

Packaging of Dounreay RHILW in TRU-Shield® Containers

(Conceptual stage)

Summary of Assessment Report

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Introduction

Dounreay Site Restoration Limited (DSRL) has sought Conceptual stage endorsement of proposals for the packaging of Dounreay RHILW in TRU-Shield® containers.

This Assessment Report provides the basis and findings of the Conceptual stage disposability assessment by NDA Radioactive Waste Management Directorate (hereafter RWMD) for packages of Dounreay RHILW in TRU-Shield containers. The assessment has been carried out through the Disposability Assessment process, whereby RWMD examines the disposability of proposed waste packages by assessment against standards and specifications and the GDF concept. This concept has been developed as part of the programme to implement geological disposal for the UK's higher activity wastes. Further information on the Letter of Compliance process is available elsewhere¹.

Background

The waste comprises a diverse range of materials that originate from operations undertaken at Dounreay; these included work in support of the UK's fast breeder reactor research programme, and include items that were irradiated in Dounreay's Prototype Fast Breeder Reactor (PFR), wastes arising from operations to reprocess PFR fuel, other operational wastes from post-irradiation examination of fuel and other experiments, and wastes from decommissioning reprocessing facilities.

By mass, the average composition of these wastes is dominated by steel (irradiated items and cladding type items arising from reprocessing operations), and polythene sheet and rigid plastic (operational wastes), although significant variation is expected – the waste stream is diverse in terms of material composition.

The majority of this waste has already been packed into 200 litre drums which are stored at Dounreay. The remainder is yet to be packed, although it is not 'arising' in the sense that it is still being produced.

In March 2007 DSRL were provided with Interim stage endorsement for the packaging of these wastes in baskets within 500 litre drums, encapsulated with a cementitious grout. Those proposals are no longer being pursued, for two reasons. Firstly, the previous proposals would have involved the construction of an encapsulation plant to package the waste, and also a shielded store, as the resultant packages would have been unshielded. The capital investment that would be required to build these new facilities is outside the annual funding constraint that has been placed on DSRL. Secondly, since the previous proposals were endorsed, Scottish Government Policy for higher activity radioactive waste management has changed, and now involves long-term storage of these wastes at or near

¹ NDA, Guide to the Letter of Compliance Process, NDA Document WPS/650, March 2008

their sites of arising. Geological disposal is not part of Scottish Government Policy, which requires that options for future waste treatment are not foreclosed.

The LoC Disposability Assessment process is based on the arrangements anticipated to follow on from the policy of the UK Government and the devolved administrations for Wales and Northern Ireland, namely geological disposal preceded by safe and secure interim storage, until a geological disposal facility is available to receive waste. These arrangements are used as the basis of this assessment. The regulators' view is that packages conditioned in anticipation of geological disposal, and assessed under the Letter of Compliance process, will also be suitable for long-term storage in accordance with Government policy in Scotland. Reference to geological disposal in this report refers to the assessment basis, not the planned outcome.

Waste Packaging Proposal and Scope of Assessment

Given the background described above, DSRL is proposing a site-wide strategy based on use of shielded containers, and without encapsulation of waste. DSRL's intention is to meet the requirements of Scottish Government Policy by providing waste packages that can be stored on site in the long term, and which are amenable to alternative future treatments (i.e. not foreclosing options), because they are not encapsulated. Non-encapsulation also removes the need for capital investment in an encapsulation plant, and use of shielded packages means that potentially cheaper, unshielded, stores can be used. Procurement of shielded packages as they are required spreads the capital cost associated with waste packaging.

This site-wide strategy is being applied to Dounreay RHILW with the proposed use of TRU-Shield containers to package the wastes. This range of containers is developed by Pacific Nuclear Systems in the US, and is typically used for the packaging and transport of trans-uranic wastes. The containers are double skinned, with the interspace being filled with lead to provide shielding. DSRL is proposing an addition to the range of containers, with several differences to those already in the range. The DSRL variant would have inner and outer skins made of stainless steel, and would be taller than the standard range to accommodate the waste as it is currently stored. It would also have an integral pallet to allow lifting and handling on-site. The packages would be vented. Should these waste packages eventually be consigned for geological disposal, DSRL proposes that this would be in groups of 4 within a stillage, which would be transported within one of the range of RWMD transport containers (known as SWTCs).

The 'stocks' waste which is already packed is held (unencapsulated) within 200 litre drums, which are themselves overpacked. It is proposed that these wastes would be retained within these current layers of containment, with one 200 litre drum and its overpack being placed in each TRU-Shield container. There are 1,166 of these 200 litre drums in stock, which would produce 1,166 TRU-Shield containers of stocks Dounreay RHILW.

