

REGULATORY OBSERVATION	
REGULATOR TO COMPLETE	
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Date sent:	16th January 2015
Acknowledgement required by:	6th February 2015
Agreement of Resolution Plan Required by:	<i>To be determined by Hitachi-GE Resolution Plan</i>
Resolution of Regulatory Observation required by:	<i>To be determined by Hitachi-GE Resolution Plan</i>
TRIM Ref.:	2015/18292
Related RQ / RO No. and TRIM Ref. (if any):	RO-ABWR-0017, RQ-ABWR-0359
Observation title:	Demonstration that the approach taken to radioactive waste management reduces risks SFAIRP
Technical area(s) 15. Radwaste & Decommissioning	Related technical area(s) 21. Generic Environmental Permitting 10. Radiation Protection & (Level 3 PSA) 9. Reactor Chemistry 11. Mechanical Engineering
<i>Regulatory Observation</i>	
SUMMARY	
<p>The approach taken to the management of liquid, solid and gaseous radioactive wastes can involve complex decisions. There is a need to show that the chosen regimes adequately balance the different benefits and detriments of the approach in order to demonstrate that this reduces risks So Far As Is Reasonably Practicable (SFAIRP).</p> <p>The management of radioactive waste can be particularly important given the potential risks posed to workers and members of the public by its inadequate execution with reference to handling, storage and processing of the waste for both pre-disposal and its ultimate disposal. In addition the management of radioactive waste will have impacts on many other areas of the UK ABWR safety-case (for example, radiation protection, mechanical engineering and GEP), and submissions already provided or scheduled to be submitted to ONR or EA.</p> <p>The objective of this Regulatory Observation (RO) is to clearly define ONR's expectations for that demonstration and to state clearly our expectation that a robust demonstration (agreed worked examples) should be submitted to ONR by 31 March 2015. Completion for all aspects is expected in the draft PCSR expected 31st May 2015.</p> <p>The scope of the As Low As Reasonably Practicable (ALARP)¹ justification required by this RO for the management of liquid, solid and gaseous radioactive wastes should cover all operating conditions and states of the plant. The scope of the ALARP assessment should reflect the level of design detail in GDA. Regardless of the outcome of the ALARP justification of the management of liquid, solid and gaseous radioactive wastes for the UK ABWR, ONR needs to be satisfied that</p> <ol style="list-style-type: none"> (1) The approach chosen reduces risks SFAIRP; (2) A process of optimisation has been followed, that this process can be demonstrated to ONR in a transparent manner, and that it forms part of the safety-case for UK ABWR. <p>To do this Hitachi-GE need to provide a demonstration that their choices reduces risks SFAIRP, clearly identifying:</p> <ol style="list-style-type: none"> (1) What are the risks being mitigated, including likelihood and consequences; 	

¹ The terms ALARP and SFAIRP can be used interchangeably. The outcome of reducing risks SFAIRP is that the level of risk is ALARP *i.e.* the outcomes are the same.

- (2) What measures are in place to mitigate these risks, including the adoption of relevant good practice measures;
- (3) What options, or range of options, could be applied to further mitigate these risks; and
- (4) A demonstration of whether these options are reasonably practicable to implement or not.

Until this robust demonstration has been provided, which takes account of all relevant risks, ONR cannot form a judgement on whether the legal duty of controlling risks and reducing risks SFAIRP will be demonstrated in the radioactive waste management safety-case for UK ABWR.

BACKGROUND

ONR's radioactive waste, spent fuel and decommissioning assessment during Step 2 of GDA of UK ABWR concluded that Hitachi-GE had presented an adequate basis to proceed to Step 3.

For radioactive waste management, the selection of appropriate pre-disposal methods (including equipment choice) and operating regime requires a detailed holistic assessment of all of the relevant risks and a demonstration that on balance, they are reduced SFAIRP for the plant as a whole. Without that robust demonstration ONR is unable to judge whether the legal duty of controlling risks and reducing risks SFAIRP, also referred to, interchangeably, as ALARP, will be demonstrated.

This RO has therefore been raised to make clear ONR's expectations regarding the quality, content and timing of the ALARP justification.

REGULATORY EXPECTATIONS.

The management of radioactive waste is an example of an area where Hitachi-GE is able to influence and control the magnitude of the radiological hazards and their resultant risks posed by the UK ABWR design.

