

Packaging of Dounreay RHILW

(Interim stage)

Summary of Assessment Report

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Introduction

This is a summary of an assessment of disposability carried out by Nirex in response to an interim stage proposal from UKAEA for the packaging of Dounreay Remote Handled ILW (RHILW).

An Interim stage disposability assessment has been conducted and an Assessment Report produced. Issues have been identified through the disposability assessment and until these issues are resolved Nirex would not be able to endorse the packaging proposal through issue of an Interim stage Letter of Compliance.

Background

The Nirex mission is, "in support of Government policy, to develop and advise on safe, environmentally sound and publicly acceptable options for the long-term management of radioactive materials in the UK". This includes all intermediate-level radioactive waste and some low-level radioactive waste (ILW and LLW).

As part of this role, Nirex sets standards and specifications for the packaging of ILW and LLW, based on its Phased Geological Repository Concept (PGRC). Nirex issues Letters of Compliance (LoC) when proposed packaging methods are assessed to be capable of producing waste packages that would be consistent with Nirex requirements for long-term management and protection of the environment. This process is intended to minimise the risk of inappropriate treatment, the need for future repackaging or the creation of a new legacy of wastes to be dealt with by future generations, with all the attendant safety, environmental and cost implications. The process of obtaining a Letter of Compliance is embedded in the regulators' arrangements for the conditioning and packaging of ILW, as described in guidance issued by the regulatory bodies.

Nirex has performed an independent assessment of the specific waste packaging proposal for Dounreay RHILW, against the requirements for future storage, transport and disposal as embodied in the Nirex PGRC to confirm disposability of the proposed waste packages.

UKAEA's proposals for packaging Dounreay RHILW

The stored Dounreay RHILW have largely arisen as a result of the operation of the fast reactor fuel cycle on the Dounreay site and associated R&D wastes. They include arisings from the operation and maintenance of the Prototype Fast Reactor (PFR), PFR fuel reprocessing cycle, and miscellaneous wastes from on-site support facilities. PFR was shutdown in 1994, and fuel reprocessing and associated operations ceased in 1996. The Dounreay RHILW is currently packed in 200 litre drums. UKAEA has confirmed that any future arisings of RHILW would not be covered by this submission, but would be the subject of a future separate submission or specific addendum to this submission.

It is also proposed to co-package 25 litres of residual PFR fuel currently in solution with the Dounreay RHILW. It is proposed to solidify the fuel solution using cement in 1 litre cans and to place one can of immobilised fuel solution into 25 of the proposed packages of Dounreay RHILW.

It is proposed that a new packaging plant will be built at Dounreay to treat these remote handled wastes. The containerised waste would be imported into the plant in shielded flasks and unloaded onto a perforated sorting table where it would be remotely sorted and segregated for appropriate treatment. Some wastes may require additional treatment before packaging, for instance soft wastes may be compacted or loose particulate may be separately immobilised.

The wastes will be conditioned by cement grouting into Nirex standard 500 litre Drums and completed packages would be transferred to on-site storage to await transfer to a disposal facility.

The proposed packaging process would lead to a predicted 310 off 500 litre Drums with an average package radionuclide inventory at 2040 of 1,061 A₂ multiples¹ and a maximum package inventory of 5,343 A₂ multiples. When compared to a reference case conditioned volume of Unshielded ILW (UILW) for the 2001 National Inventory of 152,000 m³, the Dounreay RHILW would constitute 0.1% of the volume of the UILW waste inventory considered in the 2003 Generic Post-Closure Performance Assessment.

UKAEA has also provided a Conceptual stage submission describing proposals to solidify 25 litres of residual PFR fuel which is currently dissolved in an acidic solution. It is proposed to solidify this liquor using cement powders in 1 litre batches. 25 such 1 litre containers will be produced and are proposed to be added to 25 of the Dounreay RHILW packages.

Disposability assessment

The disposability assessment conducted by Nirex considers the proposed waste packages for compliance with the Phased Geological Repository Concept (PGRC). This is achieved by assessing the proposed waste packages against published generic safety assessments that address transport of waste packages to the facility and safety of operations at the facility. The wastes and packages are also assessed against the generic post-closure performance assessment.

The assessments of transport safety have demonstrated that it may not be possible for all the proposed drums of Dounreay RHILW to comply with all relevant criteria as the fissile material content of the waste packages is not encompassed within the generic cases defined in the current Design Safety Report for the proposed transport container. If a dedicated criticality safety case were to be written to demonstrate compliance with IAEA Transport Regulations then it should be possible to transport the waste in 285 mm thick-walled Type B transport containers.

The assessments of operational safety show that it should be possible for 500 litre Drums containing Dounreay RHILW to be handled and stored safely within a repository based on the PGRC, assuming an operational criticality safety assessment can be developed to support the fissile material loadings proposed by UKAEA.

Although the current assessments indicate assessed doses that, in the worst cases, approach significant fractions of the limits applied by Nirex, consideration of the conservatism in the assessments and expected future revisions to methodologies and assumed parameters would be expected to reduce the assessed doses considerably. It is concluded that this provides robustness against any future revisions to risk or dose targets.

¹ A₂ multiples provide a measure of the activity content of transport packages, where each radionuclide is weighted according to its damage potential.

The post-closure safety assessment has revealed that a package specific post-closure criticality safety assessment will be required to define the basis for criticality safety for Dounreay RHILW. No other significant areas of concern were identified that should prejudice disposal of packages containing Dounreay RHILW.

In summary, the Assessment of Disposability has concluded that a Disposability Safety Case ultimately could be made for packages containing Dounreay RHILW, assuming criticality safety can be demonstrated through package specific criticality assessments. During the course of the assessment, areas requiring additional work to progress the proposals beyond the Interim stage were identified, and these are summarised below.

Requirements for further development work

At the Interim and Final stages, it is required that the details of the proposals be substantiated through the provision of evidence in the following areas:

- production of the wasteform, including defining both the grouting process and the necessary pre-treatment of fines and the removal of residual PFR sodium coolant;
- provision of further information on the quantity and type of filters that may require specific processing with appropriate treatment proposals;
- documentation of the process, in particular final versions of the Criticality Compliance Assurance Document and the Waste Product Specification;
- provision of detailed proposals for the provision of waste package records;
- provision of finalised 500 litre Drum design drawings;
- provision of evidence that design and development has been, and will be, performed under a suitable Quality Management System;
- improvement and substantiation of the data on the radionuclide inventory and composition of the waste.

Conclusions

The Interim stage submission from UKAEA for the packaging of Dounreay RHILW in 500 litre Drums has been assessed.

Consistency of the proposed conditioned waste packages with the Phased Geological Repository Concept has been assessed and an Interim stage Disposability Assessment produced. In assessing the Interim stage proposal, Nirex has identified a number of issues that would need to be followed-up as the strategy is taken forward.

Some of the issues identified require further work to be undertaken now before Nirex can determine whether the proposal can be endorsed by the issue of an Interim stage Letter of Compliance.

The Conceptual stage submission for co-packaging immobilised PFR fuel residue as a component of Dounreay RHILW has also been assessed for consistency of the proposed conditioned waste packages with the Phased Geological Repository Concept and Nirex has identified a number of issues that would need to be followed-up as the strategy is taken forward.

Some of the issues identified require further work to be undertaken now before Nirex can determine whether the proposal can be endorsed by the issue of a Conceptual stage Letter of Compliance.