

UK ABWR

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UK ABWR Generic Design Assessment

Summary of the Generic Environmental Permit Applications



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1. Acronyms

ABWR	Advanced Boiling Water Reactor
ALARA	As Low As Reasonably Achievable
BAT	Best Available Technique
BWR	Boiling Water Reactor
CD	Condensate Demineraliser System
CF	Condensate Filter System
COMAH	Control of Major Accident Hazards
CST	Condensate Storage Tank
CUW	Reactor Water Clean-up system
DAC	Design Acceptance Certificate
DCD	Design Control Document
EIA	Environmental Impact Assessment
EPR/EPR10	Environmental Permitting (England and Wales) Regulations 2010
F/D	Filter-Demineraliser
FAP	Forward Action Plan
GDA	Generic Design Assessment
GEP	Generic Environmental Permit
GSD	Generic Site Description
HAW	Higher Activity Waste
HCW	High Conductivity Waste System
HEPA	High Efficiency Particulate Air Filter
HLW	High Level Waste
IAEA	International Atomic Energy Agency
ILW	Intermediate Level Waste
IRA	Initial Radiological Assessment
IWS	Integrated Waste Strategy
J ABWR	Japanese ABWR
LCW	Low Conductivity Waste System
LD	Laundry Drain System
LLW	Low Level Waste
LLWR	Low Level Waste Repository site
NHS	Non Human Species
NPP	Nuclear Power Plant

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UK ABWR

Generic Environmental Permit

Revision D

OG	Off-gas System
ONR	Office for Nuclear Regulation
P&ID	Process and Information Document for Generic Assessment of Candidate Nuclear Power Plant Design
PCSR	Pre-Construction Safety Report
PSR	Preliminary Safety Report
QMP	Quality Management Plan
R/B	Reactor Building
REP	Radioactive Substances Regulation – Environmental Principle
RO	Regulatory Observation
RSR	Radioactive Substances Regulation
RW/B	Radwaste Building
RWMA	Radioactive Waste Management Arrangement
S/B	Service Building
SF	Spent Fuel
SJAE	Steam Jet Air Ejector
SoDA	Statement of Design Acceptability
SQEP	Suitably Qualified and Experienced Person
T/B	Turbine Building

2. References

- [Ref-1] Process and Information Document for the Generic Assessment of Candidate Nuclear Power Plant Designs, version 2, March 2013, Environment Agency
- [Ref-2] New nuclear reactors: Guidance to requesting parties, ONR-GDA-GD-001, Rev.0, Office for Nuclear Regulation, August 2013
- [Ref-3] UK ABWR Generic Pre-Construction Safety Report, GA10-9101-0100-00000, XE-GD-0193, Rev.A, Hitachi-GE, August 2014
- [Ref-4] Description of Hitachi-GE Organisational Capability, Systems and Management Arrangements, GA91-9901-0016-0001, XE-GD-0085, Rev.A, Hitachi-GE, 03 October 2013
- [Ref-5] Generic Site Description, GA91-9901-0020-00001, XE-GD-0095, Rev.D, Hitachi-GE, August 2014
- [Ref-6] Hitachi-GE UK ABWR Concept Design, GA91-9901-0033-00001, XE-GD-0135, Rev.A, Hitachi-GE, 06 January 2014
- [Ref-7] Quality Management Plan (For UK ABWR GDA Project), GA70-1501-0007-00001, GNQA13-0066, Rev.4, Hitachi-GE, August 2014
- [Ref-8] Genesis of ABWR Design, GA91-9901-0034-00001, XE-GD-0136, Rev.A, Hitachi-GE, 04 October 2013
- [Ref-9] Resilience of design against Fukushima type events, GA91-9901-0035-00001, XE-GD-0137, Rev.A, Hitachi-GE, 06 January 2014
- [Ref-10] US ABWR Design Control Document (Revision 4)
- [Ref-11] Prospective Dose Modeling, GA91-9901-0026-00001, HE-GD-0005, Rev.D, Hitachi-GE, August 2014
- [Ref-12] Approach to Optimisation, GA91-9901-0021-00001, XE-GD-0096, Rev.D, Hitachi-GE, August 2014
- [Ref-13] Demonstration of BAT, GA91-9901-0023-00001, XE-GD-0097, Rev.D, Hitachi-GE, August 2014
- [Ref-14] Radioactive Waste Management Arrangements, GA91-9901-0022-00001, WE-GD-0001, Rev.D, Hitachi-GE, August 2014
- [Ref-15] Approach to Sampling and Monitoring, GA91-9901-0029-00001, 3E-GD-K002, Rev.D, Hitachi-GE, August 2014
- [Ref-16] Quantification of Discharges and Limits, GA91-9901-0025-00001, HE-GD-0004, Rev.D, Hitachi-GE, August 2014
- [Ref-17] Other Environmental Regulations, GA91-9901-0027-00001, XE-GD-0098, Rev.D, Hitachi-GE, August 2014
- [Ref-18] Regulatory Guidance Series, No RSR 1; Radioactive Substances Regulation – Environmental Principles; Version 2; April 2010
- [Ref-19] Consideration of and Compliance with the Radioactive Substances Regulation Environmental Principles (REPs), GA91-9901-0028-00001, XE-GD-0099, Rev.D, Hitachi-GE, August 2014
- [Ref-20] Generic PCSR : Master Table of Contents, GA91-9101-0101-00000, XE-GD-0225, Rev.A, Hitachi-GE, August 2014

3. Introduction

Hitachi-GE Nuclear Energy, Ltd. (Hitachi-GE) is developing a Generic Environmental Permit (GEP) application, for its Advanced Boiling Water Reactor (ABWR, hereafter referred to as UK ABWR) as part of the Generic Design Assessment (GDA) process, overseen by the Office for Nuclear Regulation (ONR) and Environment Agency.

The GEP is the suite of documents developed by Hitachi-GE to provide the information requested within the Process and Information Document for the Generic Assessment of Candidate Nuclear Power Plant Designs (P&ID) [Ref-1] for both the ONR and Environment Agency. The P&ID is the Environment Agency guidance and process for assessing the suitability of new nuclear power station in the UK, and outlines what information is needed from the requesting party (Hitachi-GE in the case of the UK ABWR) in order to obtain a Statement of Design Acceptance (SoDA).

The Pre-Construction Safety Report (PCSR) is a corresponding suite of documents developed by Hitachi-GE to address the design and safety information required as part of GDA by the ONR, in order to obtain a Design Acceptance Certificate (DAC). The ONR’s requirements for GDA are outlined within their ‘New nuclear reactors: Guidance to requesting parties’ document [Ref-2].

This GEP summary document describes the overall purpose and scope of the GEP submission, outlining the structure and layout of the reports, and indicating how each addresses the requirements outlined in the P&ID. Throughout the GEP, reference is made to the PCSR; PCSR Chapter 1 [Ref-3] provides a summary of the structure of the PCSR documents and should be reviewed to give more context to this summary document.

This document complements the overall submission made to both the ONR and Environment Agency, and should be read in conjunction with the remainder of the GDA reports and supporting documents, to gain a full appreciation of the GEP submission for the UK ABWR at this point in the GDA process.

4. The Requesting Party

Hitachi-GE was founded on July 1st, 2007 as a strategic global alliance between Hitachi, Ltd. and General Electric Co. Hitachi-GE offers nuclear power plant construction and maintenance services in partnership with its US counterpart GE-Hitachi Nuclear Energy. It is majority owned by Hitachi (80.01%), with General Electric Co. holding the minority stake (19.99%), and is headquartered in Hitachi City, Ibaraki Prefecture, Japan.

Together Hitachi, Ltd. and General Electric Co. have experience in the nuclear sector reaching back over half a century; they have been co-operating on and contributing to the development and constructions of the Boiling Water Reactors (BWR) since 1967. Since the introduction of BWR technology in the US in the 1960s, Hitachi has participated in the design, development and construction of over 20 nuclear power plants within Japan.

There are three operating ABWR sites within Japan and four more under construction worldwide, as shown in Table 4-1: Global ABWR below.

Table 4-1: Global ABWR Presence

Operating ABWR	ABWR under construction
Kashiwazaki-Kariwa Nuclear Power Plant (Japan)	Shimane Nuclear Power Plant (Japan)
Hamaoka Nuclear Power Plant (Japan)	Lungmen Nuclear Power Plant (Taiwan)
Shika Nuclear Power Plant (Japan)	Higashidori Nuclear Power Plant (Japan)
	Ohma Nuclear Power Plant (Japan)

Further details on Hitachi-GE are contained within other documents as part of the GDA submissions and the Description of Hitachi-GE Organisation Capability, Systems and Management Arrangements document [Ref-4].

5. Overview of the Design

The term ‘UK ABWR’ includes not only the reactor itself but also all buildings which are dedicated exclusively or primarily to housing systems and equipment related to the nuclear system, or which control access to those equipment and systems. There are five such buildings within the scope of the UK ABWR, namely the:

- Reactor Building (including containment);
- Service Building;
- Control Building;
- Turbine Building; and,
- Radioactive waste (‘Radwaste’) Building.

Further information on the layout of these buildings on a generic site is provided in section 7.2.1 of this document and the Generic Site Description (GSD) document [Ref-5].

The major supporting system of particular relevance to the GEP submission is the the Radioactive Waste Management System. This functionally consists of three main sub-systems, namely the:

- Off-gas Treatment System;
- Liquid Waste Treatment System; and,
- Solid Waste Management System.

Figure 5-1 shows the outline of Radioactive Waste Management Systems. In summary, the UK ABWR Radioactive Waste Management System has been developed to significantly reduce the generation of radioactive waste, to adopt advanced technologies to manage and treat those wastes that do arise, as well as support the efficient operation of the reactor.

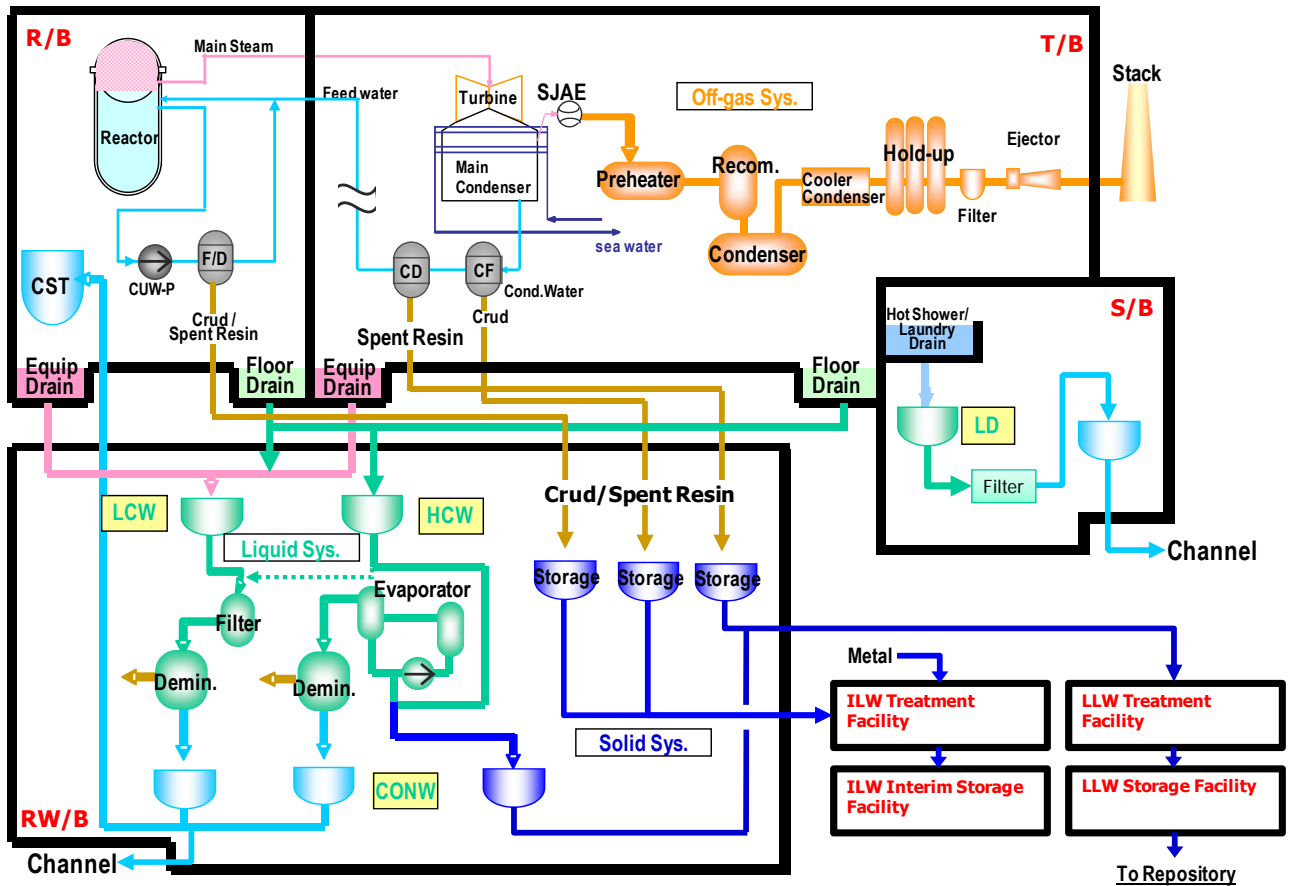


Figure 5-1: Outline of Radioactive Waste Management System

- | | |
|-------------------------------------|--|
| Channel: Main marine channel | LCW: Low Conductivity Waste System |
| CD: Condensate Demineraliser | LD: Laundry Drain System |
| CF: Condensate Filter Facility | LLWR: Low Level Waste Repository, Ltd. |
| CST: Condensate Storage Tank | R/B: Reactor Building |
| CUW: Reactor Water Clean-up System | RW/B: Radwaste Building |
| Demin: Demineraliser | S/B: Service Building |
| F/D: Filter Demineraliser | SJAE: Steam Jet Air Ejector |
| HCW: High Conductivity Waste System | T/B: Turbine Building |

An example of such an improvement regarding the management and treatment of radioactive releases is the adoption of the hold-up (delay) system through use of a charcoal adsorber for Off-gas gaseous waste (see the Off-gas Treatment System description in the following section). Full details of the Radioactive Waste Management System will be provided in the Concept Design [Ref-6] and wider PCSR however, a short summary of each of the three main sub-systems is described in the following sections.

5.1. Off-gas Treatment System

The Off-gas System (depicted in orange in Figure 5-1) takes gas arising from the main condenser (containing radioactive noble gases and radiolytic hydrogen and oxygen), processes it to reduce its activity and controls the release of the resulting gas to the site environs. Its operation maintains the exposure of individuals at a level that is As Low As Reasonably Achievable (ALARA).

The Off-gas System process equipment is located within the Turbine Building to minimise the length of piping needed to carry the gas from the main condenser, and housed in a reinforced-concrete structure to provide adequate shielding. The hold-up system is installed in a temperature-controlled room to maintain the capability of the charcoal components of the adsorber.

The Off-gas System reduces the possibility of the radiolytic hydrogen and oxygen contained in the off-gas from reacting and causing an explosion. This is accomplished by the catalytic recombination of the radiolytic hydrogen and oxygen in a recombiner within the system.

The moisture in the off-gas is condensed to reduce the volume of off-gas within the Off-gas condenser. The remaining non-condensables (principally air with a slight amount of radioactive krypton and xenon gas) are passed through Off-gas charcoal adsorbers, which provide adequate hold-up volume across activated charcoal beds to allow time for the radioactive krypton and xenon to decay to lower activity levels. After processing, the gaseous waste (whose activity is now reduced to a permitted level) is monitored and released to the environs through the stack.

Information to be provided during the GDA process will show that activity in gaseous discharges will be reduced to a very low level, in line with the application of Best Available Technique (BAT). The Environment Agency will set limits as part of the GDA process. These limits will be reviewed as part of subsequent site permitting based on any additional information provided by future UK ABWR operators.

5.2. Liquid Waste Treatment System

The Liquid Waste Treatment System (depicted in green in Figure 5-1) is designed to control, collect, process, handle, store, and dispose of liquid radioactive waste generated as the result of normal operations, including anticipated operational occurrences. All potentially radioactive liquid wastes are collected in sumps or drain tanks at various locations in the plant and transferred to collection tanks in the Radwaste Building.

System components are designed and arranged in shielded enclosures to minimise exposure to plant personnel during operation, inspection, and maintenance. Tanks, processing equipment, pumps, valves, and instruments that may contain radioactivity are located in access-controlled areas, again to minimise exposure to plant personnel.

The Liquid Waste Treatment System normally operates on a batch basis. Provision is made for sampling at important process points. Protection against accidental discharge is provided by detection of abnormal conditions and subsequent alarms, as well as by administrative controls.

The Liquid Waste Treatment System is divided into several further sub-systems, so that the liquid wastes from various sources can be segregated and processed separately, based on the most efficient and economical process for the type of impurity and chemical content in each waste stream.

