

Hitachi-GE Nuclear Energy, Ltd.
UK ABWR GENERIC DESIGN ASSESSMENT
Resolution Plan for RO-ABWR-0071
(Turbine Gland Steam System – Discharges and Optimisation)

RO TITLE:	Turbine Gland Steam System – Discharges and Optimisation		
REVISION :	1		
Overall RO Closure Date (Planned):	31 st October 2016		
REFERENCE DOCUMENTATION RELATED TO REGULATORY OBSERVATION			
Regulatory Queries	RQ-ABWR-0840: Filtration of TGS and MVP discharges and effect on monitoring efficiency.		
Linked ROs	-		
Other Documentation	-		

Scope of work: To provide further information on a) the discharges from the Turbine Gland Steam System and b) a BAT demonstration for the system.

BACKGROUND

The Turbine Gland Steam System is a source of gaseous radioactive waste that is discharged to the environment. The Turbine Gland Steam System supplies sealing steam to the turbine shaft seal parts and the major valve gland parts [1]. The Gland Steam Evaporator receives makeup water from the Makeup Water Condensate System [1]. The Makeup Water Condensate System receives water from the Low Chemical Impurities Waste System (LCW) [2]. Alternatively, steam is supplied from the Heating Steam System. Air from the Gland Steam Exhauster is discharged to the exhaust stack [1].

The Turbine Gland Steam System is not fully considered in the Generic Environmental Permit (GEP) submission Rev E and Pre-Construction Safety Report (PCSR). Regulators have therefore been unable to assess the Best Available Techniques (BAT) or As Low As Reasonably Practicable (ALARP) aspects of this system and the impacts of its discharges.

In order to progress with the Generic Design Assessment of the UK ABWR design, regulators require appropriate information on BAT, ALARP argument, radioactive waste discharges (and any associated disposals) and radiological impacts arising from the operation of the Turbine Gland Steam System. This information should be provided as requested in the Process and Information Document (P&ID) [3] and Guidance to Requesting Parties [5].

Reference

- [1] Generic PCSR Sub-chapter 17.5: Turbine Gland Steam System. Revision B. Hitachi-GE 2015.
- [2] Generic PCSR Sub-chapter 16.1: Water Systems. Revision B. Hitachi-GE 2015.
- [3] Process and Information Document for Assessment of Candidate Nuclear Power Plant Designs. Version 2. Environment Agency 2013.
- [4] Generic PCSR Sub-chapter 18.3: Off Gas Radioactive Waste Management System. Revision B. Hitachi-GE 2015.
- [5] New Nuclear Reactors: Generic Design Assessment Guidance to Requesting Parties. ONR-GDA-GD-001 Revision 2. Office for Nuclear Regulation 2016.

Scope of Work

The RO has 6 Actions. This Resolution Plan shows how each Action will be addressed and the timeframe for the project plan and delivery of the work to provide further information on the Turbine Gland Steam System.

Summary of impact on GDA submissions:

<u>GDA Submission Document</u>		<u>Submission Date to EA</u>
Prospective Dose Modelling	(GA91-9901-0026-00001)	Rev. F, 8 th July 2016
Quantification of Discharges and Limits	(GA91-9901-0025-00001)	Rev. F, 8 th July 2016
Demonstration of BAT	(GA91-9901-0023-00001)	Rev. F, 8 th July 2016
Summary of the Generic Environmental Permit Applications E1	(GA91-9901-0019-00001)	Rev. F, 8 th July 2016
Process Source Term Methodology Report	(GA91-9201-0003-00946)	Rev.3, 29 th July 2016
Process Source Term Supporting Report	(GA91-9201-0003-00945)	Rev.3, 29 th July 2016
Calculation of Process Source Term Value	(GA91-9201-0003-00944)	Rev.4, 24 th June 2016
Topic Report on Design Basis Analysis	(GA91-9201-0001-00023)	Rev. 10, 31 st August 2016
Generic PCSR Sub-chapter 17.5	(GA91-9101-0101-17005)	Rev. C, 31 st August 2017
<u>Topic Report on Discharge Assessment</u>	<u>(GA91-9201-0001-00160)</u>	<u>Rev.2, 24th June 2016</u>
<u>during Normal Operation</u>		

Description of work:

It is proposed that the steps of work outlined below are undertaken to resolve the RO.

RO-ABWR-0071.A1

RO Requirement:

Provide details of the Turbine Gland Steam System including sources of steam, radionuclide content of steam, and discharge route(s).

PCSR chapter 17.5 [1] provides a general introduction to the Turbine Gland Steam System. In order for regulators to fully assess this discharge route, more details are needed on this system. The details we require include: the routing of the Turbine Gland Steam System including all routes that radionuclides reach the stack, the different sources of the water/steam, information on the radionuclide content of the steam used; and location and function of the radiation monitor used at the Gland Steam Condenser outlet point.

In addition, the exact location of the Gland Steam Condenser outlet point is not clear. Diagrams in the PCSR chapter 18.3 [4] show the Turbine Gland Exhauster entering the same line as the Mechanical Vacuum Pump to bypass the Off Gas system and discharge directly via the main stack. PCSR chapter 17.5 [1] states that 'air from the Gland Steam Exhauster is discharged directly to the exhaust stack' but the same document later states that 'the Off Gas system extracts the Gland Steam Exhauster discharge air to the exhaust stack'. Details of the exact location of the Gland Steam Condenser outlet point are required.

Resolution proposed:

Hitachi-GE will submit a Topic Report that will include the information detailed in RO-ABWR-0071 A1. This will be a combined Topic Report which will also include the response to RO-ABWR-0071.A2.. The Topic Report will provide :

- A description of the Turbine Gland Steam System including its function in the UK-ABWR
- Diagrams showing the operational modes of the Turbine Gland Steam System
- Details of the sources of steam used in the Turbine Gland Steam System
- Details of the radionuclide content of the steam
- A description of the discharge routes/points from the Turbine Gland Steam System.

The Topic report will be issued by 8th July 2016. Where relevant, information from this Topic Report will be reproduced in the GEP documents to be submitted on the same timeframe.

Timeframe to address resolution – final issue on 8th July 2016.

RO-ABWR-0071.A2

RO Requirement:

Demonstrate that the design and operation of the Turbine Gland Steam System is consistent with the application of Best Available Techniques (BAT).

The P&ID [3] requires justification that the UK ABWR design uses BAT to ensure that wastes arising are prevented or minimised in terms of radioactivity, volume and impact to people and non-human species. The GEP Rev E 'Demonstration of BAT' document does not consider BAT for the Turbine Gland Steam System. Regulators have not seen any claims, arguments or evidence to demonstrate that the Turbine Gland Steam System is consistent with the application of BAT. An adequate demonstration of BAT is required to show that the impacts of gaseous, liquid and solid radioactive wastes are minimised from the Turbine Gland Steam System. This should include details of operational controls that can be applied to minimise wastes and the monitoring arrangements that are relevant to the Turbine Gland Steam System.

The demonstration of BAT must consider the requirements of ALARP (see ROA3) to ensure that the design is optimised.

Resolution proposed:

Hitachi-GE will undertake a BAT assessment of the TGS system. This will be reported in a Topic Report, along with the response to RO-ABWR-0071.A1. The BAT assessment work is expected to include:

- Undertaking a review of the baseline Demonstration of BAT report to determine the impact of the new TGS evidence on the strength of the existing BAT arguments.
- Taking account of the findings from the impact assessment, identify options and differentiating attributes (such as safety, environment, operability and cost) that have the potential to impact on the generation of radioactive waste and public dose.
- Undertaking a literature review of any options using qualitative evidence to determine if the contribution that the TGS makes to the performance of the UK ABWR can be further optimised and if it is proportionate to do so.
- Review and update the arguments and evidence presented within the Demonstration of BAT report.

Timeframe to address resolution –

Topic Report issue on 8th July 2016.

Updated E5 issue on 8th July 2016

RO-ABWR-0071.A3

RO Requirement:

Demonstrate that the design and operation of the Turbine Gland Steam System reduces health and safety risks As Low As Reasonably Practicable (ALARP).

The ONR guidance to requesting parties [5] requires justification that the UK ABWR design meets the ALARP criteria for the reduction of health and safety risks. The identification of an additional waste stream with potential discharge of tritium to air means that the existing ALARP argument is incomplete. An adequate and comprehensive analysis of the Turbine Gland Steam System is required to demonstrate that the health and safety risks have been reduced As Low As Reasonably Practicable.

Resolution proposed:

Hitachi-GE will undertake an ALARP assessment of the TGS system using the GDA ALARP Methodology (XD-GD-0037). This

assessment will include:

- Initially a consideration of the development of gland sealing systems on BWRs, as well as good practice on worldwide BWRs;
- then, using some hazard identification (and information from the BAT and Dose Assessment Topic Report for other RO Actions), the level of risk for the UK ABWR design will be established, and;
- finally, additional options to reduce the level of risk will be identified and qualitatively assessed, in a similar manner to the BAT Topic Report for TGS.

The findings of the assessment will be recorded and reported in a Topic Report.

Timeframe to address resolution – Topic Report issue on 31st August 2016.

RO-ABWR-0071.A4

RO Requirement:

Provide information on the quantities of gaseous radioactive waste that will be discharged to the environment, either directly or indirectly, from the Turbine Gland Steam System. Provide any changes to the proposed discharge limits and radiological dose assessments related to discharges from the Turbine Gland Steam System.

The P&ID [3] requires quantification of radioactive waste disposals including discharges of gaseous and aqueous radioactive wastes. This is to include all aspects of normal operation. Regulators require quantification of the radioactive discharges from the Turbine Gland Steam System, plus details of any changes of proposed discharge limits and associated impacts on members of the public and non-human species. Quantification of discharges should include details of any variability of discharges during the operating cycle, including any short-term 'spikes' in discharges (including the quantity of radionuclides that may be present in any 'spike' and the time duration of any 'spikes').

Resolution proposed:

This action will be completed by inclusion of the updated information in Rev.2 of EUST discharge topic report, and RevF of E7 and E8. The work is expected to involve:

- Calculation of discharges from TGS during the operational phases of the reactor.
- Add to existing discharge data and re-calculate proposed gaseous discharge limits.
- Update E7 accordingly, to include comparison of UKABWR discharges with comparable international plant (E7).
- Re-run radiological dose model and update E8 with results.

Timeframe to address resolution –

Updated (Rev.2) EUST discharge topic report issue on 24th June 2016.

Updated (RevF) E7 and E8 reports issue on 8th July 2016.

RO-ABWR-0071.A5

RO Requirement:

Ensure that the relevant GEP and supporting GDA documentation, including the documentation related to resolution of the UK ABWR source terms RI-ABWR-0001 and RO-ABWR-0006, are updated appropriately and are consistent with the response to this RO.

The GEP and supporting GDA documentation are to be updated as appropriate to reflect resolution of this RO. The updated documentation should include that provided in response to the UK ABWR source terms RI-ABWR-0001 and RO-ABWR-0006. Any information provided in response to this RO, which the Environment Agency assessors rely on for assessment of the UK ABWR design, is to be made available to the public if possible (as detailed in the P&ID [3]).

Resolution proposed:

Hitachi-GE will submit all affected GEP documents.

Hitachi-GE will update affected ST documents

Timeframe to address resolution.

Updated E1 and E6 issue on 8th July

Process Source Term Methodology Report Rev.3 issue on 29th July 2016

Process Source Term Supporting Report Rev.3 issue on 29th July 2016

Calculation of Process Source Term Value Rev.4 issue on 24th June 2016

RO-ABWR-0071.A6

Carry out a review of discharge routes to the environment, and confirm if there are any other significant sources which are not already detailed in the GEP Rev E.

Resolution proposed:

Hitachi-GE will submit a Topic Report that will include all the information detailed in RO-ABWR-0071 A6. The work is expected to involve:

- Discharge route identification by using the Piping and Instrumentation Diagram (P&ID).
- Estimation of the potential discharge via the identified discharge routes
- A description of the methodology and process used for assessing discharge route significance
- A review of the identified discharges and confirmation if any of them are considered significant enough to include in the discharge and dose assessment.

The Topic report will be issued by 8th July 2016.

Timeframe to address resolution – final issue on 8th July 2016.

Table 1 RO-ABWR-0071 Gantt Chart

Programme Milestones / Schedule:

Refer to the below Gantt-chart for the programmed activities and the schedule for the resolution of the RO.

Resolution Plan for RO-ABWR-0071			June				July				August					September				October				
Step(1 to 6 correspond to the action)	Start	Finish	W/C 6	W/C 13	W/C 20	W/C 27	W/C 4	W/C 11	W/C 18	W/C 25	W/C 1	W/C 8	W/C 15	W/C 22	W/C 29	W/C 5	W/C 12	W/C 19	W/C 26	W/C 3	W/C 10	W/C 17	W/C 24	W/C 31
1	Develop TR on TGS system	7-Jun	8-Jul																					
2-1	Develop TR on TGS BAT	7-Jun	8-Jul																					
2-2	Update E5	7-Jun	8-Jul																					
3	Develop TR on TGS ALARP	7-Jun	31-Aug																					
4-1	Update EUST discharge	7-Jun	24-Jun																					
4-2	Update E7,E8	7-Jun	8-Jul																					
5-1	Update E1 and E6	25-Jun	8-Jul																					
5-2	Update Source Term related documents	7-Jun	29-Jul																					
6	Review of discharge route and develop TR	7-Jun	8-Jul																					
7	Regulators' Assessment	11-Jul	30-Oct																					
8	RO Closure		31-Oct																					

Reference: