

Croft Associates Minibox and MA Safstore<sup>®</sup>:  
Containers only, 3 m<sup>3</sup> and 500 litre robust shielded  
containers

(Conceptual stage)

Summary of Assessment Report

Issue date of Assessment Report: 21 June 2013

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### **Introduction**

Croft Associates (Croft) has sought advice on the potential disposability issues that could arise from the use of their proposed designs of rectangular Minibox and cylindrical MA Safstore ductile cast iron waste containers for the conditioning of intermediate level waste (ILW).

This Assessment Report provides the basis and findings of the conceptual stage assessment by NDA Radioactive Waste Management Directorate (hereafter RWMD) of the proposed designs of waste container with regard to their potential to form disposable waste packages. The assessment has been carried out through the Disposability Assessment process<sup>1</sup>, whereby RWMD examines the disposability of proposed waste packages by assessment against published packaging specifications.

The use of the Minibox and MA Safstore waste containers has been proposed without any specific knowledge of the wastes that may be packaged using them. This assessment has therefore only considered the compliance of the proposed waste container designs with those aspects of the 'Generic specification for waste packages containing low heat generating waste' (published in August 2012) which are pertinent to waste containers. However, it also includes a consideration of the issues that would need to be addressed by users of the containers, especially regarding the information that would be required as part of a submission for a subsequent Disposability Assessment of waste packages manufactured using Miniboxes and MA Safstores.

### **Background**

Croft is planning to provide a range of ductile cast iron (DCI) waste containers designed for the packaging of the ILW that would arise from the decommissioning and clean-up of NDA and other UK nuclear licensed sites. The nature of the containers is such that they are intended to be used to manufacture 'robust self-shielded waste packages' in which the container provides most of the required performance of the waste package without explicitly relying on any specific properties of the contents. This relies on the waste container being sufficiently physically robust to ensure that the required waste package performance will be achieved.

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<sup>1</sup> For further information on the LoC process, reference should be made to *Guide to the Letter of Compliance Process*, NDA Document WPS/650, March 2008.

A consequence of this property is that it potentially permits such waste containers to be used for the packaging of waste in an un-encapsulated form. Although the wastes will not be routinely encapsulated, heavy solid materials are likely to be fixed to avoid compromising container walls in an impact accident. The waste container is designed to be capable of providing adequate radiation shielding such that the waste packages can be stored in a lightly shielded facility and transported through the public domain without additional protection. The suitability of the proposed Croft waste containers to be used to manufacture robust shielded waste packages is a key aspect of this assessment.

### ***Scope of assessment***

This conceptual Stage Disposability Assessment is limited to a consideration of the suitability of the proposed waste containers to provide the basis for the manufacture of waste packages that are compliant with the requirements for safe transport to and disposal in a geological disposal facility (GDF). The report assesses two types of container, the Minibox with dimensions and handling features that comply with those specified in the draft RWMD 3 m<sup>3</sup> box robust shielded waste package specification, and the cylindrical MA Safstore that has dimensions that comply with the draft RWMD 500 litre robust shielded waste package specification. It is intended that these draft specifications will be published once the outstanding issues around impact performance of DCI waste containers have been satisfactorily resolved.

Both containers are designed with filtered vents and manufactured with wall thicknesses in the range 50 mm to 300 mm (Minibox) and 160 mm to 300 mm (MA Safstore) to meet waste shielding requirements. Two variants have been proposed for each container design: one variant designed to meet IAEA Industrial Package Type 2 (IP-2) requirements and the other variant designed as an IAEA Type B transport package. RWMD is not responsible for assessing the suitability of a waste package for IAEA Type B transport and therefore focuses attention on the issues surrounding receipt of such packages at the GDF and their handling and emplacement in GDF disposal vaults.

In the current submission RWMD recognises that the Minibox top limiter and, to a lesser extent, the MA Safstore overpack proposed to ensure the packages meet Type B transport requirements, are at an early, conceptual stage of development. While this is acceptable for a conceptual, container only submission, RWMD would expect to see full design safety reports for the proposed containers in their Type B transport package configuration included with an interim stage LoC submission.

### ***Outcome of assessment***

#### **Compliance with the RWMD packaging specifications and wider regulations**

The assessment shows that the two designs of Minibox and MA Safstore waste container are compliant with the container related criteria specified by the Level 2 Generic Specification for robust shielded waste packages.