The Liquid Waste Treatment System has been designed and operated to recycle as much of the resulting treated liquid waste as possible, except for liquid waste arising from the laundry drain which contains detergent impurities making it unsuitable for re-use. Despite this innovation, there may be times when liquid discharges may be necessary due to reaching capacity limits for on-site storage of treated liquid waste. Information to be provided during the GDA process will show that such liquid discharges will be reduced to a very low level, in line with the application of BAT. The activity and impurities of all liquid discharges would be checked to confirm that they are indeed very low and that the activity is within the permit limits set by the Environment Agency.

5.3. Solid Waste Management System

The Solid Waste Management System (depicted in dark blue in Figure 5-1) is designed to control, collect, handle, process, package, and temporarily store wet and dry solid radioactive waste prior to shipment or on-site interim storage. This waste is generated as a result of normal operation and anticipated operational occurrences (i.e. due to outage). These wastes are categorised as wet solid wastes (such as spent ion exchange resin beads and filter backwash arising from the operation of the Liquid Waste Treatment System etc) or dry solid wastes (such as HEPA filters, protective clothing, tissue paper etc). Both Low Level Waste

(LLW) and Intermediate Level Waste (ILW) are processed by the Solid Waste Management System.

The Solid Waste Management System functionally consists of the following four sub-systems:

- The wet solid waste collection sub-system;
- The wet solid waste processing sub-system;
- The dry solid waste accumulation and conditioning sub-system; and,
- The container storage sub-system, utilised until the packaged waste is sent off-site for disposal.

Figure 5-1 depicts solid waste treatment and storage facilities in the bottom right (black boxes containing red text). These are areas where management options are being reviewed as part of GDA. Further information will be made available in subsequent GDA Steps.

It is worth noting that the management of spent fuel (SF) is the subject of ongoing work to determine the nature of its interim, on-site storage following removal from the reactor. The system is described as part of PCSR Chapter 32 on Spent Fuel Interim Storage. The nature of its interim storage will influence its management beforehand; following the conclusion of the ongoing assessments, further information on the nature of the SF management and on-site storage system will be submitted as part of GDA.

A single UK ABWR operating for 60 years is estimated to generate approximately 20m³/yr of wet LLW plus miscellaneous LLW (quantity yet to be determined). It will also produce approximately 10m³/yr of wet ILW plus irradiated metal (quantity yet to be determined). The actual volumes of waste generated by an operating UK ABWR depends upon a number of site-specific factors, for example the waste strategy (including optimisation of treatment) adopted by the utility and the operating cycle selected (i.e. the period between outages). In all cases waste volumes will be minimised.

6. Purpose of the GEP

Figure 6-1 shows the indicative programme associated with the different steps of the GDA process contained within the P&ID [Ref-1].

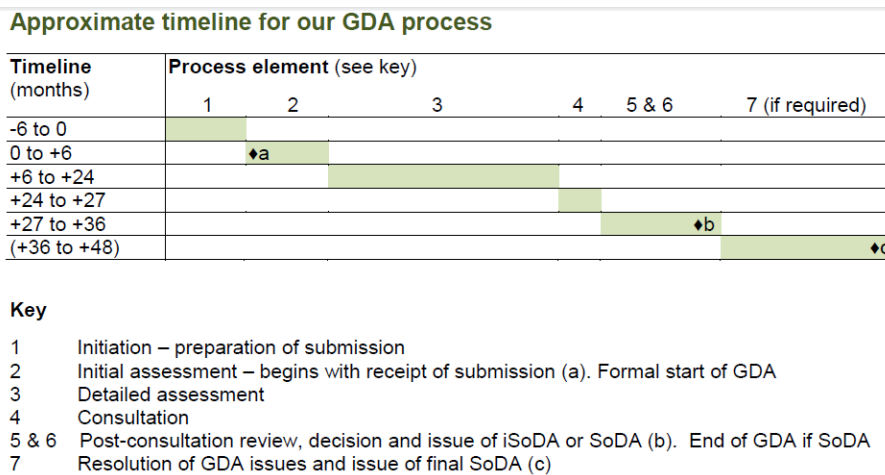


Figure 6-1: Indicative GDA Timeline - from P&ID [Ref-1]

For this submission, the GEP presents the currently available information to support the UK ABWR GDA process. As shown above, at this stage of the GDA the Environment Agency require sufficient information

to allow them to undertake their Initial Assessment, which is described in the P&ID as:

“...when we (the Environment Agency) receive the submission and examine it at an outline level, to identify whether:

- further information is required;*
- there are any matters that are obviously unacceptable;*
- any significant design modifications are likely to be required.”*

The Environment Agency goes on to state that they will look in detail at the requesting party's management arrangements for production of the submission, and they may look in more detail at:

- “the generic site description, to ensure it appropriately reflects the relevant constraints of potential sites; and*
- the assessment of the impact of proposed discharges to give early assurance that dose constraints will be complied with.”*

Hitachi-GE has provided the requested information in line with the requirements above to enable the Environment Agency to undertake their Initial Assessment. Hitachi-GE has also provided additional information to meet other P&ID requirements, support the wider GDA submission and enable meaningful discussion with the Environment Agency for subsequent stages of GDA.

It is recognised that some of the submitted information is considered ‘generic’ to both the ONR and the Environment Agency and will be presented in either the PCSR or the GEP suite of documents. There will be clear signposting between the submissions where this occurs. A significant example is the information relating to the Hitachi-GE Management Systems which is provided to both regulators. This information is therefore not contained within the GEP and can be found within the Description of Hitachi-GE Management Arrangements document [Ref-4].

It should be noted that there are gaps identified in this submission and plans have been put in place to provide the necessary information in later GDA Steps, as set out in the Forward Action Plan (FAP) outlined in section 9 of this document. It is also recognised that subsequent versions of the documents outlined in section 6.1 will develop to include this more detailed information as it becomes available, in order to allow the Environment Agency to undertake more detailed assessment later in the GDA process.

6.1. Structure of the GEP Reports

The major components of Hitachi-GE’s GEP submission and its structure have been guided by the layout of the P&ID [Ref-1]; however, some adjustments to this structure have been made to aid the presentation of information and information availability within Hitachi-GE. Table 6.1-1: Hitachi-GE GEP Core gives a high level indication of the contents of each GEP document submitted by Hitachi-GE.

In addition, information that is relevant in addressing the requirements of the P&ID and highly relevant to the GEP is presented in other submitted documents, including the PCSR and Common Documents. In these instances, there is clear signposting to ensure clarity.

Table 6.1-1: Hitachi-GE GEP Core Documents

GEP Number	Document ID/ Document Number	Document Name
E1	GA91-9901-0019-00001 XE-GD-0094	Summary of the Generic Environmental Permit Applications (this document)
E2	GA91-9901-0020-00001 XE-GD-0095	Generic Site Description
E3	GA91-9901-0021-00001 XE-GD-0096	Approach to Optimisation
E4	GA91-9901-0022-00001 WE-GD-0001	Radioactive Waste Management Arrangements
E5	GA91-9901-0023-00001 XE-GD-0097	Demonstration of BAT
E6	GA91-9901-0029-00001 3E-GD-K002	Approach to Sampling and Monitoring
E7	GA91-9901-0025-00001 HE-GD-0004	Quantification of Discharges and Limits
E8	GA91-9901-0026-00001 HE-GD-0005	Prospective Dose Modelling
E9	GA91-9901-0027-00001 XE-GD-0098	Other Environmental Regulations
E10	GA91-9901-0028-00001 XE-GD-0099	Consideration of and Compliance with the Radioactive Substances Regulation Environmental Principles (REPs)

6.1.1. Coverage of P&ID Requirements

Figure 6.1.1-1 Structure of the GEP Application shows how the P&ID requirements, shown in blue, are addressed through either the GEP documents, shown in green, or other GDA documents, shown in orange. The P&ID numbering relates to the item of the requirements included in the P&ID [Ref-1]. More information is provided in Appendix A.

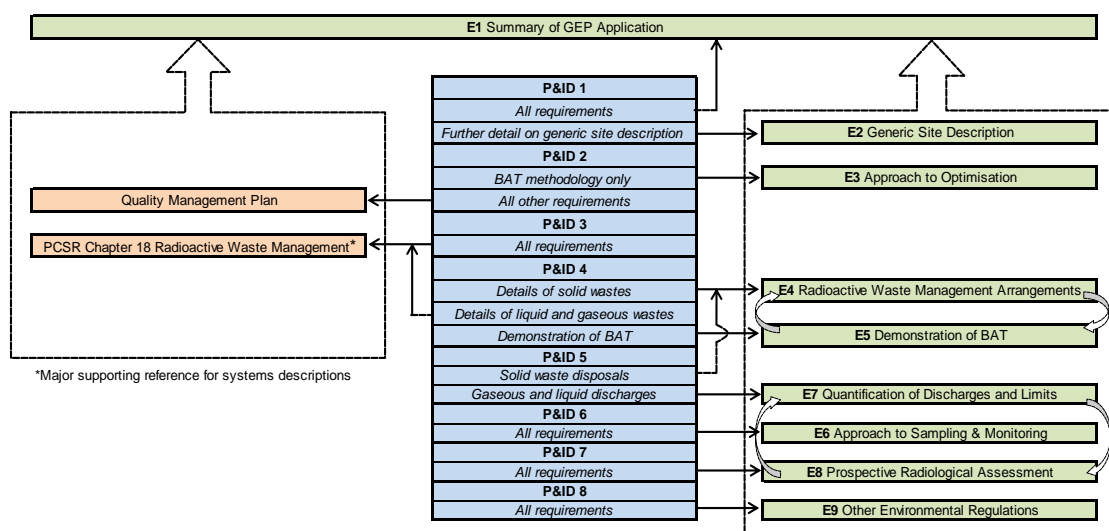


Figure 6.1.1-1: Structure of the GEP Application

Appendix A maps the P&ID requirements against the report structure laid out in Table 6.1-1: Hitachi-GE GEP Core above to give in understanding how the Environment Agency's P&ID requirements have been addressed. Where the full scope of requirements is met within the initial submission this is stated. Similarly, where information has not been submitted at this stage of the GDA process this is also stated. As stated above, the FAP is included within section 9 to highlight how any current gaps in information are being addressed.

7. Summary of Submission

What follows is a summary of the documentation that is included as part of the GEP submission, covering the core documents outlined in Table 6.1-1: Hitachi-GE GEP Core above and other supporting documentation in the PCSR and Common Documents.

7.1. Supporting Documentation

7.1.1. Management Arrangements

The management arrangements that support the delivery of the GDA process form an integral part of the GEP. The information requested in the P&ID regarding management arrangements is presented in the Description of Hitachi-GE Organisational Capability, Systems and Management Arrangements [Ref-4]. This document summarises the management system arrangements that are founded in Hitachi-GE's Quality Management Plan (For UK ABWR GDA Project) (QMP) [Ref-7] and its suite of supporting procedures.

The purpose of these quality assurance arrangements for GDA is to:

- Ensure nuclear safety as the first priority;
- Ensure conformity to all applicable laws, codes, standards, regulations and the UK Licensing Conditions, to fulfil regulatory expectations; and,
- Successfully complete the GDA process.

The Description of Hitachi-GE's Management Arrangements document is also the main document by which Hitachi-GE can demonstrate to the Environment Agency that their management arrangements are adequate to take the UK ABWR through the GDA process.

The Description of Hitachi-GE's Management Arrangements document identifies that the QMP has been prepared in accordance with ISO9001-2008, ISO 14001-2004 for which Hitachi-GE has certification, and IAEA Safety Requirement No. GS-R-3.

Appendix A of the QMP ('Management for Environmental Protection'), specifically considers the Environmental Agency's expectations during GDA activities related to radioactive substances, waste management and compliance with environmental permits. The Description of Hitachi-GE's Management Arrangements document and the QMP signpost to where and how important elements of the arrangements are addressed in supporting procedures, as described below:

- Information on how the management of the GDA project is arranged, the organisational structure and the associated roles and responsibilities is within the 'Communication, Reporting Lines and Distribution of Information in the GDA Organisation' procedure.
- The development of the design and methods for controlling change to the design of the UK ABWR are in the 'Generic Design and Development Control' and 'Design Change Control and Documentation' procedures.
- The capability of the organisation by way of the assessment of competency of individuals, including key environmental roles, within the Hitachi-GE GDA organisation and of

consultants supporting the organisation is delivered through the ‘SQEP Requirements for Hitachi-GE and Supplier Personnel’ procedure.

- Document control procedures, including document numbering and the methods used for formal communication within the GDA project and with the ONR/Environment Agency are detailed in the ‘GDA Document Control Manual’. The particular arrangements and agreements between Hitachi-GE and both regulators are provided in ‘Generic Design Assessment Interface Arrangements Office for Nuclear Regulation/Environment Agency and Hitachi-GE Nuclear Energy, Ltd. (Revision 0 September 2013)’. This document has been adopted as a supporting procedure to the management arrangements.
- Management arrangements shall be subject to self-assessment, auditing and checking by Hitachi-GE in accordance with ‘Assessment of GDA arrangements (Internal Audits, Self-assessment)’.

7.1.2. Technical description of Hitachi-GE Activities

The full technical description of Hitachi-GE activities is provided as the entire submission to the ONR and Environment Agency. Particularly relevant documents in the wider submission include:

- Hitachi-GE UK ABWR Concept Design (C1a) [Ref-6]
- Genesis of ABWR design (C2a) [Ref-8]
- Resilience of design against Fukushima type events (C3a) [Ref-9]
- Description of Hitachi-GE Organisational Capability, Systems and Management Arrangements (C4a) [Ref-4]
- US ABWR Design Control Document (C5a) [Ref-10] (for information purposes only).

7.2. The GEP Submission

7.2.1. The Generic Site Description (E2)

7.2.1.1. Site characteristics

The GSD [Ref-5] describes the characteristics of the generic site which have been used in the assessments in Hitachi-GE’s GDA submission. This information is provided to allow the Environment Agency (and other interested parties) to determine the basis of Hitachi-GE’s GDA submission, and carry out their own check modelling or assessments for the radiological impact assessment as required. Hitachi-GE believes that the information provided in this submission adequately represents a generic site.

The assessments which form part of the GDA submission include the initial radiological dose assessment which is part of the Prospective Dose Modelling [Ref-11]. This includes short-term, annual and collective dose assessments to humans and dose assessments on non-human biota.

In common with all likely new build sites in the UK, the generic site selected by Hitachi-GE is coastal. For the purposes of GDA the UK ABWR will be once-through sea-water cooled, drawing cooling water from the adjacent sea and returning the cooling water (12°C warmer) to the sea.

The geology at the generic site is assumed to be stable with no active faults. It should be noted that the seismic activity of potential sites is assessed on a site-specific basis by the ONR at the time of site licensing; the effects of seismic activity on the UK ABWR design itself is assessed elsewhere in the GDA submission as part of the PCSR.

The generic site and surrounding area is assumed to be a flat plain, with no large buildings, other than the UK ABWR nuclear power plant, in the immediate vicinity. In reality, all likely new build sites in the UK are situated adjacent to existing power stations. The actual effects of how neighbouring buildings are laid

out and local terrain will be considered at the site specific permitting stage.

The following additional general assumptions are also in place regarding the generic site:

- The site is not located on an aquifer;
- There is no standing water at the site;
- No water bodies or watercourses cross the site;
- There are no discharges made to rivers or streams; and,
- There is no ground or groundwater contamination present.

7.2.1.2. Data used

The actual figures, as opposed to the descriptive characteristics above, provided in the GSD document are limited only to those required in the assessments at this stage of GDA. Should the need arise, the GSD will be expanded to include additional parameters and data used in assessments in later GDA stages.

The majority of the data used in the radiological assessment are from generic publications/guidance and would be the same for any of the potential UK nuclear new build sites. In some instances additional site specific data has been used and this is described below.

