

Packaging of Solid ILW at Hinkley Point A Decommissioning Site (Conceptual stage)

Summary of Assessment Report

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Introduction

This is a summary of an assessment carried out by Nirex in response to a proposal from British Nuclear Group Magnox Electric Ltd for the retrieval, containerisation, storage and eventual grouting of Solid Intermediate Level Waste at Hinkley Point A Decommissioning Site.

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 specifications and standards for the packaging of ILW and some LLW, based on its Phased Geological Repository Concept (PGRC)¹. Nirex issues Letters of Compliance when the proposed packaging methods are judged 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 and 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 the guidance issued by the regulators^{2,3}.

In line with regulatory guidance, Nirex carries out independent assessment of the specific waste packaging proposals in particular to assess disposability of the proposed waste packages by consideration against the requirements for future storage, transport and disposal as embodied in the Nirex PGRC and the Nirex Generic Waste Package Specification.

¹ *The Nirex Phased Disposal Concept*, Nirex Report N/074, July 2003.

² *Improved Regulatory Arrangements for the Conditioning of Intermediate Level Radioactive Waste on Nuclear Licensed Sites: Provision of Advice to the Health and Safety Executive by the Environment Agency and the Scottish Environment Protection Agency*, Regulators' Position Statement, December 2003.

³ *Conditioning of Intermediate Level Radioactive Waste on Nuclear Licensed Sites: Provision of Advice by the Health and Safety Executive, the Environment Agency and the Scottish Environment Protection Agency*, Guidance to Industry, March 2005.

Magnox Electric Ltd Proposals for Hinkley Point A solid ILW

At Hinkley Point A, solid intermediate level waste (ILW) has been generated from the treatment of spent Magnox reactor fuel prior to its transport to Sellafield for reprocessing. The Hinkley Point A solid ILW comprises Fuel Element Debris including Magnox items known as splitter vanes and braces (or splitters) and end fittings including Nimonic springs that are removed from the outside of fuel elements to assist with packing for transport. The resulting waste is composed of predominantly Magnox metal (a magnesium-based alloy that corrodes relatively easily), Nimonic springs and miscellaneous steel items. These are currently held in storage vaults on site which are either dry or water-filled depending upon the particular vault design.

The published strategy for Hinkley Point A solid ILW involves early retrieval and packaging to Nirex standards and specifications through a process of mechanical retrieval from storage vaults, sorting to remove any pieces of nuclear fuel and mobile material, placement in stainless steel Nirex standard 3m³ Boxes and immobilisation using a cement grout. The waste packages would then be transferred to a purpose-built, shielded ILW store on the Hinkley Point site to await the availability of a national long-term waste management facility.

Magnox Electric Ltd has been encouraged by the Nuclear Decommissioning Authority (NDA) to examine whether the current strategies for decommissioning and waste management at Magnox reactor sites can be improved and whether they offer best value for money. Consequently, the 'Magnox Innovations Project' has been established, and has challenged current waste management practices for wastes produced by the operation of Magnox reactors.

The Magnox Innovations Project has identified an alternative "innovation" strategy for Hinkley Point A solid ILW that does not provide for early packaging to Nirex standards and specifications. Instead, the solid ILW would be retrieved from its storage vaults, sorted to remove any fuel fragments and wastes that require additional treatment, including mobile particulate material, and then transferred into stainless steel 3m³ Box containers for storage in an Intermediate Level Waste Store, which is a new facility designed to modern standards. The containerised waste would need to be recovered at some time in the future and an immobilisation matrix added to produce waste packages compliant with Nirex standards and specifications. It is envisaged that this immobilisation step will involve the addition of cement grout and would be deferred for an initial period of up to 15 years, and subject to assessment for a longer time until the site is finally cleared, which could be in 80-100 years time.

The total packaged volume of these wastes is expected to be approximately 780m³. These wastes therefore constitute approximately 0.5% of the total volume of such 'unshielded ILW' being considered by Nirex. The activity of these wastes is low in comparison to the average inventory of ILW.

Disposability Assessment for the Alternative Strategy

Magnox Electric Ltd accepts that the proposed approach would initially produce non-compliant packages when judged against Nirex waste packaging standards and that an essential future step would be to convert the containerised solid ILW into a disposable form fully compliant with Nirex standards and specifications.

There are circumstances where Nirex can provide endorsement of proposals for interim packing of waste. This would be where, for example, technical challenges prevent the production of a fully disposable package immediately, and the existing conditions under which the waste is being stored required immediate improvement. In such cases, it is an essential prerequisite for Nirex endorsement that credible plans are in place for the future conversion of the wastes into a fully disposable form compliant with Nirex standards and specifications.

In the case of Hinkley Point A solid ILW, Magnox Electric Ltd has not identified any technical challenges that would prevent the early production of disposable packages and that would necessitate an alternative strategy such as containerised storage. In fact, Nirex has previously endorsed the production of fully disposable packages for similar wastes at Trawsfynydd decommissioning site and equivalent plans at other sites are being actively pursued.

A key aspect of the disposability assessment has been the consideration of the likely evolution of the containerised waste during storage and how this may impact on proposals to rework the containerised waste in the future to produce Nirex compliant disposal packages. In this context, based on current knowledge of cement immobilisation, it is important to ensure that the solid wastes are segregated from mobile particulate material and other materials that require additional treatment. This will require that wet wastes are washed to remove adhering sludge and dried to prevent further corrosion during storage. It would also be important to maintain the containerised wastes in a dry and controlled condition to prevent corrosion during storage, and to undertake appropriate monitoring of the environmental conditions and of the containerised waste itself. In particular Magnox Electric Ltd should adopt a similar rigorous approach as used at the Magnox Debris Handling and Sorting Facility, operated at Trawsfynydd for the containerised storage of similar materials. Furthermore the mobile particulate and sludge wastes should be subject to separate treatment, by intimate mixing with an appropriate matrix to produce suitable wasteforms for disposal.

The assessment has highlighted that the packaging proposal needs to be augmented by the introduction of positive steps to identify components of the waste requiring further treatment or characterisation, during retrieval and/or packing operations. This will be necessary to ensure that any limits on particular components of the waste or the mixing of wastes, are adhered to and to ensure that objective evidence of such adherence is recorded and retained. The successful diversion of such waste items and the treatment undertaken will need to be verified and recorded.

Deferral of the conditioning step for the solid wastes introduces some uncertainty in the final condition of the waste after containerised storage, and this will require regular specific monitoring and inspection checks to be undertaken on the wastes and container. In particular these checks would need to provide the necessary evidence that continued storage is safe and acceptable, that the wastes and container are performing as predicted and that final grouting of the waste remains feasible and consistent with expectations. It is important that the safety case for continued storage is subject to periodic review, and it is understood that this will be undertaken on a 10 to 15 yearly basis.

The proposals considered by this assessment are a development of proposals that were first submitted to Nirex in 2004 for Sizewell Magnox Fuel Element Debris. At that time, the "innovation strategy" involved retrieval, containerisation and storage of the Magnox Fuel Element Debris for up to 100 years. The proposal was not endorsed by Nirex as the assessment, at that time, identified three key concerns.

- Technical justification for deferral of production of waste packages that would be compliant with Nirex disposability criteria was not given. This was seen as an important omission given that fully compliant packages had been planned previously and were being produced on other decommissioning sites.
- The assessment identified many potential issues relating to degradation of the containerised raw waste and the proposed carbon steel container during the 100 year period that the waste could be expected to be in store.
- The assessment concluded that plans for creation of Nirex compliant packages at the end of the 100 year interim storage period could not be considered credible given the uncertainties surrounding the evolution of waste and its condition at the end of storage.

Magnox Electric Ltd has subsequently modified the strategy to address feedback from Nirex and other stakeholders and the revised strategy now applied to the Hinkley Point A solid ILW, proposes to use a Nirex standard stainless steel waste container for these wastes. Importantly Magnox Electric Ltd has provided better information on the state of the waste and its expected evolution in the containerised form and has committed to a monitoring and checking programme during the storage period. Furthermore, Magnox Electric Ltd has given further consideration to the period of deferral and has now committed to a formal safety review after a maximum period of 15 years into the Care and Maintenance phase, at which time the waste would be converted into a Nirex compliant form, or a case made for continued containerised storage based on the outcome of the monitoring and checking programme. Magnox Electric Ltd has recognised the importance of controlling the storage environment to maintain humidity and chloride levels within appropriate bounds and recognises the need to apply controls defined within Nirex guidance and the Magnox Electric code of practice for care and management of intermediate level waste packages.

Assessment of these proposals for Hinkley Point A solid ILW has concluded that production of Nirex compliant waste packages should not be compromised by a deferral period of 15 years, subject to Magnox Electric complying with a number of conditions including sludge removal and drying of wet wastes, identification of wastes that require additional treatment, waste and container monitoring and checking and application of appropriate storage environmental controls. A number of detailed action points that Magnox Electric Ltd would need to address within the development programme for Hinkley Point A solid ILW have been identified.

Conclusions

The Conceptual stage submission from Magnox Electric Ltd for the packaging of the waste that would arise from the solid ILW project at Hinkley Point A Decommissioning Site has been assessed.

The Assessment has concluded:

- The current published strategy to provide an early packaging plant and to produce conditioned waste packages for on-site storage, would meet Nirex waste packaging standards and facilitate early transport and management at other facilities including the Phased Geological Repository Concept.
- The alternative strategy of containerised storage and deferred grouting will lead to non-compliant waste packages when judged against the Nirex packaging standards and specifications and would require additional work in the future to make them disposable.
- An 80 to 100 year deferral period introduces significant uncertainty and raises many issues relating to degradation of containerised raw waste during storage. Production of a Nirex compliant waste package by introduction of cement grout at that time is not considered to be a credible outcome at this stage.
- A deferral period of 15 years before grouting has been assessed and subject to Magnox Electric Ltd complying with a number of conditions including washing and drying of Magnox FED retrieved from the water-filled vaults, waste segregation and treatment, appropriate monitoring and inspection of the container and waste and controls on the storage environment to meet technical criteria defined by Nirex and Magnox Electric Ltd, the production of Nirex compliant waste packages should not be compromised.
- The detailed proposals as currently presented, do not demonstrate sufficient control on the positive identification and segregation of wastes that may require additional treatment prior to packing into the 3m³ Box container. Furthermore, the data

recording proposals require further development to demonstrate that the range of wastes in the storage vaults can be adequately characterised.

- Justification for the revised strategy which defers manufacture of the final waste packages to the future is not clear and whether this is consistent with the principles of sustainability remains an open question. A Best Practicable Environmental Option (BPEO) study has been undertaken but the robustness of the final conclusion is questioned.

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

The technical issues identified relating to sorting, segregation and characterisation 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.

The proposal has the potential to raise significant disposability and policy issues and deferral of grouting increases the risk that the packages will in the future be found to be non-compliant. The proposal has been categorised as Category 1 under Nirex assessment procedures and consequently will require to be considered by the Nirex Waste Management Advisory Committee and Nirex Directorate.