

REGULATORY OBSERVATION

REGULATOR TO COMPLETE

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TRIM Ref:	
Related RQ / RO No. and TRIM Ref: (if any):	RQ-UKHPR1000-0265 (2019/201036) RQ-UKHPR1000-0406 (2019/221623) RO-UKHPR1000-0005 (2018/348624)
Observation title:	In-Core Instrument Assemblies Radioactive Waste Safety Case
Lead technical topic:	Related technical topic(s):
17. RadWaste, Decommissioning & Spent Fuel Management	9. Fault Studies 10. Fuel & Core 11. Human Factors 14. Mechanical Engineering 16. Radiological Protection 21. Environmental

Regulatory Observation

Background

ONR has commenced Step 4 of the Generic Design Assessment (GDA) for the UK HPR1000. During Step 3 of the GDA ONR sought information concerning the Requesting Party's (RP's) demonstration that non-fuel core components (NFCCs) can be managed safely, so that the relevant risks associated with their: retrieval, processing, packaging, transport and storage can be demonstrated to be reduced to as low as reasonably practicable (ALARP).

NFCCs are typically metal components used inside the nuclear reactor core, and are therefore subjected to an intense neutron flux during their operational life, and become activated. NFCC is a collective term for three types of components: Rod Cluster Control Assemblies (RCCA), Stationary Core Component Assemblies (SCCA) and In-Core Instrumentation Assemblies (ICIAs).

Some aspects of the management of ICIAs appear to be unique for the UK HPR1000 design, with limited experience found within the wider Chinese fleet of Pressure Water Reactors (PWRs) [Ref. 1]. The RP has provided a number of documents which refer to the characteristics and management strategy for ICIAs. The four key references are:

- Management Proposal of Waste Non-fuel Core Components [Ref. 1];
- The Waste Inventory for Operational Solid Radioactive Waste [Ref. 2] provides information on the ICIAs;
- Pre-Construction Safety Report, Chapter 23 (Radioactive Waste Management) [Ref. 3]; and
- Pre-Construction Safety Report, Chapter 29 (Interim Storage of Spent Fuel) [Ref. 4].

During Step 3 ONR assessed Refs. 1-4 and raised several Regulatory Queries (RQs) seeking further information/clarifications concerning the management of, and other aspects related to ICIAs: RQ-UKHPR1000-0265 [Ref. 5] and RQ-UKHPR1000-0406 [Ref. 6]. ONR's assessment of the RP's submissions and their responses to Refs. 5 and 6 has revealed several inconsistencies. For example:

- Some of the documents are not self-consistent i.e. Ref. 1;

- The waste classification of ICIA is unclear i.e. whether they are High Level Waste (HLW) and/or Intermediate Level Waste (ILW);
- The proposed waste management strategy for ICIA is unclear, particularly with respect to the proposals for their interim storage.

As well as the inconsistencies identified above, based on ONR's assessment of this topic to date, the generic safety case appears to provide very little information on ICIA and does not appropriately describe the risks and hazards associated with their management. Until these inconsistencies are resolved and the generic safety case is improved, with respect to scope and content related to ICIA, ONR is unable to reach a judgement whether the RP has developed adequate proposals to safely manage ICIA throughout their entire lifecycle, and whether relevant risks can be demonstrated to be reduced to ALARP. This RO is therefore being raised to:

- Articulate ONR's regulatory expectations;
- Ensure that inconsistencies in the ICIA management strategy/strategies are resolved in a satisfactory and timely manner during Step 4 of the GDA for the UK HPR1000; and
- Ensure updates are made to the generic safety case to demonstrate that ICIA will be safely managed within the UK HPR1000 facilities throughout their lifecycle from: generation, to interim storage, pending final disposal.