Radioactive waste management as defined in the IAEA Safety Glossary is:

"All administrative and operational activities involved in the handling, pre-treatment, treatment, conditioning, transport, storage and disposal of radioactive waste. Where:

conditioning. Those operations that produce a waste package suitable for handling, transport, storage and/or disposal. Conditioning may include the conversion of the waste to a solid waste form, enclosure of the waste in containers and, if necessary, provision of an overpack.

immobilization. Conversion of waste into a waste form by solidification, embedding or encapsulation. □ Immobilization reduces the potential for migration or dispersion of radionuclides during handling, transport, storage and/or disposal.

overpack. A secondary (or additional) outer container for one or more waste packages, used for handling, transport, storage and/or disposal.

packaging. Preparation of radioactive waste for safe handling, transport, storage and/or disposal by means of enclosing it in a suitable container. All of the above options, or combination of options either have been, or are being utilised by BWRs that are currently operating. This provides a strong indication that there are a number of options for UK ABWR which are reasonably practicable to implement. ONR's expectation is that the option, or combination of options which achieves the lowest level of residual risk and which is reasonably practicable, should be implemented.

pre-disposal. Any waste management steps carried out prior to disposal, such as pretreatment, treatment, conditioning, storage and transport activities.

- Pre-disposal is used as a contraction of 'pre-disposal radioactive waste management', not a form of disposal.

pretreatment. Any or all of the operations prior to waste treatment, such as collection, segregation, chemical adjustment and decontamination. processing. Any operation that changes the characteristics of waste, including pretreatment, treatment and conditioning.

segregation. An activity where types of waste or material (radioactive or exempt) are separated or are kept separate on the basis of radiological, chemical and/or physical properties, to facilitate waste handling and/or processing.

treatment. Operations intended to benefit safety and/or economy by changing the characteristics of the waste. Three basic treatment objectives are:

- (a) Volume reduction;

(b) Removal of radionuclides from the waste;

(c) Change of composition.

Treatment may result in an appropriate waste form.

- If treatment does not result in an appropriate waste form, the waste may be immobilized.

volume reduction. A treatment method that decreases the physical volume of a waste.

- Typical volume reduction methods are mechanical compaction, incineration and evaporation.
- Should not be confused with waste minimization.”

While this RO is concerned with the approach taken to management of radioactive wastes, the impacts and options available to mitigate the identified risks may be outside of the radioactive waste safety-case area (for example, shielding provisions). ONR would expect the demonstration to be based on the overall plant risks being reduced SFAIRP, by whatever appropriate means.

Further guidance on ONR's expectations is provided below.

More specific detailed guidance on ONR's expectations in relation to the management of radioactive waste is given in NS-TAST-GD-024 [1]. ONR's expectations with respect to demonstrating ALARP are also given in NS-TAST-GD-005 [2]. The Health and Safety Executive (HSE) have also published (online) a suite of guidance on ALARP [3-8]:

ONR expect Hitachi-GE to take due account of the principles and guidance set out in these documents when preparing their ALARP demonstration for the radioactive waste safety-case and approach taken to the management of liquid, solid and gaseous radioactive waste for UK ABWR. More specifically, ONR would expect Hitachi-GE to include the following:

- a) **Relevant Good Practice (RGP):** ONR expects Hitachi-GE to apply RGP as a minimum. 'Relevant' means it should be appropriate to the activity and associated risks, and should be up to date. ONR will form a judgement by comparing Hitachi-GE's proposed approach to radioactive waste management against RGP and good design principles. The use of good practice at the design stage is essential to demonstrating the achievement of ALARP.

As a guide, Hitachi-GE should aim and compare against levels of safety that are known to have been achieved in other designs. ONR expect that UK ABWR would not give rise to a risk level greater than that achieved by the existing practice for comparable functions. Where others are achieving a higher standard, ONR will challenge Hitachi-GE whether this standard is, in effect, good practice.

Common practice may not necessarily be good practice or reduce risks to ALARP and Hitachi-GE should not assume that it does. What is good practice may cease to be relevant with the passage of time and new technology may make a higher standard reasonably practicable.

- b) **Options and optioneering:** For UK ABWR a selection amongst options for radioactive waste management for liquid, solid and gaseous radioactive wastes will be needed.

An effective approach for demonstrating that risks are ALARP is to start with the safest option within the range of practicable solutions. This option should be chosen by Hitachi-GE unless they can show it is not reasonably practicable; in which case attention should pass to the next safest option. There should also be a comparison of the chosen option with the 'best' current practice to confirm that residual risks are no greater than the best of existing radioactive waste management practices for similar waste types.

ONR will form a judgement as to whether the approach taken to liquid, solid and gaseous radioactive waste presented for UK ABWR reduces risks to ALARP based on our knowledge as a regulator, including: knowledge of relevant good practice in the area, ONR's knowledge of other possible options, and our judgement of the arguments and evidence presented in Hitachi-GE's case.

To aid transparency in the ALARP demonstration, ONR would expect Hitachi-GE to record the range of options considered and discarded. ONR expect the ALARP demonstration to be made in an appropriate place in the safety-case for UK ABWR.

- c) **Known problem areas:** The ALARP demonstration should set out how known problem areas (e.g.

identified from Operational Experience Feedback (OEF), improved analysis, or improving standards) have been addressed and how and why the particular option, or solution chosen, was arrived at.

- d) **Proper balancing of all risks:** ONR expects Hitachi-GE to use good practice which will be relevant to the risks from operation of the UK ABWR and to cover all risks.

The ALARP argument needs to consider all types of risk that are relevant and where these conflict with one another, ensure that an appropriate overall balance is achieved in regard to their management. Risk should be considered over the life of the facility and all affected groups taken account of. The potential scale and nature of risks considered needs to be clearly presented.

- e) **Taking cognisance of all relevant legislation:** Hitachi-GE will have to select an approach taking account of legislation regulated by ONR and also the Environment Agency, where the requirement to apply Best Available Techniques (BAT) to discharges and disposals of radioactive waste applies. ONR would therefore expect Hitachi-GE to arrive at an 'optimised' solution, where the UK ABWR design will be capable of best meeting the requirements of all relevant legislation.
- f) **Uncertainties and the precautionary principle:** Where the potential radiological consequences are high, ONR would expect Hitachi-GE to take a precautionary approach by giving more weight to the use of sound engineering and operational practice rather than arguments about the probability of failure. The essence of the precautionary approach is essentially that precautions should be taken unless there is a good reason to think that the risk is insignificant.

Thought should also be given to the robustness of the conclusions of the ALARP demonstration with respect to uncertainties and to any assumptions employed in the demonstration. Where a case uses quantitative methods, sensitivity studies to test the robustness of the arguments should be provided.

References:

- [1] Technical Assessment Guides. Management of Radioactive materials and Radioactive waste on Nuclear Licensed site, NS-TAST-GD-024, Revision 4, ONR,
[2] Technical Assessment Guides, Guidance on the Demonstration of ALARP, NS-TAST-GD-005, Revision 6, ONR, September 2013.
[3] Principles and Guidelines to Assist HSE in its Judgements that Dutyholders have Reduced Risk as Low as Reasonably Practicable.
[4] Assessing Compliance with the Law in Individual Cases and the use of Good Practice.
[5] Policy and Guidance on Reducing Risks as Low as Reasonably Practicable in Design.
[6] HSE Principles for Cost Benefit Analysis in Support of ALARP Decisions.
[7] HSE – Risk Management: ALARP at a Glance.
[8] HSE – Risk Management: Cost Benefit Analysis (CBA) Checklist.

Regulatory Observation Actions

RO-ABWR-0036.A1 – Hitachi-GE to provide a robust demonstration to show that the approach taken to the management of radioactive waste reduces risks SFAIRP

Hitachi-GE should provide a robust demonstration for the methods chosen for management of radioactive waste for UK ABWR, which demonstrates that:

- (1) The option chosen reduces risks SFAIRP;
- (2) A process of optimisation has been followed, that this process can be demonstrated to ONR in a transparent manner, and that it forms part of the safety-case for UK ABWR

ONR would expect such a response to include a clear description of:

- (1) What the risks are that are being mitigated, including likelihood and consequences;
- (2) What measures are in place to mitigate these risks, including the adoption of relevant good practice measures;
- (3) What options, or range of options, could be applied to further mitigate these risks; and
- (4) A demonstration of whether these options are reasonably practicable to implement or not.

NOT PROTECTIVELY MARKED

ONR expect that the expectations given above, in addition to that given in relevant ONR guidance, as referenced in this RO, will be included in the submission provided in response to this Action.

While this RO is concerned with the approach taken to the management of radioactive waste, the impacts and options available to mitigate the identified risks may be outside of the radioactive waste management safety-case area (for example, shielding provisions). ONR would expect the demonstration to be based on the overall plant risks being reduced SFAIRP, by whatever appropriate means.

ONR recognise that some of the detailed supporting evidence that underpins the conclusions of this demonstration may not be available in a timescale compatible with this RO, however we would expect details of key supporting evidence (i.e. those which could materially change the conclusions) to be available, where reasonably practicable, along with details of what other supporting evidence will be made available during later steps in GDA.

RESOLUTION REQUIRED BY: 31 May 2015.

REQUESTING PARTY TO COMPLETE

Actual Acknowledgement date:

RP stated Resolution Plan agreement date: