Cyfoeth Naturiol Cymru
Natural Resources Wales

Environment Agency

Assessing new nuclear power station designs

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

Summary decision document

December 2017

The Environment Agency protects and improves the environment.

We help people and wildlife adapt to climate change and reduce its impacts, including flooding, drought, sea level rise and coastal erosion.

We improve the quality of our water, land and air by tackling pollution. We work with businesses to help them comply with environmental regulations. A healthy and diverse environment enhances people's lives and contributes to economic growth.

We can't do this alone. We work as part of the Defra group (Department for Environment, Food & Rural Affairs), with the rest of government, local councils, businesses, civil society groups and local communities to create a better place for people and wildlife.

Natural Resources Wales is the largest Welsh government sponsored body. We were formed in April 2013, largely taking over the functions of the Countryside Council for Wales, Forestry Commission Wales and the Environment Agency in Wales, as well as certain Welsh government functions.

Natural Resources Wales' purpose is to pursue sustainable management of natural resources in all of our work.

Natural Resources Wales brings together the skills and expertise needed to ensure that we can operate effectively across our wide range of roles from adviser, facilitator, regulator and designator, to incident responder, partner and operator.

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Introduction

New nuclear power stations are an important part of the government's plans for generating secure low carbon electricity. Regulators are scrutinising new nuclear power station designs thoroughly, making sure people and the environment are properly protected.

The Environment Agency and Natural Resources Wales consulted on their generic design assessment of the UK Advanced Boiling Water Reactor (UK ABWR) nuclear power station design between 12 December 2016 and 3 March 2017. This is the summary of our finalised decision document, after considering the responses we received to our consultation.

Our conclusion is that the environmental aspects of the design would be acceptable and we are issuing a statement of design acceptability (SoDA) for the UK ABWR.

The Environment Agency and Natural Resources Wales work together so that the GDA outcome applies in both England and Wales. References to 'we', 'our', or similar terms throughout this document refer to both the Environment Agency and Natural Resources Wales, unless specified otherwise. In this GDA, where reference is made to Environment Agency documents the reader is to assume that Natural Resources Wales accepts and has adopted such documents as its own.

Hitachi-GE Nuclear Energy Ltd (Hitachi-GE), a major provider of nuclear technologies, has developed the ABWR plant and used it in Japan. It submitted the UK ABWR design to the UK nuclear regulators (Office for Nuclear Regulation, Environment Agency and Natural Resources Wales) for generic design assessment (GDA).

GDA is the process that allows us to begin scrutinising new nuclear power station designs well in advance of specific sites being identified and construction starting. This means that we can identify any potential design issues at an early stage and ask the reactor design company to address them. This helps to avoid any potential costly and time-consuming changes during construction.

New nuclear power stations – the government's view

The UK government has outlined its commitment to new nuclear developments in the UK. It states that nuclear power, together with gas and renewable energy, such as wind and solar power, will help meet the country's energy needs in the future. It will also meet its commitment to reduce carbon emissions. As part of the development of new nuclear power stations, it has asked nuclear regulators to assess the safety, security and environmental impacts of new reactor designs before they are built.

Regulating nuclear power stations

The Environment Agency regulates the impacts of nuclear sites in England on people and the environment by issuing environmental permits to cover site preparation, construction, operation and decommissioning. Natural Resources Wales carries out the same role in Wales. We also work closely with the Office for Nuclear Regulation, which regulates the safety and security aspects of nuclear sites. When we use the term 'nuclear regulators', we refer to ONR, Environment Agency and Natural Resources Wales.

Government and industry expect power stations of almost the same design might be built on a number of sites and potentially be run by different operating companies. Therefore, we have split

our regulatory process for assessing and permitting the operational stage of new nuclear power stations into 2 parts.

The first phase is generic design assessment (GDA), when we carry out assessments of designs and, at the end, we provide a statement about the acceptability of each design. There may be matters that cannot be resolved at GDA, these are captured as GDA Issues and Assessment Findings, which are associated with any statement issued. For the UK ABWR, we are in this phase now.

> A **GDA Issue** is an unresolved issue that is significant, but resolvable, and which requires resolution before construction of the reactor starts. The company must publish a 'resolution plan' setting out how it will address the issue. All GDA Issues must be resolved to the satisfaction of the regulators before GDA can be completed.
>
> An **Assessment Finding** is an unresolved issue that is not considered critical to the decision to start construction - it will need to be addressed during the design, procurement, construction or commissioning phase of the new build project.

In the second phase, following GDA, we receive applications for environmental permits for a specific site. We take into account all of the work we have done during GDA, so that our efforts are focused on site-specific matters, including how the operator is addressing GDA Assessment Findings. We will also carry out further public consultation before deciding whether to issue operational permits for a specific site.

Generic design assessment

GDA is a joint process by the Office for Nuclear Regulation and the Environment Agency. GDA means that we begin assessing the acceptability of the environmental aspects of a design before an application is made to build the power station. We get involved with designers and potential operators at the earliest stage when issues can be best addressed effectively and efficiently before construction begins.

There are a number of stages.

1. **Initial assessment**: we may ask the Requesting Party for further information or design changes to be made.
2. **Detailed assessment**: we form our preliminary views to go to consultation.
3. **Consultation**: we ask for views following detailed assessment.
4. **Post consultation review**: we consider all responses to the consultation.
5. **Decision and statement**: we decide whether to issue a statement of design acceptability (SoDA), an interim statement of design acceptability (iSoDA) if there are any outstanding issues to be addressed or no statement of acceptability - this is the stage we are in now.

GDA is based on a generic site. When assessing applications for environmental permits, we use the actual characteristics of the specific site where it is proposed to build. The site-specific characteristics may be different from those of the GDA generic site. More details of our GDA process can be found in our process and information document (P&ID) (Environment Agency, 2016a).

There are 3 possible results for a GDA.

- We issue a statement of design acceptability (SoDA) if we are satisfied with the design.
- If we are largely satisfied, we provide an interim statement of design acceptability (iSoDA) that identifies the issues that must be addressed before we could consider issuing a full statement of design acceptability.
- If we are not satisfied, we do not issue a statement of design acceptability or an interim statement of design acceptability.

The UK ABWR design

There are various types of nuclear reactors around the world, with over 400 in operation. One of the most common types is the boiling water reactor (BWR), of which the Advanced Boiling Water Reactor (ABWR) is the latest design in operation. Capable of producing around 1,350 megawatts of electricity, enough to power more than 2 million homes on average, the ABWR is already operational elsewhere in the world.

Figure 1. A simplified illustration of the Advanced Boiling Water Reactor

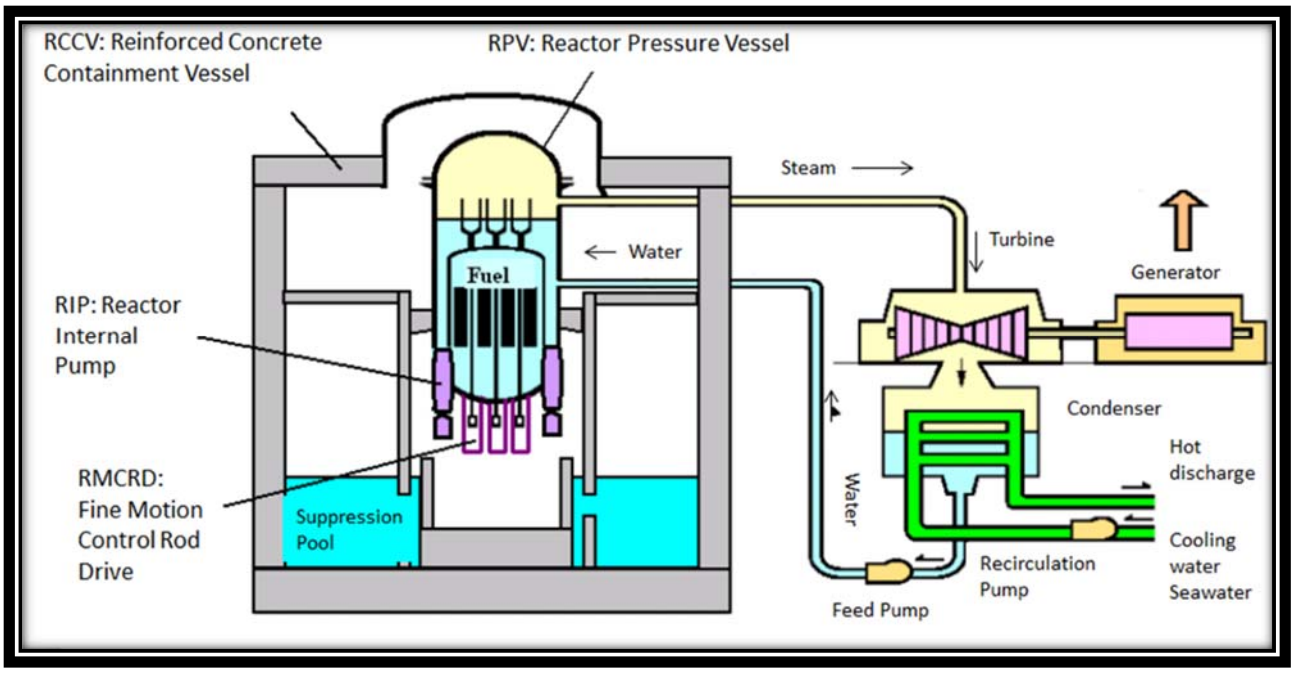

Image courtesy of Hitachi-GE

BWRs work by passing the steam that has been generated inside the reactor directly to the turbine. This makes the turbine spin and it drives a generator producing electricity.

