

UK ABWR

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UK ABWR Generic Design Assessment
Generic Site Envelope



UK ABWR

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Abbreviations and Acronyms

ABWR	Advanced Boiling Water Reactor
DBE	Design Basis Earthquake
GDA	Generic Design Assessment
HVAC	Heating, Ventilation & Cooling
LOOP	Loss of Offsite Power
OBE	Operational Basis Earthquake
RCW	Reactor (building) Cooling Water (system)
RHR	Residual Heat Removal (system)
RSW	Reactor (building) Service Water (system)
SHA	Seismic Hazard Assessment
SSCs	Structures, Systems and Components
UHSp	Uniform Hazard Spectra
UHS	Ultimate Heat Sink

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1. Introduction

This document describes the methodology for enveloping generic site data, relating to appropriate external hazards, into a series of Generic Site Conditions. These Generic Site Conditions can then be used for the generic design of the Standard UK ABWR Structures, Systems and Components (SSCs) for any specific candidate site in the UK.

The Generic Site Conditions will take into account those naturally occurring environmental external hazards and man-made external hazards such as:

- Meteorological
- Hydrological
- Seismic and Soil Properties
- Electrical
- Geophysical / Landslide
- Man-made
- Biological
- Others

Detailed descriptions relating to external hazards can be found in GDA Step 1b document “Preliminary Safety Report on Civil Engineering and External Hazard” [RD 1]

2. Approaches to Generic Site Envelope Identification

The relevant parameters defined within this report will be enveloped into a set of Generic Site Conditions that can be used for potential UK ABWR sites in the UK. Standard UK ABWR Structures, Systems and Components (SSCs) will be designed to accommodate the Generic Site Conditions.

Generic Site Conditions for the UK ABWR will be defined based on the consideration of extreme values taken from historical data, and where appropriate will allow for the influence of climate change for the candidate nuclear specific sites. The purpose of defining Generic Site Conditions is to provide common design conditions across the UK ABWR projects.

In some circumstances, there will be external hazards associated with site specific design conditions, for UK candidate sites, which are not appropriate to incorporate within the Generic Site Conditions. In these cases, the site specific hazards will be included in the site specific characterisation.

3. Generic Site Envelope

Generic Site Conditions described in this document, relating to external hazards, can be grouped as follows:

- Heat Sink – Possible type of heat sink source(heat sink for safety / non-safety) / Temperature/ Flow rate of the cooling water;
- Meteorology - Air temperature (including Climate change) / Wind load / Tornado / Precipitation / Humidity / Lightning / Sand storm;
- Hydrology - Sea water level (including Climate change) / External flooding;
- Seismicity and Soil Properties / Ground Conditions – Seismic /Soil Properties /Ground Conditions / elevation;
- Electrical Grid Connections – Condition of the Grid Connections / Loss Of Offsite Power (LOOP).

The impact of several of these parameters on the safe operation of the generic design will be assessed in detail in future Topic Report. These assessments shall include the possible influence of climate change, based on the information. Table 1 provides a summary of the design parameters.

3.1 Heat Sink

The UHS (Ultimate Heat Sink) serves the safety-related functions of providing cooling water and acting as a heat sink for the system during accident conditions. The UHS also serves as a heat sink during normal operation by accepting the heat load of the Reactor Building Service Water System (RSW). The UHS is designed to provide an adequate source of cooling water which is available at all times for reactor operation, shutdown cooling and for accident mitigation. Based on the data of the heat sink water temperature in the candidate site, minimum and maximum cooling water temperatures for ABWR will be determined:

- Maximum Temperature for Safety
- Minimum Temperature for Safety

The cooling water systems such as RCW and RSW and the heat removal systems including the Residual Heat Removal System (RHR) will be designed based on this sea water temperature.

3.2 Meteorology

3.2.1 Air Temperature

This section describes the characteristics of the air temperature surrounding the nuclear power station. The generic design of the nuclear power station will consider the extreme air temperature conditions of the potential UK sites.

Extreme air temperatures will be derived from historical data relating to the potential UK sites. The effects of climate change will also be taken into consideration. The data will clearly define the maximum and minimum extreme air temperatures. The HVAC of the nuclear power station will be designed based on this extreme air temperature.

3.2.2 Wind Speed

Wind speed of the Generic Site Condition will be defined taking into account the maximum wind speed (including tornado) that could be achieved from the historical data of the possible site in UK.

3.2.3 Precipitation

Precipitation for the Generic Site will be defined taking into account the maximum rainfall, and snow conditions from the historical data of the possible site in UK. This will also include consideration for extreme weather and climate change effects.

3.3 Hydrology

3.3.1 Flood Level

This section describes the characteristics of design consideration against external flooding. The design of nuclear power station considers the external flooding. The exact value of external flooding level will be defined, based on the historical data of the site.

In the site licensing, the effect of external flooding are considered as follows,

- Ground level of the site will be designed to be above the potential flooding level .
- Coastal or river levee will be constructed around the nuclear power station as needed.
- Watertight doors will be considered for protection of important Structures, Systems and Components (SSCs).

3.3.2 Ground Level

Final Ground Levels for the UK ABWR will be set appropriately higher than the maximum flood level stated in 3.3.1.

3.4 Seismic Input and Soil Properties / Ground Conditions

3.4.1 Seismic Input

The seismic design of the UK ABWR considers the effect of the seismic design earthquakes: Design Basis Earthquake (DBE) and Operational Basis Earthquake (OBE). DBE is assumed to envelope the Uniform Hazard Spectra (UHSp) that is obtained from Seismic Hazard Assessment (SHA) of candidate sites.

3.4.2 Soil Properties

The generic UK ABWR plant will be designed to accommodate standard soil parameters that are defined considering soil conditions of candidate site. The standard soil parameters to be determined from site data and local site records shall include minimum static bearing capacity, minimum shear wave velocity and liquefaction potential.

3.4.3 Ground Conditions

The generic UK ABWR plant will be designed to accommodate the ground conditions generally (including geological and hydrogeological) that are to be defined for the candidate site.

The generic UK ABWR plant will be designed (ie: the siting and location of the plant) to accommodate the natural elevation of the site, including general topography.

3.5 Grid Connections

Grid Connection of the ABWR will be defined considering the grid configuration of the each site.

The condition of the grid connection will be different for each site, therefore a detailed study and coordination with the grid company will be take took place and appropriate Grid connection will be defined.

A detailed description of the Grid Connection is provided within the GDA Step 1b document “Preliminary Safety Report on Electrical Engineering” [RD 2]

3.6 Loss Of Offsite Power (LOOP)

The feature of LOOP is defined based on the frequency and duration. This value is calculated in the probabilistic safety assessment considering both plant on-site configuration and External Grid configuration.

4. Conclusion

This document has identified the Generic Site Conditions to be included in the GDA for the UK ABWR. These conditions are summarized in Table 1. The values for these identified conditions will be defined in Step 2. A review of the data, including both generic information and some site specific information is currently underway.

5. Reference

Reference Number	Document Title
[RD 1]	“Preliminary Safety Report on Civil Engineering and External Hazards”, GA91-9901-0004-00001, XE-GD-0112, 2013
[RD 2]	“Preliminary Safety Report on Electrical Engineering”, GA91-9901-0006-00001, XE-GD-0114, 2013

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Table 1 – Generic Site Conditions

Generic Site Conditions		
Parameter	Definition	Remarks
Heat Sink Temperature		
Maximum Safety		
Minimum Safety		
Air Temperature		
Maximum Safety		
Minimum Safety		
Maximum Normal		
Minimum Normal		
Wind Speed		
Operating Basis		
Tornado		
Seismic		
Fault Displacement Potential		
Soil		
Average Allowable Static Bearing Capacity		
Shear Wave Velocity		
Liquefaction Potential		
Missile		
Flood Level		
Ground Water Level		
Plant Grade Elevation		
Precipitation		
Rain		
Snow		