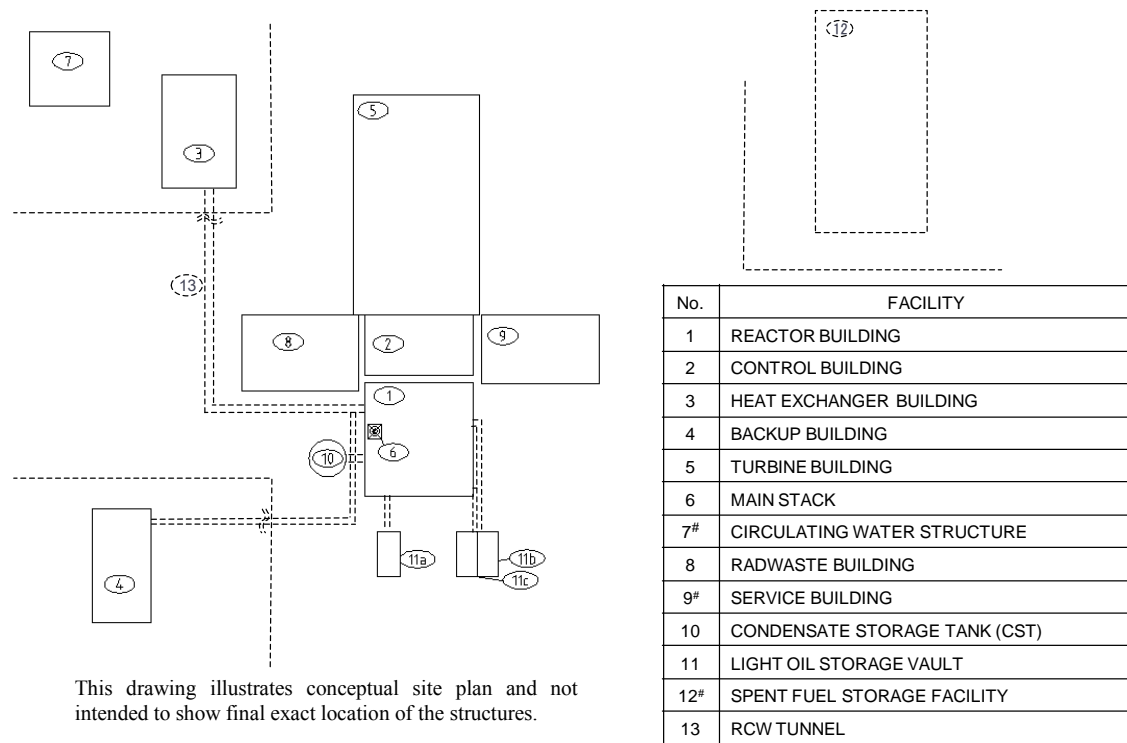
The parameters required for stage 1 modelling of the initial radiological dose assessment use generic datasets as included within modelling packages used within the UK nuclear industry. For stage 2 modelling of the initial radiological dose assessment, generic data sets are also used; however, in places, more refined data is conventionally used to deliver a realistic assessment. For the UK ABWR GDA, the dataset used for the stage 2 of the initial radiological assessment uses generic data augmented by real data from the North Wales coast. For stage 3 modelling of the radiological dose assessment, additional refined data from the Irish Sea has also been used to augment the main generic dataset.

This limited use of real data in stage 2 modelling of the initial radiological assessment has been analysed to make sure that it is representative of all likely new build sites in the UK, as well as to understand the extent of its influence on the dose assessment results. Following analysis, it has been shown to have limited influence on the resulting assessment.

More detailed descriptions of the settings of proposed UK ABWR sites and detailed impact assessments will be provided at site-specific permit application stage to fully assess the differences in individual sites characteristics. Such site-specific information will be used in subsequent assessments supporting the production of Environmental Statements (the product of the Environmental Impact Assessment [EIA] process), as well as Environmental Permit applications for radioactive substance activities, combustion activities and discharges to surface waters.

7.2.1.3. Generic site layout

The layout of the generic UK ABWR nuclear power station considered at GDA is shown in Figure 7.2.1-1 below. A description of the main components and operation of the UK ABWR is provided in the GDA UK ABWR Concept Design [Ref-6].



This drawing illustrates conceptual site plan and not intended to show final exact location of the structures.

Structures NOT included in the GDA scope

Figure 7.2.1-1: UK ABWR Power Station GDA Site Layout

N.B. Final locations of buildings, stacks and vents depend on site specific conditions and will be addressed as part of future building layout design activities.

As shown in Figure 7.2.1-1, there is a single discharge point to air for radioactive gaseous discharges on the roof of the reactor building. There will be separate gaseous discharge points for combustion plant (diesel generators etc). There will also be a single outlet for radioactive releases to sea (not shown in figure). Once determined there may be additional discharge points from interim storage facilities for ILW and SF. These will be incorporated into the generic site layout due course.

7.2.2. Optimisation Techniques (E3 & E5)

The requirement to undertake environmental optimisation for discharges of radioactivity and to demonstrate the application of BAT is defined for the GDA submission within the P&ID [Ref-1]. These requirements are consistent with the conditions included in the Environment Agency’s standard permit template and which would apply to any future operator of a UK ABWR. To ensure compatibility of the GEP application with all future site specific permit applications Hitachi-GE has elected to use the BAT conditions contained within the standard permit template. These conditions have been used to form the Claims that are integral to demonstrate the application of BAT.

In the case of demonstrating BAT, the objective of Hitachi-GE’s approach to environmental optimisation [Ref-12] is to deliver the following objectives:

- Protect members of the public from exposure to potentially harmful ionising radiation and reduce any doses to ALARA;
- Protect the environment within which we operate and live;
- Enable the nuclear power station to operate efficiently;

- Enhance reputation as a ‘good neighbour’; and
- Comply with regulations.

Hitachi-GE’s approach is guided by the following principles:

- **Evolution of the UK ABWR design:** Boiling water reactors benefit from a long operational history, which has enabled operational feedback to inform the design. Safety, environment and operability have all influenced how the design has evolved at each design iteration. Through the application of this methodology Hitachi-GE will demonstrate how the design has evolved resulting in very low discharges to the environment.
- **Integration of the BAT methodology into decision making:** There are several considerations that must be borne in mind when making decisions on the design and future operation of a nuclear power station. Some of these are directly attributed to the ONR requirements, for example, the reduction of worker dose to ALARA, whereas others are less specific, such as “trouble” (e.g. ease of implementation, operability and decommissioning implications) or “technology maturity”. Importantly, the demonstration of BAT needs to be integrated into the project programme and decision making process.
- **Opportunity:** Recognising that the demonstration of BAT should cover the lifecycle of the plant, certain elements will be best addressed during GDA whereas others will be better managed at a site-specific level. In conjunction with future operators, Hitachi-GE has endeavoured to identify the best time to deliver elements of the programme to ensure that opportunities to further optimise the UK ABWR can be realised.

The Demonstration of BAT report [Ref-13] presents the Claims, Arguments and Evidence which demonstrate the practice of generating electricity from the UK ABWR is optimised and that BAT is applied in:

- Preventing and minimising (in terms of radioactivity) the creation of radioactive waste
- Minimising (in terms of radioactivity) discharges of gaseous and aqueous radioactive wastes;
- Minimising the impact of those discharges on people, and adequately protecting other species;
- Minimising (in terms of mass/volume) solid and non-aqueous liquid radioactive wastes and spent fuel; and,
- Selecting optimal disposal routes (taking account of the waste hierarchy and the proximity principle) for those wastes.

The methodology for the demonstration of BAT selected here is already widely used in the nuclear and other high hazard industries in the preparation of safety cases, including that of the UK ABWR (the PCSR). This approach is also being used progressively to demonstrate environmental compliance for a number of projects in the UK nuclear industry including:

- GDA submissions for the Westinghouse AP1000 and the Areva UK EPR;
- The Environmental Permit (RSR) application for the proposed new nuclear power station at Hinkley Point in Somerset;
- Construction of facilities to support decommissioning of the Dounreay Site in Northern Scotland; and
- Construction of metallurgical manufacturing facilities at Nuclear Defence sites in the UK.

7.2.3. Radioactive Waste Management Arrangements (E4)

The Radioactive Waste Management Arrangements (RWMA) report [Ref-14] describes the strategy for managing radioactive wastes and spent fuel in the UK ABWR's lifecycle (including decommissioning).

The RWMA document concentrates upon those wastes which will be treated and packaged in some way either for immediate disposal or on-site interim storage as 'solid' waste, pending disposal at a later date, including SF. For solid wastes, the RWMA document establishes the quantities and types of radioactive waste that a single UK ABWR unit will produce. Further information on the waste volumes arising through decommissioning, along with the approach undertaken to decommissioning, is explained in full in the PCSR Chapter 31 on Decommissioning.

The systems in place for the management and treatment of gaseous and liquid radioactive discharges are described in PCSR Chapter 18 Radioactive Waste Management and will be underpinned by Demonstration of BAT [Ref-13]. As indicated by Figure 7.2.1-1, there is a single discharge point to air for radioactive gaseous discharges on the roof of the reactor building and there will be a single outlet for treated and permitted radioactive releases to sea. Once determined, there may be additional discharge points from interim storage facilities for ILW and SF. Consideration of these discharge points will be incorporated in due course.

Sources of radioactivity are generated within the reactor via different mechanisms and processes. These will be described in full in the Demonstration of BAT report [Ref-13] and other supporting documentation, including the RWMA document and the PCSR Chapter Reactor Chemistry. Examples of the sources of the radioactive species to be examined are:

- Fission of tramp Uranium;
- Fission of fuel fissile material;
- Fission of structural Uranium;
- Activation of structural component;
- Activation of coolant substance or impurity;
- Activation of fuel component or impurity;
- Ternary fission in fuel;
- Secondary neutron sources; and
- Boron in control rods.

The RWMA document has been produced with potential site operators in mind to ensure that any site specific documents can be developed [e.g. Integrated Waste Strategy (IWS)] and can follow on from these generic arrangements without any major changes/additions. The approach to this is described in the RWMA document.

7.2.4. Approach to Sampling and Monitoring (E6)

Hitachi-GE recognises that the description of the sampling arrangements, techniques and systems for measurement and assessment of discharges and disposals of radioactive waste is an important aspect of the GDA process. As part of the design development of the UK ABWR, the approach adopted and the commitment to undertake further design work for the discharge sampling/monitoring is included in the Approach to Sampling and Monitoring report [Ref-15].

At Step 2 GDA the actual sampling and monitoring arrangements that will be deployed in a UK ABWR are unconfirmed because the technology selection is influenced by the demonstration of BAT, the selection of

radionuclides for limits (based on the output of the Source Term RO), the need for information on plant performance and the final plant design/layout. Hitachi-GE has initiated a project to review the best approach to sampling and monitoring or radioactive releases.

7.2.5. Quantification of Discharges and Limits (E7)

The Quantification of Discharges and Limits document [Ref-16] establishes the approach that Hitachi-GE is adopting to estimate the radioactive discharges from the UK ABWR and to propose limits for a single UK ABWR unit. The approach for estimating discharges is based on the technique that is used for estimating discharges in Japan and has been extended to make use of actual discharge data available for operating Japanese ABWR units where available and applicable. Additional estimation techniques have been developed for a number of radionuclides that must be considered in the European Union which are not typically considered in Japan. The initial information within the Quantification of Discharges and Limits document [Ref-16] was provided to enable meaningful discussions to take place between Hitachi-GE and the Environment Agency as part of the GDA process.

As a result of on-going discussions with the UK Regulators (ONR/Environment Agency), additional work is now underway within Hitachi-GE to further define and justify the Source Term used for the quantification of radioactive discharges within the UK ABWR. This is captured within a Regulatory Observation (RO) (reference when available) on Source Terms. The (RO) Resolution Plan is in place to respond to the Source Term RO and is available on the Hitachi-GE web-site. The output will be used to inform the Quantification of Discharges and Limits document [Ref-16] in early 2015.

The results presented in within the wider GEP establish that, using cautiously derived data and based on initial assessments, the impacts of discharges from the UK ABWR will be within required dose constraints and dose limits. Further information on the associated dose assessment is contained within the Prospective Dose Modelling report.

7.2.6. Radiological Assessment (E8)

In accordance with the P&ID, a prospective radiological assessment is required at the proposed limits for discharges to the environment. The prospective dose assessment carried out for the UK ABWR is provided in the Prospective Dose Modelling report [Ref-11] and includes:

1. Annual dose to most exposed members of the public for liquid discharges;
2. Annual dose to most exposed members of the public for gaseous discharges (identifying separately the dose associated with on-site incineration where applicable);
3. Annual dose to the most exposed members of the public for all discharges from the facility;
4. Annual dose from direct radiation to the most exposed member of the public;
5. Annual dose to the representative person for the facility;
6. Potential short-term doses, including via the food chain, based on the maximum anticipated short-term discharges from the facility in normal operation;
7. A comparison of the calculated doses with the relevant dose constraints;
8. An assessment of whether the build-up of radionuclides in the local environment of the facility, based on the anticipated lifetime discharges, might have the potential to prejudice legitimate users or uses of the land or sea;
9. Collective dose truncated at 500 years to the UK, European and world populations; and,
10. Dose-rate to non-human species.

In line with industry practice, this process is broken down into a number of stages (not to be confused with GDA steps):

- Stage 1: uses the Environment Agency's Initial Radiological Assessment (IRA) methodology and standard generic parameters which enable a cautious assessment of the radiological impact of discharges.

If the assessed dose is $> 20\mu\text{Sv/y}$, then proceed to Stage 2:

- Stage 2: uses the IRA methodology and refined data with more realistic parameters.

If the assessed dose is $> 20\mu\text{Sv/y}$, then proceed to Stage 3:

- Stage 3: uses more detailed site-specific data. Stage 3 does not use the IRA methodology but more detailed codes (in the case of Hitachi-GE, PC CREAM 08[®]). The computer code PC-CREAM 08[®] comprises of a number of modules that predict the transfer of radionuclides in the environment.

A site-specific radiological assessment should be undertaken if the overall dose remains greater than $20\mu\text{Sv/y}$ at the end of Stage 2.

For GDA, the Stage 3 modelling for the discharges from the UK ABWR has been undertaken and the results are presented in the Prospective Dose Modelling report [Ref-11]. Should there be any changes to the Source Term, design or operational philosophy for the UK ABWR the dose modelling will be reviewed accordingly.

7.2.7. Conventional Impact Assessment (E9)

The P&ID [Ref-1] details the information Hitachi-GE is required to provide regarding the applicability and impact of other environmental regulations on the design and generic site. The areas in question relate to the non-radioactive regulations such as:

- Water use and abstraction;
- Discharges to surface waters;
- Discharges to groundwater;
- Operation of installations (combustion plant and incinerators); and,
- Substances subject to the Control of Major Accident Hazards Regulations (COMAH).

Within the Other Environmental Regulations report [Ref-17], Hitachi-GE have summarised the applicability of regulations in each of these areas, have undertaken aspects of the required assessments to support GDA and have established any additional actions to address the P&ID requirements in future GDA submissions.

7.2.8. Consideration of and Compliance with the REPs (E10)

Hitachi-GE have reviewed the full list of 'Fundamental' and 'Generic Developed Principles: Regulatory Assessment' from the Environment Agency's Radioactive Substances Regulation Environmental Principles (REPs) document [Ref-18]. Hitachi-GE's approach to demonstrating compliance is laid out in the Consideration of and Compliance with the REPs document [Ref-19]. The applicability of each REP to the UK ABWR design process has been assessed, and the document signposts out to other parts of the GDA submission where evidence of compliance can be found.

8. Links to other GDA Documentation

There are several important sources of information within the suite of safety related documents being prepared in support of the UK ABWR GDA submission. The key ‘common’ documents are:

- Hitachi-GE UK ABWR Concept Design (C1a) [Ref-6]
- Genesis of ABWR Design (C2a) [Ref-8]
- Resilience of design against Fukushima type events (C3a) [Ref-9]
- Description of Hitachi-GE Organisational Capability, Systems and Management Arrangements (C4a) [Ref-4]
- US ABWR DCD Rev.4 (C5a) (for information purpose) [Ref-10]

There are several important sources of useful information within the suite of safety related documents being prepared in support of the UK ABWR GDA submission. The key ‘safety’ documents are:

- Chapter 9: General Description of the Unit (Facility)
- Chapter 16: Auxiliary Systems
- Chapter 18: Radioactive Waste Management (this is the primary PCSR reference and is used to support the GEP submission)
- Chapter 19: Fuel Storage and Handling
- Chapter 20: Radiation Protection
- Chapter 23: Reactor Chemistry
- Chapter 27: Human Factors
- Chapter 28: ALARP Evaluation
- Chapter 29: Commissioning
- Chapter 30: Operation
- Chapter 31: Decommissioning
- Chapter 32: Spent Fuel Interim Storage

The table of contents of the entire PCSR is shown in the Generic PCSR:Master Table of Contents [Ref-20].

9. Summary of Forward Action Plan (FAP)

A Forward Action Plan (FAP) setting out the work to be undertaken during Step 3 of the GDA is shown in Table 9-1: GEP Forward Action Plan . For specific documents within the GEP submission (i.e. Demonstration of BAT) additional detailed actions are included within the specific report.

Table 9-1: GEP Forward Action Plan

GEP Report	Actions for Step 3 GDA
Summary Document (E1)	Update the E1 document to reflect changes to E2 to E10, including an update to the Forward Actions.
Generic Site Description (E2)	Update the Generic Site Description to take into account any other parameters used in the assessment and/or modeling of the UK ABWR.
Approach to Optimisation (E3)	Further integration of BAT methodology into Hitachi-GE's Design Control Process.
Radioactive Waste Management Arrangements (E4)	Provision of further information on the specific technologies (radioactive wastes, Spent Fuel) to be included within the UK ABWR for the management, supported by the demonstration of BAT (see E5).
Radioactive Waste Management Arrangements (E4)	To incorporate the findings of the Radioactive Waste Management Ltd. assessment of ILW and SF in relation to the long term disposal strategy in the UK. (Disposability Assessment).
Demonstration of BAT (E5)	For each Argument within the current document, provide sufficient Evidence to support the Demonstration of BAT and identify those areas subject to further optimisation by future site operators. See detailed Forward Action Plan within E5: Demonstration of BAT.
Approach to Sampling & Monitoring (E6)	Undertake further design work to supplement the sampling and monitoring system for the UK, and incorporate into the GEP submission.
Quantification of Discharges and Proposed Limits (E7)	Update the Quantification of Discharges and Proposed Limits (E7) report and data sets to reflect the outcome of the Source Term RO.
Prospective Dose Modelling (E8)	Update the Prospective Dose Modelling (E8) report and data sets to reflect the outcome of the Source Term RO and the proposed limits within E7.
Other Environmental Regulations (E9)	Completion of further modelling to underpin the potential environmental impacts for non-RSR aspects.
Consideration of and Compliance with the Radioactive Substances Regulation Environmental Principles (REPs) (E10)	Continued discussion and review of the REPs to ensure compliance with each is demonstrated.

Appendix A: Mapping of P&ID Requirements against GEP Reports

Item	Information required	Included in this submission?	Where in the GEP		Further information source (i.e. C1a, PCSR Strategy)
			Document	Section	
1	General information relating to the requesting party and the design.				
	Include:				
	Brief details about the requesting party, including its experience of reactor design and plants in service.	Yes	E1: Summary of GEP Submission	4	C1a: Hitachi-GE UK ABWR Concept Design (part of step 1a submission)
	A simple, outline description of the design including schematic diagrams.	Yes	E1: Summary of GEP Submission	5	
	A brief history of the design, identifying predecessor plant and the main design changes.	Yes	E1: Summary of GEP Submission	8	C2a: Genesis of ABWR design (part of step 1a submission)
	Identification of discharge points to the environment for gaseous and aqueous radioactive wastes.	Yes	E1: Summary of GEP Submission	5	
	Description and characteristics of the generic site (or sites) that the requesting party will use to provide its dose assessment (see item 7 below). 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.	Yes	E1: Summary of GEP Submission	7.2.1	E2: Generic Site Description
	A summary of the proposed discharges of radioactive waste and their potential impact on members of the public and non-human species at the generic site.	Yes	E1: Summary of GEP Submission	7.2.5 7.2.6	E4: Radioactive Waste Management Arrangements E7: Quantification of Discharges and Limits
A summary of the 'conventional' environmental impacts (see item 8 below) of the facility.	Yes	E1: Summary of GEP Submission	7.2.7	E9: Other Environmental Regulations	

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Item	Information required	Included in this submission?	Where in the GEP		Further information source (i.e. C1a, PCSR Strategy)
			Document	Section	
2	A description of the requesting party's management arrangements and responsibilities for:				
	Developing the design	No	-	-	This will be covered in the Hitachi-GE Quality Management arrangements for GDA. Specifically, the Design Development and Control procedure.
	Managing the GDA project	No	-	-	This will be covered in the Hitachi-GE Quality Management Plan and supporting procedure for organizational arrangements.
	Establishing the methodology for identifying the 'best available techniques' (BAT - see 4 below) and ensuring their use in the design	Yes	E3: Approach to Optimisation	Whole document	
	Producing and maintaining the submission	No	-	-	This will be covered in the Hitachi-GE Quality Management arrangements for GDA. Specifically the Master Document Submission List and the Document Control Manual.
	Ongoing communications with the regulators and responding to matters raised by them during GDA	No	-	-	This is addressed within the Interface Arrangements between Hitachi-GE and the Regulators. Management arrangements have been developed to support the specific requirements.

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Item	Information required	Included in this submission?	Where in the GEP		Further information source (i.e. C1a, PCSR Strategy)
			Document	Section	
	Maintaining records of design and construction	No	-	-	This will be covered in the Hitachi-GE Quality Management arrangements for GDA. Specifically the Document and Record Management Procedure and the Design Development Control procedure.
	Controlling and documenting design modifications, both during and after completion of GDA	No	-	-	This will be covered in the Hitachi-GE Quality Management arrangements for GDA. Specifically the Design Development Control procedure and the procedure for Design Change Documentation.
	Transferring information to potential operators and providing ongoing support to them throughout the reactor's lifecycle.	No	-	-	This being considered by Hitachi-GE and potential site operators. A plan will be developed for implementation during GDA Step 4.
3	Detailed information relating to the design.				
	Include:				
	A technical description of the facility's main plants, systems and processes, supported by process diagrams.	No	-	-	This information is provided in Step 2 PCSR documentation as referenced from the RWMA.
	Identification of the plants, systems and processes which have a bearing on: - radioactive waste (solid, liquid and gaseous) generation, treatment, measurement, assessment and disposal - the conventional environmental impacts (see item 8 below) of the facility.	No	-	-	This information is provided in Step 2 PCSR documentation as referenced from the RWMA.

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Item	Information required	Included in this submission?	Where in the GEP		Further information source (i.e. C1a, PCSR Strategy)
			Document	Section	
4	A detailed description of the radioactive waste management arrangements.				
	Include:				
	Identification of the strategic considerations with respect to radioactive waste management which underpin the design.	Yes	E4: Radioactive Waste Management Arrangements	-	RWMA updated to reflect current status of ILW And SF projects.
	A description of how radioactive wastes and spent fuel will arise throughout the facility's lifecycle (including decommissioning) and your plans for how they will be managed and disposed of, to encompass:	Yes	E4: Radioactive Waste Management Arrangements	-	RWMA updated to reflect current status of ILW And SF projects.
	- sources of radioactivity and matters which affect wastes arising	Yes	E4: Radioactive Waste Management Arrangements	-	Information provide and subject to change as a result of Source Term RO.
	- gaseous, aqueous and other wastes.	No	-	-	This information is provided in PCSRs for Chapter 18 Radioactive Waste Management Arrangements.
	A description of how the production, discharge and disposal of radioactive waste will be managed to protect the environment and to optimise the protection of people.	Yes	E5: Demonstration of BAT	-	The majority of the Claims, Arguments and Evidence are presented in E5: Demonstration of BAT. This will be developed further in Step 3 GDA.
You should describe your optimisation process and identify and justify the techniques you are proposing as BAT.	Yes	E3: Approach to Optimisation	Whole document		

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Item	Information required	Included in this submission?	Where in the GEP		Further information source (i.e. C1a, PCSR Strategy)
			Document	Section	
	In identifying techniques, you should address both the technology you use and the way the facility is designed and will be built, maintained, operated and dismantled.	Yes	E5: Demonstration of BAT	-	The majority of the Claims, Arguments and Evidence are presented in E5: Demonstration of BAT. This will be developed further in Step 3 GDA.
	In justifying techniques as BAT you should address the following, in respect of wastes arising throughout the lifetime of the facility:				
	- Preventing and minimising (in terms of radioactivity) the creation of radioactive waste	Yes	E5: Demonstration of BAT	-	The majority of the Claims, Arguments and Evidence are presented in E5: Demonstration of BAT. This will be developed further in Step 3 GDA.
	- Minimising (in terms of radioactivity) discharges of gaseous and aqueous radioactive wastes	Yes	E5: Demonstration of BAT	-	The majority of the Claims, Arguments and Evidence are presented in E5: Demonstration of BAT. This will be developed further in Step 3 GDA.
	- Minimising the impact of those discharges on people, and adequately protecting other species	Yes	E5: Demonstration of BAT	-	The majority of the Claims, Arguments and Evidence are presented in E5: Demonstration of BAT. This will be developed further in Step 3 GDA.
	- Minimising (in terms of mass/volume) solid and non-aqueous liquid radioactive wastes and spent fuel	Yes	E5: Demonstration of BAT	-	The majority of the Claims, Arguments and Evidence are presented in E5: Demonstration of BAT. This will be developed further in Step 3 GDA.

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Item	Information required	Included in this submission?	Where in the GEP		Further information source (i.e. C1a, PCSR Strategy)
			Document	Section	
	- Selecting optimal disposal routes (taking account of the waste hierarchy and the proximity principle) for those wastes	Yes	E5: Demonstration of BAT	-	The majority of the Claims, Arguments and Evidence are presented in E5: Demonstration of BAT. This will be developed further in Step 3 GDA.
	- The suitability for disposal of any wastes and spent fuel for which there is no currently available disposal route and how they will be managed in the interim so as not to prejudice their ultimate disposal. [You should obtain a view from the Nuclear Decommissioning Authority (as the UK authoritative source in providing such advice) on the disposability of such wastes and spent fuel.]	No	-	-	Hitachi-GE is in the process of obtaining the view from the Nuclear Decommissioning Authority in the form of Disposability Assessments. This will be included in (through reference) the E4: RWMA once completed.
5	Quantification of radioactive waste disposals. Provide quantitative estimates for normal operation of:				
	- Discharges of gaseous and aqueous radioactive wastes	Yes	E7: Quantification of Discharges and Limits	-	Information provided and subject to change as a result of Source Term RO.
	- Arisings of combustible waste and disposals by on-site or off-site incineration	Yes	E4: Radioactive Waste Management Arrangements	-	Information provide and subject to change as a result of Source Term RO.

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Item	Information required	Included in this submission?	Where in the GEP		Further information source (i.e. C1a, PCSR Strategy)
			Document	Section	
	- Arisings of other radioactive wastes [by category and disposal route (if any)] and spent fuel; 'Normal operation' includes the operational fluctuations, trends and events that are expected to occur over the lifetime of the facility, such as start-up, shutdown, maintenance, etc. It does not include increased discharges arising from other events, inconsistent with the use of BAT, such as accidents, inadequate maintenance, and inadequate operation. For gaseous and aqueous radioactive wastes, you should estimate your monthly discharges:	Yes	E4: Radioactive Waste Management Arrangements & E7: Quantification of Discharges and Limits	-	Information provided and subject to change as a result of Source Term RO.
	- On an individual radionuclide basis for significant radionuclides;	Yes	E7: Quantification of Discharges and Limits	-	Information provided and subject to change as a result of Source Term RO.
	- On a group basis (for example 'total alpha' or 'total beta') for other radionuclides;	Yes	E7: Quantification of Discharges and Limits	-	Information provided and subject to change as a result of Source Term RO.
	- Via each discharge point and discharge route.	Yes	E7: Quantification of Discharges and Limits	-	Information provided and subject to change as a result of Source Term RO.
	Provide your proposed limits for:				
	- Gaseous discharges	Yes	E7: Quantification of Discharges and Limits	-	Information provided and subject to change as a result of Source Term RO.

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Item	Information required	Included in this submission?	Where in the GEP		Further information source (i.e. C1a, PCSR Strategy)
			Document	Section	
	- Aqueous discharges	Yes	E7: Quantification of Discharges and Limits	-	Information provided and subject to change as a result of Source Term RO.
	- Disposal of combustible waste by on-site incineration.	Yes	E7: Quantification of Discharges and Limits	-	Information provided and subject to change as a result of Source Term RO.
	Provide your proposals for annual site limits (on a rolling twelve months basis) for gaseous and aqueous discharges, and monthly limits for disposals by on-site incineration, and tell us how you derived these. You may additionally propose limits to reflect an operating cycle, that is, 'campaign' limits.	Yes	E7: Quantification of Discharges and Limits	-	Information provided and subject to change as a result of Source Term RO.
6	A description of the sampling arrangements, techniques and systems for measurement and assessment of discharges and disposals of radioactive waste.				
	Include:				
	Details of in-process monitoring arrangements, as well as those for final discharges of gaseous and aqueous wastes, and disposals of non-aqueous liquid and solid wastes	No		-	An indication of approach is contained within this submission (E6) with further information to be provided in Step 3.
A demonstration that your proposals represent the best available techniques for monitoring	No		-	An indication of approach is contained within this submission (E6) with further information to be provided in Step 3.	

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Item	Information required	Included in this submission?	Where in the GEP		Further information source (i.e. C1a, PCSR Strategy)
			Document	Section	
	Confirmation that the sensitivity is sufficient to: - Readily demonstrate compliance with the proposed limits;	No		-	An indication of approach is contained within this submission (E6) with further information to be provided in Step 3.
	- Meet the levels of detection specified in reference EU, 2004.	No		-	An indication of approach is contained within this submission (E6) with further information to be provided in Step 3.
7	A prospective radiological assessment at the proposed limits for discharges and for any on-site incineration.				
	Include:				
	Annual dose to most exposed members of the public for liquid discharges	Yes	E8: UK ABWR prospective Dose Modelling	-	The prospective dose modelling will be updated throughout GDA to reflect changes to data and assumptions used.
	Annual dose to most exposed members of the public for gaseous discharges (identifying separately the dose associated with on-site incineration where applicable)	Yes	E8: UK ABWR prospective Dose Modelling	-	The prospective dose modelling will be updated throughout GDA to reflect changes to data and assumptions used.
	Annual dose to the most exposed members of the public for all discharges from the facility	Yes	E8: UK ABWR prospective Dose Modelling	-	The prospective dose modelling will be updated throughout GDA to reflect changes to data and assumptions used.
	Annual dose from direct radiation to the most exposed member of the public	Yes	E8: UK ABWR prospective Dose Modelling	-	The prospective dose modelling will be updated throughout GDA to reflect changes to data and assumptions used.

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Generic Environmental Permit

Revision D

(Continued)

Item	Information required	Included in this submission?	Where in the GEP		Further information source (i.e. C1a, PCSR Strategy)
			Document	Section	
	Annual dose to the representative person for the facility	Yes	E8: UK ABWR prospective Dose Modelling	-	The prospective dose modelling will be updated throughout GDA to reflect changes to data and assumptions used.
	Potential short-term doses, including via the food chain, based on the maximum anticipated short-term discharges from the facility in normal operation	Yes	E8: UK ABWR prospective Dose Modelling	-	The prospective dose modelling will be updated throughout GDA to reflect changes to data and assumptions used.
	A comparison of the calculated doses with the relevant dose constraints	Yes	E8: UK ABWR prospective Dose Modelling	-	The prospective dose modelling will be updated throughout GDA to reflect changes to data and assumptions used.
	An assessment of whether the build-up of radionuclides in the local environment of the facility, based on the anticipated lifetime discharges, might have the potential to prejudice legitimate users or uses of the land or sea	Yes	E8: UK ABWR prospective Dose Modelling	-	The prospective dose modelling will be updated throughout GDA to reflect changes to data and assumptions used.
	Collective dose truncated at 500 years to the UK, European and world populations	Yes	E8: UK ABWR prospective Dose Modelling	-	The prospective dose modelling will be updated throughout GDA to reflect changes to data and assumptions used.
	Dose-rate to non-human species*.	Yes	E8: UK ABWR prospective Dose Modelling	-	The prospective dose modelling will be updated throughout GDA to reflect changes to data and assumptions used.
	You should tell us which models you used to calculate these doses and why they are appropriate, and set out all the data and assumptions (with reasoning) that you used as input to the models.	Yes	E8: UK ABWR prospective Dose Modelling	-	The prospective dose modelling will be updated throughout GDA to reflect changes to data and assumptions used.

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(Continued)

Item	Information required	Included in this submission?	Where in the GEP		Further information source (i.e. C1a, PCSR Strategy)
			Document	Section	
8	Information relating to other environmental regulations				
	<i>Water use and abstraction</i>				
	Provide details and estimates of fresh water requirements for the design.	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
	Provide details and estimates of cooling water requirements for the design relevant to the generic site. Include consideration of:	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
	- Seawater or river water abstraction	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
	- Use of conventional cooling towers or hybrid cooling towers	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
	- Abstraction inlet fish deterrent schemes	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
	- Fish return systems.	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
	<i>Discharges to surface waters</i>				
	Provide a description of how aqueous waste streams will arise, be managed and be disposed of throughout the facility's lifecycle. Include:	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
- Sources and quantities of contaminants (including disinfectant and biocides), highlighting any priority substances (as specified in the 'Priority Substances' Directive (EU, 2008))					

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(Continued)

Item	Information required	Included in this submission?	Where in the GEP		Further information source (i.e. C1a, PCSR Strategy)
			Document	Section	
	- Identification of the effluent and surface water runoff streams contributing to the overall discharge and how they are controlled	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
	- Potential options and associated environmental impact for disposal of each individual effluent stream	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
	- The means of control in the event of detection of unplanned radioactive or other contamination of the discharge	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
	- Options for beneficial use of the waste heat produced	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
	- Environmental impact of thermal discharges.	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
<i>Discharges to groundwater</i>					
	If there will be discharges to groundwater, describe the nature and quantity of those discharges and provide an assessment of the impact on groundwater. (Note: 1. You should address prevention of accidental discharges of radioactivity to land and groundwater in your response to item 4 above. 2. We do not normally permit discharges to groundwater.)	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.

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Revision D

(Continued)

Item	Information required	Included in this submission?	Where in the GEP		Further information source (i.e. C1a, PCSR Strategy)
			Document	Section	
<i>Operation of installations (combustion plant and incinerators)</i>					
	Identify what combustion plant (for example, for standby generation or auxiliary boilers) will be provided.	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
	If the aggregate rated thermal input of all combustion plant is greater than 50 MW, provide a comparison of the proposed technology against our sector guidance.	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
	If the aggregate rated thermal input of all combustion plant is greater than 20 MW, describe how greenhouse gas emissions will be monitored.	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
	If the design includes an on-site incinerator with a capacity of 1 tonne or more per hour, provide a comparison of the proposed technology against our sector guidance.	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.
<i>Substances subject to the Control of Major Accident Hazards Regulations</i>					
	Identify any need for on-site storage of substances above the qualifying thresholds in COMAH99. If a threshold is exceeded, describe the measures taken in the design to prevent a major accident to the environment.	Yes	E9: Other Environmental Regulations	-	This requirement is addressed within the Step 2 submission.