More information on the UK ABWR is available on the Hitachi-GE website

Our assessment

Hitachi-GE submitted its UK ABWR design for GDA in January 2014. We completed our initial assessment and published our report in August 2014 (Environment Agency, 2014). Since then, we have been carrying out our detailed assessment. We formed our preliminary conclusions and went to public consultation between 12 December 2016 and 3 March 2017.

We are now presenting our conclusions. We have based our final findings on:

- the final versions of the GDA submission (submitted 31 August 2017)
- technical discussions held with Hitachi-GE
- consideration of the responses to our consultation
- consideration of comments submitted to Hitachi-GE through the 'GDA comments process' website and the responses

We are publishing 11 updated assessment reports and an independent dose assessment alongside our decision document.

Our consultation

We work openly and clearly, subject to commercial and security sensitive constraints. We have deliberately made this assessment open, clear and consultative, because this helps to inform our decision and build confidence in us and the process. We consulted on our preliminary conclusions, following our detailed assessment so far, for 12 weeks, from 12 December 2016 to 3 March 2017 (Environment Agency, 2016b).

We are confident that we did all we should do to properly consult and that this consultation was accessible to, and clearly targeted at, the people and organisations it was intended for. We are grateful to all who took the time to contribute and to attend our consultation events in both England and Wales.

During 2014 to 2016, we worked with Sciencewise to help us understand how the public want to be involved and consulted about our assessment of new nuclear power station designs. The findings from this work, along with other evaluation and research, informed our communications and engagement plan for our consultation on the UK ABWR.

Our GDA consultations are also evaluated by an external independent organisation. The evaluation of this consultation will be published in spring 2018.

Our decision following consultation

Based on our findings, our conclusion is that we consider the environmental aspects of the design would be acceptable under normal operations. Therefore, we can issue a statement of design acceptability (SoDA) for the UK ABWR.

There are no unresolved GDA Issues.

We have identified 17 Assessment Findings (AF) in the assessment reports. These are also summarised in our decision document and at the end of this report. We will expect a future operator to address these at the appropriate stage in the life cycle of the plant.

Our full decision document and updated assessment reports are available on the GOV.UK

Alternatively, you can request a copy via email at gda@environment-agency.gov.uk.

Next steps

Horizon Nuclear Power is proposing to build the UK ABWR at its sites Wylfa Newydd on the Isle of Anglesey and Oldbury-on-Severn in South Gloucestershire.

Any company that wants to build and operate a new nuclear power station must obtain a number of important site-specific permissions from regulators. These include a nuclear site licence and relevant consents from ONR and environmental permits from the Environment Agency or Natural Resources Wales and planning permissions from the Planning Inspectorate.

Environmental permits

Horizon Nuclear Power will be applying for a range of environmental permits relating to the building and operating a nuclear power station and for relevant ‘associated developments’ such as workers’ accommodation. This includes permits for radioactive discharges, cooling water discharges and operating combustion plant, such as emergency diesel generators.

The Environment Agency or Natural Resources Wales will decide if the permits should be issued and, if so, what permit conditions should apply. When making decisions about site-specific permit

Environment Agency and Natural Resources Wales:

applications, the regulators will take account of the work done during GDA. We will also carry out further public consultation before deciding whether to issue operational permits for a specific site.

Nuclear site licence

The Office for Nuclear Regulation is responsible for licensing proposed new sites for nuclear power stations. Any organisation that wants to carry out prescribed nuclear activities must apply for, and be granted, a nuclear site licence before it starts building a nuclear safety-related plant. Granting a nuclear site licence is a significant step, but, on its own, does not give permission to start nuclear-related construction. That requires a regulatory permission from ONR.

Planning permission

A new nuclear power station needs a Development Consent Order (DCO) from the Secretary of State, who takes a recommendation from the Planning Inspectorate.

Assessment Findings

Below is a summary of our Assessment Findings, further detail on context and expectations is included in our assessment reports. These Assessment Findings should be read with the supporting information contained in our decision document and assessment reports.

AF Number	Assessment Finding
UK ABWR-AF01	A future operator shall provide details of how the proximity principle has been applied in its demonstration of best available techniques for solid and incinerable liquid wastes before it starts active commissioning of the UK ABWR.
UK ABWR-AF02	If appropriate, a future operator shall produce an assessment of best available techniques that covers all of its sites, noting economies of scale and other efficiencies in disposal of solid and incinerable liquid wastes across all of its sites before it starts active commissioning of the UK ABWR.
UK ABWR-AF03	A future operator shall demonstrate that the UK ABWR will be operated in a manner that represents best available techniques, addressing in particular: • fuel selection • fuel and core management • avoidance of control rod failure in power suppression situations • consideration of all normal operational modes and stages of the reactor's life cycle • control of water chemistry • selection of demineraliser resins for liquid waste management systems
UK ABWR-AF04	A future operator shall review the practicability of techniques for abatement of carbon-14 prior to operation.
UK ABWR-AF05	A future operator shall assess the partitioning of carbon-14 between gaseous, aqueous and solid waste streams, during initial operations.
UK ABWR-AF06	A future operator shall address the 15 forward actions as identified by Hitachi-GE in the 'Demonstration of best available techniques' submission - GA91-9901-0023-00001 Rev. G. August 2017.

AF Number	Assessment Finding
UK ABWR-AF07	A future operator shall provide an evidence based definition of the decontamination factors likely to be achieved for aqueous effluent treatment prior to operation and then compare these with the actual decontamination factors achieved during operation. Differences in expected and actual decontamination factors should be explained.
UK ABWR-AF08	A future operator shall assess the chemical speciation of radioactivity in aqueous discharges. It shall consider the implications of this for the receiving environment so that discharges are shown to represent best available techniques.
UK ABWR-AF09	A future operator shall, before procurement, provide detailed designs for solid radioactive waste management, storage and conditioning facilities that were covered at a conceptual level during generic design assessment, and demonstrate how these represent best available techniques.
UK ABWR-AF10	A future operator shall demonstrate optimised management and disposal of solid radioactive wastes from the UK ABWR, addressing in particular: • conditioning of higher activity waste arisings to ensure disposability • selection of disposal routes for wastes at the low activity waste/high activity waste boundary • management of spent nuclear fuel and any associated secondary wastes to ensure disposability • selection of disposal routes for low activity waste
UK ABWR-AF11	A future operator shall address the 12 forward actions identified in the 'Approach to sampling and monitoring' submission - GA91-9901-0029-00001 Revision H, August 2017.
UK ABWR-AF12	A future operator shall undertake tests to determine the particle concentration profile and whether multi-nozzle probes are required for the main stack sampling.
UK ABWR-AF13	A future operator shall demonstrate, prior to reactor commissioning, that the final configuration of the sampling lines and the layout and positioning of the monitoring room are optimised.
UK ABWR-AF14	A future operator shall demonstrate that, prior to procurement, the specific sampling and monitoring equipment for the determination of the discharges represents best available techniques and enables the EU recommended levels of detection to be met.
UK ABWR-AF15	A future operator shall demonstrate that the systems and equipment used for monitoring and sentencing solid waste represent best available techniques.
UK ABWR-AF16	A future operator shall appropriately characterise all aqueous waste streams in its water discharge activity permit application. This shall include identification of all significant contaminants (including biocides, detergents and metals), the concentrations and volumes being discharged to the environment.
UK ABWR-AF17	A future operator shall specify the minimum performance parameters of the combustion plant in its application for a combustion activity permit.

References

Reference	Details
Environment Agency, 2016a	Process and information document for generic assessment of candidate nuclear power plant designs, Version 3, Environment Agency, October 2016. https://www.gov.uk/government/publications/assessment-of-candidate-nuclear-power-plant-designs
Environment Agency, 2016b	Consultation document: GDA of Hitachi-GE Nuclear Energy Ltd's UK Advanced Boiling Water Reactor. https://www.gov.uk/government/consultations/gda-of-hitachi-ge-nuclear-energy-ltds-uk-advanced-boiling-water-reactor https://naturalresources.wales/guidance-and-advice/environmental-topics/consultations/our-own-consultations-closed/assessing-new-nuclear-power-station-designs/?lang=en
Environment Agency, 2014	Report on initial assessment of Hitachi-GE Nuclear Energy, Ltd's UK Advanced Boiling Water Reactor https://www.gov.uk/government/publications/discharges-from-boiling-water-reactors-review-of-discharge-data

Natural Resources Wales Customer Care Centre 0300 065 3000 (Mon-Fri, 9am-5pm)

Our Customer Care Centre handles everything from general enquiries to more complex questions about registering for various permits.

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