The two designs have also been reviewed against the draft unpublished Level 3 specifications for i) 500 litre robust shielded waste packages and ii) 3 m<sup>3</sup> robust shielded box waste packages. These are currently being developed as the RWMD specifications against which they would be tested for a future interim stage disposability assessment. The additional information and work that RWMD currently believes would be required to make an interim stage submission is identified in the assessment report and summarised as numbered Action Points.

## Compliance with concepts for a Geological Disposal Facility and Transport Regulations

The current assessment has considered the designs of Minibox and MA Safstore as both IP-2 and Type B transport packages. The MA Safstore and the Minibox are designed to contain a range of wastes, these could include unimmobilised dried sludges and ion exchange resin wastes where a significant proportion of the activity in the waste would be mobile in an accident scenario resulting in the potential for relatively high release fractions (RFs) if the packages were to lose containment. Based on these assumptions, and their common handling arrangements with other DCICs, it is concluded that both types of package should be placed in the dedicated DCIC vault. Clearly, these conclusions would need to be reviewed in any subsequent Minibox and MA Safstore waste package assessment in the light of the wastes proposed for packaging.

The GDF disposal concept for packages placed in the dedicated DCIC vault currently considers that packages would be stacked 5 high. Initial designs of dedicated DCIC vaults use an overhead crane for emplacement. This results in maximum drop heights of 10.5 metres onto the vault floor and 9 metres onto another container. While DCI has higher fracture toughness than grey cast iron, it can potentially exhibit brittle behaviour under a range of impact conditions. Evidence is required of the ability of Minibox and MA Safstore DCICs to withstand impact accidents without resulting in breaches of containment that compromise the ability to make an operational safety case, across the full operational temperature range. This is seen at the present time as a key requirement for any interim stage LoC submission disposability assessment involving DCIC.

RWMD also notes that, given the need to remain within specified overall package mass limits, package payloads could exceed specified mass limits at very limited waste loadings for some DCIC wall thicknesses. RWMD notes that to reduce RFs in accident situations it may be beneficial in some cases to have an encapsulated waste. In these circumstances, the waste payload would be even more restricted for thick-walled packages.

### **Conclusions**

The assessment has concluded that, on the basis of compliance with the container related criteria contained in the Level 2 Generic Specification for robust shielded waste packages, a conceptual stage Letter of Compliance (LoC) can be issued for the use of the two proposed designs of Minibox and MA Safstore waste containers for the manufacture of disposable waste packages containing ILW.

Due to the range of wall thicknesses proposed for the Minibox, the mass of waste packages proposed by Croft could exceed those in the draft 3 m<sup>3</sup> robust shielded waste package specification. RWMD is therefore restricting the endorsement of Minibox containers to their use for manufacturing waste packages not exceeding a mass of 25 t.

In the case of the MA Safstore the proposed package masses, of up to 10 t, are within the limit specified in the draft 500 litre robust shielded waste package specification.

A number of further issues have been identified in the assessment that have been noted as Action Points and are summarised at the end of the report. These do not affect the granting of a conceptual, container only LoC but will need to be addressed in any subsequent interim LoC submission.

As referred to above, the key issue for RWMD at present is the impact accident behaviour of DCICs. RWMD requires a more complete understanding of the impact accident performance to make a judgement on whether DCIC waste packages can be safely stacked in the GDF vaults to the heights currently proposed. The information required to assess the implications of the impact performance of DCI containers in transport and GDF accidents is defined in the report.

RWMD has previously undertaken work to investigate whether a technical case exists to change RWMD's disposal system to accommodate waste packages manufactured using designs similar to the Minibox and MA Safstore DCI waste containers. A formal disposal system change control process to incorporate the containers as standard waste packages has been initiated, which once the impact performance issues have been resolved, would result in the publication of Level 3 WPSs for:

- i) 500 litre robust shielded waste packages and
- ii) 3 m<sup>3</sup> robust shielded waste packages.

Drafts of these WPSs have been used to assess the future requirement at interim stage LoC for development of the proposed designs of Minibox and MA Safstore waste container. Endorsement of an interim stage proposal will require the adequate resolution of the Action Points referred to above, to permit compliance with the container related factors in the relevant Level 3 WPSs to be demonstrated.

RWMD will also expect to see a justification that there would be a net benefit over the entire waste management lifecycle resulting from the use of Minibox or MA Safstore for waste packaging. This cannot be evaluated as part of this 'container only' Disposability Assessment but it should form an important part of any future assessment of any proposed use of the containers for the packaging of actual waste.