

## Harwell Remote-handled ILW (RHILW)

(Interim)

### Summary of Assessment Report

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#### **Background**

UKAEA has sought Interim Stage endorsement for the production of disposable waste packages containing Harwell Remote-handled Intermediate Level Waste (RHILW) and a number of additional wastes that would be packaged using the same process.

This document summarises the results of the assessment carried out by Nirex in response to the submitted proposals. The assessment has been carried-out as part of the Letter of Compliance process, whereby Nirex examines the disposability of the proposed waste packages by assessment against ILW packaging standards and specifications and the Phased Geological Repository Concept (PGRC). Further information on the Letter of Compliance process is available elsewhere<sup>1</sup>.

#### **Scope of the Proposals**

RHILW includes those wastes produced in radiation-shielded facilities or which require such facilities for packaging. The RHILW to be packaged on the Harwell site is a diverse waste, originating from the following:

- operational RHILW already in store at the Harwell and Winfrith sites;
- future arisings of operational RHILW;
- early decommissioning wastes from the Harwell and Winfrith sites.

RHILW has arisen from a wide range of activities on the Harwell and Winfrith sites, including reactor fuel fabrication; examination of irradiated fuel; development of reprocessing technologies; waste processing and recycling; radioactive source manufacture; and diverse research activities. Typically it includes redundant equipment, samples of radioactive materials and fuel, waste from development work and recycling, spent sources and general laboratory trash.

The waste may result in up to about 1000 packages. The radionuclide inventory is generally moderate but in a few cases package inventories could be towards the higher end expected in intermediate level waste. Amongst these higher activity wastes are sources, fuel residues and fuel components resulting from fuel element break-down. Consequently, careful control of the waste distribution is required to manage heat output, dose-rates and fissile loading. Nonetheless, the waste generally does not represent a major fraction of the total inventory of ILW.

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<sup>1</sup> *Guide to the Nirex Letter of Compliance Process*, Nirex Document WPS/650, June 2006.

## ***Packaging proposals***

To allow RHILW processing to start, the process has been considered by Nirex in two phases:

- the initial sorting, assay and packing of the waste into containers (500 litre drums);
- the encapsulation of the waste to produce disposable packages.

A period of interim storage of the packed but un-encapsulated wastes has been required to await the construction and operation of the final packaging plant.

The sorting and packing of the waste has been considered by Nirex and Final Stage endorsement of this phase of the process has been provided. Packing operations have commenced and at the time of writing more than 60 drums of waste have been packed and moved to storage. In addition to simple sorting and packing as outlined above, a number of particular items of waste have been identified as requiring additional treatment to render them suitable for packing with general RHILW.

The Harwell RHILW container is compliant with the Nirex specification for 500 litre drums. The container is double-skinned with a pre-cast cement annulus between the two skins. The container itself and the inner and outer lids are fabricated from stainless steel.

The final packaging of the waste to produce disposable waste packages is to be performed in the Waste Encapsulation Plant (WEP) to be constructed at Harwell.

Packages containing sorted and packed wastes would be retrieved from interim storage and transferred to WEP. In WEP the waste would be encapsulated by infiltration using a cement grout based on 3:1 mixture of pulverised fuel ash and ordinary Portland cement (PFA/OPC). After setting, the wasteform would be capped by a further addition of grout before the package was lidded.

Completed packages would be returned for continued storage to await transport to a final disposal facility.

## ***Assessment of Disposability***

The acceptability of the proposed packages has been assessed against criteria established within the Nirex PGRC and associated Generic Waste Package Specification (GWPS).

The Assessment of Disposability is based upon the inventory data supplied by UKAEA for general RHILW and for the various additional wastes. It has been noted that the definition of a fully accurate inventory is not possible until the packing of the RHILW has been completed and all data collected.

The proposed waste packages examined herein are consistent with the requirements of the Nirex GWPS and the process has been judged to follow established practice by waste producers for the packaging of solid wastes. Numerous analogues of the proposed wasteform are available and the associated development work assessed by Nirex provides confidence that an adequate wasteform could be produced by cement infiltration of the previously packed RHILW.

The assessments of transport safety show that it should be possible for 500 litre drums containing Harwell RHILW to comply with all relevant transport safety criteria if transported in a Type B transport container with 285mm thick walls, such as the Nirex Standard Waste Transport Container (the SWTC-285). In particular, it has been shown that the activity potentially released during the week following a notional transport accident would meet the necessary limits.

Similarly, the assessments of operational safety show that it should be possible for 500 litre drums containing Harwell RHILW to be handled and stored safely within the repository. Although the assessed doses for worst case accidents are significant fractions of the limits applied by Nirex, several conservatisms have been used in the assessment. Furthermore,

expected revisions to methods and parameters would be expected to reduce the assessed doses considerably. It is concluded that this provides robustness against any future changes to risk or dose targets.

The post-closure safety assessment revealed no significant areas of concern that should prejudice disposal of packages containing Harwell RHILW. This is due to the number of packages, the moderate average radionuclide inventory associated with them and the absence of materials that might cause problems.

A safe fissile mass for the proposed packages has been established, which would ensure that a criticality would not be plausible during transport or operations, or in the post-closure period. The assessment inventory complies with this safe fissile mass, showing that the packages would not present a criticality hazard.

In summary, the Assessment of Disposability has concluded that a Disposability Safety Case ultimately could be made for packages containing Harwell RHILW, and that the proposals for the packaging of these wastes can be endorsed at the Interim Stage. 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***

The assessment by Nirex has been based upon the development work performed by UKAEA. At the Final Stage, it is required that the necessary arrangements for the operation of the proposed packaging plant should be agreed and demonstrated through the following:

- demonstration of the satisfactory operation of the completed plant by providing the results of commissioning activities;
- development of the (Quality) Management System for the operation of WEP;
- documentation of the endorsed packaging process through issue of an approved Waste Product Specification (WPrS) for the encapsulation of the waste in WEP;
- provision of an updated Criticality Compliance Assurance Documentation (CCAD), taking account of the overall disposition strategy for Harwell RHILW (and any potential revision of the fissile limits, to be agreed separately to the current assessment);
- provision of detailed proposals for producing waste package records;
- proposals for the onward storage of completed waste packages;
- continuing provision of evidence that activities such as plant commissioning and the continuing packing of waste in the plant have been, and will be, performed under a suitable (Quality) Management System.

At this time, Nirex is not aware of any issues that require specific experimental work.

### ***Conclusions***

The assessment of the proposals has concluded that packages containing Harwell RHILW are potentially consistent with disposal under the PGRC and can be endorsed at the Interim Stage. The consistency of the proposed waste packages with the PGRC has been demonstrated through the provision of an Assessment of Disposability.