE has not selected the most conservative site for its Stage 3 impact assessment. However, the data value sits within the range of typical UK parameters and the Stage 1 and 2 impact assessments, using IRAT, represent the conservative bounding case. This is considered acceptable for the purpose of GDA. In our independent dose assessment (Environment

Agency, 2016d) we selected a more conservative site for marine parameterisation to investigate the effect of Hitachi-GE's site selection.

2.4.5. Regulatory queries raised and responses

Hitachi-GE provided its first version of the 'Generic site description' (Revision A) (Hitachi-GE, 2013a) in December 2013. We raised 3 RQs relating to this document asking why:

- milk products had been excluded from the local resident family exposure group in Table 5.3-2 [RQ-ABWR-0067]
- the referenced document quoted for seaweed consumption data in Table 6 did not contain any seaweed consumption data [RQ-ABWR-0068, query 1]
- the referenced document for atmospheric data in Table 5 (Figure 11, Reference 5) did not contain the data quoted [RQ-ABWR-0068, Query 2]
- 'Note 2' in the footnote for Table 5.5-1 was not used in the data in the table [RQ-ABWR-0068, Query 3]
- the figure for volumetric exchange rate quoted in the 'Generic site description' (Hitachi-GE, 2013a) was not the same as the figure quoted in the Prospective Dose Modelling (Revision A) submission (Hitachi-GE, 2013b) [RQ-ABWR-0069]

For each of these queries we received a satisfactory response and the 'Generic site description' submission was revised where necessary for Revision B and subsequent document revisions.

During the time between submissions an updated version of the ERICA tool was released (NRPA, 2014), which resulted in a difference in the reference organisms considered for non-human radiological impact assessment in Revisions D and E of the generic site description.

2.5. Assessment findings

We are content that the generic site is appropriate to use in GDA and there are no Assessment Findings.

3. Compliance with Environment Agency requirements

Table 2. Compliance with Environment Agency requirements

P&ID Table 1 Section or REP	Compliance comments
P&ID Table 1 Section or REP	Compliance comments
P&ID Table 1 (generic site)	Appropriate data provided, for coastal site assuming once-through seawater cooling only.
SEDP1 - General Principle for Siting of New Facilities	Appropriate government policy documents relating to siting of new reactors are identified and referenced and relevant factors are taken into account in generic site description.

4. Public comments

There have been 2 comments from the public to the Hitachi-GE GDA comments process up to 8 July 2016 relating to the selection of the generic site for GDA. Hitachi-GE responded to these comments.

Both comments related to cooling towers, however as the generic site for GDA assumes a once-through seawater cooling system there will be no cooling towers at the generic site. Therefore, these comments are not considered here, but would be addressed during the site-specific phase if appropriate.

Comments received during the consultation process will be considered in the next revision of this document.

5. Conclusion

Based on the latest 'Generic site description' (Revision E) (Hitachi-GE, 2016) we have concluded the following:

- Hitachi-GE has selected a coastal site to represent the generic site. As government's National Policy Statement for Nuclear Generation (DECC, 2011a and 2011b) notes that all potential sites for new nuclear power stations are either located on the coast or on large estuaries, we are content that selecting a coastal site is appropriate for GDA. However, we are aware that for an estuarine location, such as Oldbury, these site characteristics cannot be considered to be representative.
- Hitachi-GE has assumed that there is no standing water on the site. This could be considered to be unrealistic for the temperate climate of the UK, but surface water management is a site-specific aspect of design and we consider this to be appropriate for GDA.
- Hitachi-GE has assumed that there are no discharges to freshwaters. We consider this a reasonable assumption for a coastal nuclear site, based on discharges from existing sites. This has resulted in the exclusion of freshwater species from the non-human radiological assessment, but we will expect this to be considered at site-specific environmental permitting if appropriate.
- We consider Hitachi-GE to have considered an appropriate range of factors as required by SEDP1 – General principle for siting of new facilities. Although Hitachi-GE has not identified this REP as being relevant or indicated compliance with this REP, it is clear that it has referred to the relevant government policy documents (DECC, 2011a and 2011b) and has, therefore, complied with this REP. We expect Hitachi-GE to document this compliance with SEDP1 in future revisions of the GEP submission, the final revision is expected in August 2017.

Based on the latest 'Generic site description' (Revision E) (Hitachi-GE, 2016) we have no Assessment Findings related to the generic site. However, we note that the coastal nature of the generic site and the assumption of once-through direct cooling will limit the applicability of any future SoDA to a site with these characteristics.

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List of abbreviations

Abbreviation	Details
ABWR	Advanced Boiling Water Reactor
ALARA	As low as reasonable achievable
BERR	Business enterprise and regulatory reform
DECC	Department of energy and climate change
ERICA	Environmental Risk from Ionising Contaminants: Assessment and Management
GDA	Generic design assessment
GEP	Generic environmental permit
HPA	Health Protection Agency (previously NRPB)
IRAT	Initial Radiological Assessment Tool
NRPA	Norwegian Radiation Protection Authority
NRPB	National Radiological Protection Board
NRW	Natural Resources Wales
ONR	Office for Nuclear Regulation
PCSR	Pre-construction safety report
PHE	Public Health England (previously HPA)
P&ID	Process and Information Document
REP	Regulation Environmental Principle
RI	Regulatory issue
RO	Regulatory observation
RQ	Regulatory query

Abbreviation	Details
RSR	Radioactive substances regulation
SAC	Special area of conservation
SEDP	General RSR Site Evaluation Principle
SoDA	Statement of design acceptability
SPA	Special protection area
SSSI	Site of special scientific interest
UK	United Kingdom

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