

Remote Handled ILW at Harwell in Waste Encapsulation Plant (progress towards final)

Summary of Assessment Report

Issue date of Assessment Report: 7 September 2010

Background

Research Sites Restoration Ltd (RSRL) has sought Final Stage endorsement for the packaging of Harwell Remote-handled Intermediate Level Waste (RHILW) and a number of additional wastes. All the waste is currently held at Harwell where the waste is either stored within cans within the Harwell vault store awaiting packing or has already been packed into 500 litre drums.

Historically, the Radioactive Waste Management Directorate (RWMD) has separately assessed and endorsed:

- 'packing' of Harwell RHILW; and
- subsequent 'packaging' of Harwell RHILW.

In this context, 'packing' is defined as the retrieval and any necessary preparation of Harwell RHILW and placement of the waste into stainless steel 500 litre drums. 'Packaging' is defined as the conditioning step whereby the contents of the 500 litre drum are encapsulated by the addition of cementitious grout. This separate consideration of two stages of waste processing reflects the historic necessity to make progress with waste packing, in advance of the completion of development work for final packaging. The packing of RHILW received Final stage endorsement in December 2000.

This Assessment Report summarises the conclusions of the assessment carried out by RWMD of the Final stage submission for 'packaging'. Due to delays in the inactive commissioning programme for Harwell WEP, many significant documents were not available for assessment. This assessment report has been prepared by RWMD to provide RSRL with the current status of the assessment and to highlight additional information required in order to issue a Final stage Letter of Compliance for the packaging of Harwell RHILW.

The assessment has been carried out as part of the Letter of Compliance process, whereby RWMD examines the disposability of the proposed waste packages by assessment against ILW packaging standards and specifications. Further information on the Letter of Compliance process is available elsewhere ^[1].

Scope of the Proposals

This assessment has considered the compatibility of the proposed packages with the requirements for safe long-term management, including storage, transport, emplacement and extended storage underground, and disposal. Where appropriate,

¹ *Guide to the RWMD Letter of Compliance Process*, RWMD Document WPS/650, March 2008.

the effects of prolonged storage of the waste on the site of arising have also been assessed.

This report also provides an assessment of disposability of the proposed waste packages. This represents our advice as to the disposability of the proposed waste packages based upon the standards and specifications developed from our disposal concept. This considers safety and environmental protection requirements for transport, handling and disposal of radioactive waste. The assessment of disposability would be expected to contribute to the Radioactive Waste Management Case to be produced by licensees as required by the regulators, and specifically to the reasoned judgement that the conditioned waste will meet the anticipated requirements for acceptance from the potential disposal site operator.

The UK radioactive waste inventory identifiers for the raw waste covered by this assessment include:

- 5C30 – Harwell Remote Handled ILW;
- 5C54 – Zenith Fuel;
- 6C32 – NDS² Remote Handled ILW.

Once the raw waste is packed into drums, it becomes part of waste stream:

- 5C52 – Processed RHILW.

RHILW includes those wastes produced in radiation-shielded facilities or which require such facilities for packaging. The RHILW to be packaged at Harwell is diverse, originating from a wide range of activities on the RSRL sites, including:

- reactor fuel fabrication;
- examination of irradiated fuel;
- development of reprocessing technologies;
- waste processing and recycling;
- radioactive source manufacture;
- diverse research activities.

Typically, the RHILW includes redundant equipment, samples of radioactive materials and fuel, waste from development work and recycling, spent sources and general laboratory trash.

The RHILW is currently stored in cans within the Harwell vault store and is being retrieved for sorting and characterisation, before being packed into 500 litre stainless steel drums. It is anticipated that the waste will produce around 700 drums for disposal. 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 strontium-90 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.

It is suggested that the proposals be considered as MEDIUM priority under the current regulatory prioritisation scheme³. The principal reason for this judgement is

² National Disposal Service - waste from industry, hospitals and research establishments.

³ *The Management of Radioactive Waste on Nuclear Licensed Sites – Part 1: The Regulatory Process*, Guidance from the Health and Safety Executive, the Environment Agency and the Scottish Environment Protection Agency to nuclear licensees, February 2010.

the potentially high dose rates from some packages in the event of the project being ill-conceived or implemented. RSRL is advised to seek the necessary interaction with regulators to confirm this position.

Packaging proposals

To allow processing of the RHILW to start, the process has been considered by RWMD in two separate phases; packing and packaging, as explained above.

A period of interim storage of the packed but un-encapsulated wastes has been required to await the construction and operation of the final Waste Encapsulation Plant (WEP). The WEP has now been constructed and is currently undergoing inactive commissioning.

Packing operations have commenced and, at 1 April 2010, 328 drums of waste had 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 RWMD 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. In July 2007, RWMD endorsed the use of a metal-to-metal seal, replacing the elastomeric seals, to improve drum performance.

According to the current plan, packages containing sorted and packed wastes will be retrieved from the vault store 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 Portland cement. After setting, the wasteform would be capped by a further addition of the same type of grout before the package is lidded.

Completed packages would be returned for continued storage in the vault store to await transport to a geological disposal facility.

Assessment of Disposability

The acceptability of the proposed packages has been assessed against criteria established for geological disposal within the Generic Waste Package Specification.

The Assessment of Disposability is based upon the inventory data supplied by RSRL for the packed RHILW (wastestream 5C52), supplemented by data on the raw wastes from the UK Radioactive Waste Inventory. It has been noted that the definition of a fully accurate inventory is not possible until the packing of the waste has been completed and all data collected.

The proposed wasteform is consistent with the requirements of the GWPS and the encapsulation process has been judged to follow established practice for the packaging of solid wastes. Numerous analogues of the proposed wasteform are available and the associated development work assessed by RWMD provides confidence that an adequate wasteform could be produced by cement infiltration of the packed RHILW. Evidence (e.g. the inactive commissioning report) that an adequate wasteform can be achieved in practice has not yet been supplied to RWMD.

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 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 a Geological Disposal Facility.

The post-closure safety assessment revealed no significant areas of concern that should preclude disposal of packages containing Harwell RHILW.

The assessment of criticality safety has been based on the currently approved safe fissile mass limits of:

- 70g U-235 equivalent for drums containing more than 1kg graphite,
- 88g U-235 equivalent for drums containing less than 1kg graphite.

It is noted that RSRL is currently investigating the possibility of increasing these limits.

Outstanding requirements for completion of Final stage assessment for packaging of Harwell RHILW

The following key information is required to enable RWMD to complete the assessment for packaging of the Harwell RHILW:

- an issued version of the *Waste Product Specification for Encapsulation of waste in WEP*,
- Provide an approved version of the *CCAD*, with a completed Section 4.2 'Current limits'.
- the *Inactive Commissioning Report*, and any relevant Local Working Instructions, procedures and quality plans.
- a description of the full suite of records that support the disposability of the packages, and provision of a *sample drum record* detailing what RSRL will record for each 500 litre drum.

Conclusions

An Assessment of Disposability has been completed as far as is possible at this stage based on the information provided to date by RSRL. This assessment report has concluded that packages containing Harwell RHILW are potentially consistent with disposal under the geological disposal concept. Further information necessary to complete and address outstanding issues has been identified. Once the additional documentation required for Final stage assessment has been received and reviewed by RWMD, a decision on whether the packages can be endorsed at Final stage will be made.