Relevant Legislation, Standards and Guidance

ONR's SAPs [Ref. 8] on radioactive waste management include a number of considerations relating to:

- RW.1 A strategy should be produced and implemented for the management of radioactive waste on a site;
- RW.2 The generation of radioactive waste should be prevented or, where this is not reasonably practicable, minimised in terms of quantity and activity;
- RW.3 The total quantity of radioactive waste accumulated on site at any time should be minimised so far as is reasonably practicable;
- RW.4 Radioactive waste should be characterised and segregated to facilitate its subsequent safe and effective management;
- RW.5 Radioactive waste should be stored in accordance with good engineering practice and in a passively safe condition;
- RW.6 Radiological hazards should be reduced systematically and progressively. The waste should be processed into a passive safe state as soon as is reasonably practicable;
- RW.7 Information that might be needed for the current and future safe management of radioactive waste should be recorded and preserved.

ONR has a number of Technical Assessment Guides (TAGs) which represent guidance for ONR inspectors on what they should expect of a nuclear licensee or duty holder. Relevant to this RO are:

- The specific TAG on radioactive waste management [Ref. 9], which contains further information including fundamental expectations, policy considerations and refers to relevant international guidance.
- Guidance on the demonstration of ALARP [Ref. 10] recognises the possibility for conflict in the different regulatory application of ALARP by ONR and the application of Best Available Techniques (BAT) by the Environment Agency in nuclear safety and environmental protection, which is of relevance to radioactive waste management. The TAG states it is important that, during optioneering studies carried out, that adequate weighting is given to health and safety aspects so that an overall ALARP solution that balances health, safety and environmental aspects is reached in an optimised manner.

ONR and the Environment Agencies (EA, Scottish Environmental Protection Agency (SEPA) and Natural Resources Wales (NRW)) have issued joint guidance to nuclear licensees on the management of higher activity waste on nuclear licensed sites known as the "Joint Guidance" [Ref. 10], which is also relevant to management of non-fuel core components, including ICIA. It is noted that:

- The Joint Guidance defines Higher Activity Waste (HAW) as "*HLW, ILW and such LLW as cannot be disposed of at present*", which all NFCCs within the UK HPR1000 meet the definition of upon arising.

This list is not intended to be exhaustive.

Regulatory Expectations

ONR's expectation is that the UK HPR1000 generic safety case should provide an adequate demonstration that risks relevant to radioactive waste management are reduced to ALARP. To achieve this, as part of the resolution of the RO, the RP should provide the following:

- Evidence that the inconsistencies in the ICIA management strategy have been resolved within the RP's submissions.
- Evidence to demonstrate that the risks associated with the; retrieval, processing, packaging, transport and storage of the ICIAs, can be demonstrated to be ALARP. This should take into account Relevant Good Practice (RGP) and provide a robust justification for what the RP considers to be RGP, and identify any gaps.
- Evidence that the generic safety case demonstrates that ICIAs can be safely managed within the UK HPR1000 facilities throughout the ICIA lifecycle.

The Regulatory Observation Actions (ROAs) given below are structured in such a way to enable provision of this information in a logical and step-wise manner, to facilitate ONR's assessment. More detailed regulatory expectations are also articulated under each ROA.

Early in Step 3 of GDA, ONR raised RO-UKHPR1000-0005 titled *Demonstration that the UK HPR1000 Design Reduces the Risks Associated with Radioactive Waste Management, So Far As is Reasonable Practicable* [Ref. 12]. [Ref. 12] and this RO are inextricably linked. ONR would therefore expect the RP to take account of any inter-dependencies between the work being delivered to resolve RO-UKHPR1000-0005 and work to address this RO.