It is proposed that the 'arising' wastes, which are not yet packed in any way, would be direct packed into TRU-Shield containers. It is predicted that this would produce a further 142 packages. Overall, these proposals will therefore produce a total of 1,308 waste packages based on TRU-Shield containers, including two distinct 'wasteforms', due to the different packaging proposals for stocks and arising.

Although the proposals do not include encapsulation of these wastes, the submission refers to the potential to add cementitious grout to the packages at a later date, should this be found to be necessary. For arising wastes this would lead to direct encapsulation, for stocks wastes the result would be entombment of the overpack within the TRU-Shield container.

The conclusions from this assessment have been referred to the RWMD Nuclear Safety and Environment Committee (NSEC). The comments of the NSEC are reflected in this document.

Outcome of Assessment

Compliance with Waste Package Specification

A Waste Package Specification does not exist for TRU-Shield containers, and so these proposals have been compared with both the Generic Waste Package Specification, which applies to all packages and the Waste Package Specification for 500 litre drums, which is the closest analogue amongst the range of containers for which a GDF is currently being planned to accommodate.

This comparison has revealed some areas of non-compliance, in particular:

- The package design is not currently compatible with the requirement to be able to lift individual packages out of stillages for monitoring and inspection;
- For arisings wastes, the necessary degree of containment has not been demonstrated for the proposed combination of waste container and wasteform;
- The proposals may result in significant voidage. RWMD continues to investigate the post-closure implications of package voidage, and should these be found to be unacceptable, void filling may be required. The multiple layers of containment in the stocks packages may hinder void filling;
- It has been difficult to quantify the expected impact performance of arisings packages on the basis of the information provided, and instead RWMD has calculated a 'target' impact release fraction which if achieved, would not present an operational safety issue. RWMD is not yet confident that DSRL will be able to demonstrate such a low release fraction for the arisings packages, and also notes that there is potential for a significant change in impact performance from a small change in impact energy (referred to as a 'cliff-edge effect') which is not consistent with requirements. This could be resolved by a change to the design of the lid.
- Doses from fire faults in the operational phase of a GDF have been estimated and found to be unacceptably high. RWMD considers that a case can be made for lower fire release fractions for some radionuclides which could resolve this – DSRL should make this case.

Compliance with Concepts for a Geological Disposal Facility

TRU-Shield containers are not currently part of the GDF concept, and would require introduction to this concept via a process of change control, should it be decided to adopt geological disposal as the defined end-point for these waste packages. Certainly, for any future Interim stage endorsement, it would be necessary to undertake a concept change to introduce these containers, such that a Waste Package Specification could be produced against which they could be compared. Any such decision to commence change control would be taken in consultation with the NDA taking due account of Scottish Government Policy and the overall business case for such a change.

As an initial, Conceptual stage assessment, these proposals have been compared with the concept as it stands, and the compliance issues noted above have been identified. In addition, there is a need to confirm that the waste packages, as proposed for transport (in groups of four within a stillage), will physically fit within the cavity of one of the existing range of Standard Waste Transport Containers (SWTC). These issues should be resolved before any change to the concept is sought, and also need to be resolved before Conceptual stage endorsement could be provided.

Regardless of the introduction of a novel container, these proposals also involve transport at a much later date than is envisaged for waste from other sites. Consideration of transport as part of disposability assessments is based on transport at the earliest planned date of 2040. The ability to transport waste at this date will allow maximum flexibility in planning consignments of waste to a GDF. DSRL has requested that this assessment also considers

whether waste packages would be transportable in 2100, as well as considering transportability at the usual 2040 date. RWMD recognises that any endorsements which are conditional on a particular transport date could constrain the planning of waste consignments to a GDF, and also recognises that planning for later transports could lead to an increased risk of future non-compliance, since transport regulations may not evolve favourably over such a long timescale. RWMD would need to seek advice from its Nuclear Safety and Environment Committee (NSEC) concerning the potential for endorsement of proposals for which transport would not be feasible until a date after 2040, based on existing regulations. The need to seek such advice from NSEC has already been highlighted in RWMD's assessment of PFR Decommissioning Wastes.

Statement of Disposability

Because of the areas of non-compliance noted above, RWMD has found that it has not been demonstrated that packages produced as proposed would be disposable, and therefore Conceptual stage endorsement has not been provided. A series of Action Points has been placed to help DSRL in reaching Conceptual stage endorsement.

Conclusions

Endorsement of these proposals cannot be provided at this time. A series of Action Points has been placed to help DSRL in reaching Conceptual stage endorsement. Any decision to commence change control of the GDF concept to accommodate these packages would be made taking due account of Scottish Government policy, NDA strategy and the overall business case for the change.

The findings from this assessment have been referred to the RWMD Nuclear Safety and Environment Committee (NSEC). The comments of the NSEC are reflected in this document.