

UK ABWR

Document ID	:	GA91-9101-0101-05003
Document Number	:	UE-GD-0147
Revision Number	:	Rev.A

UK ABWR Generic Design Assessment

Generic PCSR 5.3 : Definition of Design Basis Faults and Beyond Design Basis Faults



DISCLAIMERS

Proprietary Information

This document contains proprietary information of Hitachi-GE Nuclear Energy, Ltd. (Hitachi-GE), its suppliers and subcontractors. This document and the information it contains shall not, in whole or in part, be used for any purpose other than for the Generic Design Assessment (GDA) of Hitachi-GE's UK ABWR. This notice shall be included on any complete or partial reproduction of this document or the information it contains.

Copyright

No part of this document may be reproduced in any form, without the prior written permission of Hitachi-GE Nuclear Energy, Ltd.

Copyright (C) 2014 Hitachi-GE Nuclear Energy, Ltd. All Rights Reserved.

Table of Contents

5.3 Definition of Design Basis Faults and Beyond Design Basis Faults5.3-1

5.3 Definition of Design Basis Faults and Beyond Design Basis Faults

It is an important principle in the design of modern nuclear facilities that they should be “fault tolerant”, which means that faults and other disturbances to normal operating conditions should not lead to undesirable consequences. However, it is not reasonably practicable to expect that the response to events of all magnitudes and frequencies should be the same. This leads to the identification of a number of categories of events, defined by their frequency and potential consequences.

Consequences are related to two levels, defined in the ONR Safety Assessment Principles:

- Basic Safety Level (BSL) – this defines the boundary between acceptable and unacceptable consequences. Provision must be made in the design to prevent any potential consequences above the BSL.
- Basic Safety Objective (BSO) – this defines a target which is expected to be achieved by all new plant. Consequences below the BSO are deemed to be broadly acceptable.

Events are also divided into two broad groups by frequency. Frequent events have a frequency greater than once in 1000 years of operation; infrequent events less than once in 1000 years.

The categories of events identified for UK ABWR are as follows:

- Expected Events
- Foreseeable Events
- Design Basis Faults
- Beyond Design Basis Faults

(1) Expected Events

The events are expected to occur at least once during the lifetime of the plant. It is expected that their effect on the plant should be minimal, amounting to no more than a mild deviation from normal operating conditions and consequences below the BSO without any mitigating actions.

(2) Foreseeable Events

Foreseeable events are frequent events with unmitigated consequences below the BSL. However, it is possible that some mitigation action is required to reduce consequences below the BSO.

(3) Design Basis Faults

Design Basis (DB) Faults are faults whose potential unmitigated consequences would be above the BSL. Because such consequences are unacceptable, it is necessary for the design to make provision for these consequences to be reduced.

DB Faults may be either frequent DB faults or infrequent DB faults, however, there is a cut-off value of frequency, below which infrequent DB faults do not need to be considered.

(4) Beyond Design Basis Faults

Beyond Design Basis (BDB) Faults are faults whose potential unmitigated consequences would be above the BSL but whose frequency is below the cut-off for infrequent DB faults. There is no formal requirement to include these faults in the design basis but it is required to demonstrate that there are no “cliff-edge” effects near the cut-of frequency and that risks are ALARP.

The definition of the categories of faults and events used for UK ABWR in this PCSR are summarised in Table 5.3-1.

Table 5.3-1: Faults and Events Categories

Fault /Event Category		Fault Frequency	Potential Consequences	
			Off-site	On-site
Design Basis Faults	Frequent DB Faults	$> 10^{-3}$	> 1 mSv (BSL)	> 20 mSv (BSL)
	Infrequent DB Faults	10^{-3} to 10^{-4} 10^{-4} to 10^{-5}	> 10 mSv (BSL) > 100 mSv (BSL)	> 200 mSv (BSL) > 500 mSv (BSL)
Beyond Design Basis Faults		10^{-5} to 10^{-7}	> 100 mSv	> 500 mSv
Foreseeable Events		$> 10^{-3}$	0.01 mSv (BSO) to 1 mSv (BSL)	0.1 mSv (BSO) to 20 mSv (BSL)
Expected Events		$> 10^{-2}$	< 0.01 mSv (BSO)	< 0.1 mSv (BSO)

The values for the BSL and BSO in the above table are taken from the ONR Safety assessment Principles.