References

- [Ref. 1] GH X 00100 064 DNFF 03 GN, Management Proposal of Waste Non-fuel Core Components, December 2019, CM9 Ref. 2020/501.
- [Ref. 2] GH X 00100 069 DNFF 03 GN, Waste Inventory for Operational Solid Radioactive Waste. November 2019. CM9 Ref. 2019/360596.
- [Ref. 3] HPR/GDA/PCSR/0023 Version 000-1, Pre-Construction Safety Report, Chapter 23, Radioactive Waste Management. CM9 Ref. 2020/13969.
- [Ref. 4] HPR/GDA/PCSR/0029 Revision 001, Pre-Construction Safety Report, Chapter 29, Interim Storage of Spent Fuel. CM9 Ref. 2020/13986.
- [Ref. 5] RQ-UKHPR1000-0265, July 2019, CM9 Ref 2019/201036
- [Ref. 6] RQ-UKHPR1000-0406, August 2019, CM9 Ref 2019/221623.
- [Ref. 7] ONR-GDA-GD-001 GDA guidance for HPR1000 ONR-GDA-GD-001, New nuclear reactors: Generic Design Assessment Guidance to Requesting Parties for the UK HPR1000, Revision 4. October 2019
- [Ref. 8] Safety Assessment Principles for Nuclear Facilities, 2014 Edition, Revision 1, Office for Nuclear Regulation, January 2020
- [Ref. 9] Nuclear Safety Technical Assessment Guide Management of Radioactive Materials and Radioactive Waste on Nuclear Licensed Sites, NS-TAST-GD-024, Revision 6, Office for Nuclear Regulation, September 2019.
- [Ref. 10] Nuclear Safety Technical Assessment Guide Guidance on the Demonstration of ALARP (As Low As Reasonably Practicable), NS-TAST-GD-005, Revision 10, Office for Nuclear Regulation, December 2019.
- [Ref. 11] The management of higher activity radioactive waste on nuclear licensed sites, Revision 2, February 2015, ONR, NRW, SEPA and EA, February 2015.
- [Ref. 12] RO-UKHPR1000-0005, Demonstration that the UK HPR1000 Design reduces the risks associated with radioactive waste management, so far as is reasonably practicable. October 2018, CM9 Ref. 2018/348624.

Regulatory Observation Actions

RO-UKHPR1000-0037.A1 – Robust Definition of ICIA Lifecycle Characteristics

In response to this ROA, the RP should:

- Provide information on, and a suitable justification for, the radioactive waste classification (i.e. Low Level Waste (LLW), Intermediate Level Waste (ILW) or High Level Waste (HLW)) of all types and components of ICiAs;
- Given the assumption that ILW will be interim stored until the Geological Disposal Facility (GDF) is available, information on whether any of the ICiAs are expected to decay to LLW during the storage period;
- Justify the basis for the decay storage period selected for the relevant type of ICiA, including any uncertainty relating to the defined decay period; and

The response to this ROA may be combined with any other ROA under this RO, if deemed appropriate.

Resolution required by 'to be determined by General Nuclear System Resolution Plan'

RO-UKHPR1000-0037.A2 – Robust Management Strategy for ICiAs.

In response to this ROA, and based on the outcome of ROA1 above, the RP should:

- Describe and justify the management strategies for the three types of ICiAs across the lifecycle from: generation to interim storage, pending disposal. The justification should also include reference to any optioneering undertaken.
- Justify, or otherwise, whether a period of decay storage for any of the three types of ICiAs is required within the Spent Fuel Pool (SFP) before they are transferred for interim storage.
- Justify the selected management strategies against RGP and any identified gaps.

The response to this ROA may be combined with any other ROA under this RO, if deemed appropriate.

Resolution required by 'to be determined by General Nuclear System Resolution Plan'

RO-UKHPR1000-0037.A3 – Appropriately Describe and Document, in the UK HPR1000 Generic Safety Case, the Risks and Hazards Associated with the Management of ICiAs.

In response to this ROA, and based on the outcomes of ROAs 1 and 2 above, the RP should:

- Provide a clear and logical description, supported by appropriate evidence, of the hazards associated with the management of ICiAs.
- Provide suitable and sufficient evidence that any faults associated with the management of the ICiAs have been identified, prevented and/or mitigated, together with an explanation of the measures implemented within the UK HPR1000 design.
- Clearly identify relevant limits and conditions in the interest of safety required for the management of ICiAs.
- Provide an adequate justification (i.e. evidence) that the relevant risks associated with the management of ICiAs will be reduced to ALARP.

The response to this ROA may be combined with any other ROA under this RO, if deemed appropriate.

Resolution required by 'to be determined by General Nuclear System Resolution Plan'

REQUESTING PARTY TO COMPLETE

Actual Acknowledgement date:

RP stated Resolution Plan agreement date: