

# Generic Use of Comb Superplasticisers in Cement Grouts for Packaging of ILW (Conceptual stage)

## Summary of Assessment Report

Issue date of Assessment Report: 13 April 2010

---

### **Introduction**

Magnox North Ltd has sought Conceptual stage endorsement of proposals for the generic use of comb superplasticisers in cementitious grouts used in the conditioning of Intermediate Level Wastes (ILW) destined for a Geological Disposal Facility (GDF)

This Assessment Report summarises the conclusions of the assessment by NDA Radioactive Waste Management Directorate (hereafter RWMD) of the Conceptual stage submission. The assessment has been carried out as part of the Letter of Compliance process, whereby RWMD examines the disposability of proposed waste packages by assessment against ILW packaging standards and specifications and the Geological Disposal Facility concept. Further information on the Letter of Compliance process is available elsewhere<sup>1</sup>.

### **Scope of the Proposals**

Cementitious grouts are used extensively for active waste conditioning and the manufacture of stable waste packages for storage and ultimate disposal to a future GDF. These proposals are for the generic application of a "comb superplasticiser"<sup>2</sup> based cement additive which would result in the potentially beneficial modification of cement properties. These include increased fluidity and reduced water content, which if successfully taken advantage of could allow increased waste package loading, reduced bleed water and may eliminate the need for a capping grout of different formulation. Reduced water usage may also reduce corrosion of reactive metals and subsequent gas generation. These benefits would increase packaging efficiency, resulting in processing efficiency and fewer waste packages to be consigned to a GDF. The proposals present, with supporting documents, a reference formulation for assessment. Although generic in their application, the proposals highlight several Magnox Fuel Element Debris (FED) based waste types for early consideration.

This assessment report is based on the information provided in the submitted documentation. The assessment has considered the key performance parameters of waste packages manufactured with a comb superplasticised grout against the requirements for long-term management including storage, emplacement and

---

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

<sup>2</sup> Comb superplasticisers are organic molecules consisting of a straight backbone with pendant side chains.

extended storage underground, and disposal as currently expressed in the Generic Waste Package Specification<sup>3</sup> (GWPS).

This report also provides an assessment of disposability based on the assumption of eventual geological disposal. RWMD would expect the assessment of disposability 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 disposal site operator.

### ***Packaging Proposals***

The proposals include example wastes with which RWMD is familiar. They do not suggest any changes to specific packaging processes, waste containers or storage plans and only relate to the replacement of the originally proposed cementitious grout by the reference formulation containing the superplasticiser additive.

### ***Assessment of Disposability***

The acceptability of the proposed waste packages has been assessed where possible against criteria established for geological disposal and the associated GWPS. The assessment was limited by the lack of evidence for the performance of wasteforms prepared with superplasticised grouts.

The nature and quantity assessment has highlighted that full details of the constituents and potential loadings of the superplasticiser have not been provided. Further details of the constituents and proposed loadings would be needed to support a fuller assessment of the potential impact of their use on disposability.

Transport and operational safety assessments have not been made at this stage due to uncertainties in how the addition of a superplasticiser affects wasteform breakup and fire accident behaviour.

The post-closure safety assessment has highlighted concerns over the apparent increase in actinide solubility in aqueous solutions of the superplasticised product. There is uncertainty as to how this effect relates to cement pore water.

The justification and substantiation of the claimed benefits that may derive from the introduction of comb superplasticisers have been assessed, and it is concluded that the submission does not provide enough information to confirm that the majority of benefits are realisable.

The Assessment of Disposability has concluded that there is not enough information regarding the chemical composition of the proposed product to enable endorsement at the Conceptual stage. It is expected that future assessment stages would enable the assumptions used in the assessments to be refined.

### ***Requirements for Further Development Work***

Having determined that the proposed waste product is, at the Conceptual stage, not compliant with disposal requirements, RWMD has identified a number of issues that require further development work. For Conceptual stage endorsement, the requirement is for:

- Further information on the composition of the proposed superplasticiser additive.

---

<sup>3</sup> NDA, *Generic Repository Studies Generic Waste Package Specification Volume 1 – Specification*, NDA

Document N/104 (Issue 2), March 2007.

Additional issues have been identified that would need to be addressed before Interim stage endorsement could be given. These include:

- An understanding of the long term solubility of radionuclides in pore water from superplasticised grouts;
- Evidence of wasteform performance, such as thermal conductivity, dimensional changes due to wasteform evolution and particulate generation on impact.
- Information on gas generation and corrosion of reactive metals in superplasticised grouts.

### ***Conclusions***

The assessment has concluded that the current proposals are not fully compliant with the GWPS and the geological disposal concept, and that endorsement cannot therefore be given at this time. A number of Action Points have been raised which will need to be addressed by the future development programme.

The proposals to use cementitious grouts with a comb superplasticiser additive for Magnox derived wastes have been judged against the regulatory prioritisation scheme, and the view of RWMD is that they be considered as MEDIUM priority. The reasons for this judgement are that the wastes that these proposals apply to are greater than 1% of the total ILW destined for a GDF. Magnox North is advised to seek the necessary interaction with regulators to confirm this position.

