

Siempelkamp Ductile Cast Iron 'Blue Barrel':
Containers only
(Conceptual stage)

Summary of Assessment Report

Issue date of Assessment Report: 16 September 2013

Introduction

Siempelkamp Nukleartechnik GmbH (SNT) has sought advice on the potential disposability issues that could arise from the use of the 'Blue Barrel' ductile cast iron cylindrical waste container concept 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 process¹, whereby RWMD examines the disposability of proposed waste packages by assessment against published packaging specifications.

The use of the Blue Barrel 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 Waste Package Specification (GWPS) which are pertinent to waste containers. Despite this, it 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 Blue Barrels.

Background

SNT 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.

¹ 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 the potential compromising container walls and closure in an impact accident. The waste container will also be required 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 Blue Barrel 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 Blue Barrel 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. The report assesses two types of Blue Barrel, the Blue Barrel 'Magnox' with dimensions and handling features that are designed to comply with those specified in the draft *Type 1060/1500 robust shielded waste package transported as a Type IP-2 transport package* Waste Package Specification (WPS) and the Blue Barrel 'SNT', which is similar but has larger dimensions and was designed by SNT to meet a potential requirement from Magnox for a larger cylindrical container.

The designs indicate that the containers can be either vented or unvented. The containers can be manufactured with a range of wall thicknesses to meet shielding requirements, but for this assessment the wall thicknesses specified in the submission are used. The Blue Barrel Magnox design has a wall thickness of 160mm, whereas the Blue Barrel SNT design has a wall thickness of 200mm. RWMD has assessed the containers on the basis that they would be used to manufacture packages which will be qualified for use as IAEA Type IP-2 transport packages. SNT has stated the proposed container designs could potentially also be used as the basis of an IAEA Type B transport package. This has not been considered in this assessment and further information and evidence would be required before the container could be assessed for producing packages that could be approved for Type B transport.

Outcome of assessment

Compliance with the RWMD packaging specifications and wider regulations

The assessment shows that the Blue Barrels 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 unpublished, draft Level 3 specification for *Type 1060/1500 robust shielded waste packages transported as Type IP-2 transport packages* (NDA, RWMD WPS/305/01 Draft). The published version of this will be considered as the RWMD specification against which the Blue Barrel Magnox would be tested for a future interim stage disposability assessment. For now, an assessment against the draft version should help prepare an Interim stage submission. As previously stated, the Blue Barrel Magnox is largely compliant with this WPS in the areas that can be assessed in the absence of a waste to be packaged in the waste container.

The Blue Barrel SNT is not compliant as its size exceeds the WPS specified dimensions, both in diameter and height. Future endorsement would require the design to be assessed through the RWMD change control process, and a new Level 3 WPS published. It has been agreed with SNT that this will only be considered if Magnox, or another waste producer, comes forward with a submission to package waste in this design of container. The additional information and work that RWMD currently believes would be required to make an interim stage submission for both designs of container is identified in the assessment report and summarised as numbered Action Points. Where an Action Point is specific to the Blue Barrel SNT, rather than the Blue Barrel Magnox or to both designs, it is explicitly identified.

Compliance with concepts for a Geological Disposal Facility and Transport Regulations

It should be noted that the current assessment has been limited to considering the two designs of Blue Barrels as IP-2 packages. No wastes were defined for the containers but for the purposes of the assessment it was assumed that the containers would contain a range of materials from immobilised wastes and activated metals, where the activity would not be mobile in an accident, to unimmobilised dried sludges and ion exchange resin wastes where a significant proportion of the activity in the waste could be mobile in an accident scenario resulting in the potential for relatively high release fractions (RFs). On the basis of these assumptions RWMD concluded that the packages should be placed in dedicated DCIC vaults in a Geological Disposal Facility (GDF). These assumptions would be reviewed in any subsequent Blue Barrel waste package assessment in the light of the wastes proposed for packaging.

The GDF disposal concept for packages placed in the dedicated DCIC vaults currently considers that packages will be stacked up to 5 high. On the basis of this, the maximum drop heights would be 10.5 metres onto the vault floor (which is assumed to yield when impacted by a DCI container) and 9 metres onto another DCI container, which is assumed to be an unyielding target. 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 Blue Barrel DCICs to withstand impact accidents without resulting in containment breaches that compromise the ability to make an operational safety case across the credible operational temperature range. This is seen at the present time as a key requirement for any interim stage LoC submission disposability assessment, and is the main reason that a WPS for this type of package cannot currently be finalised.

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 Blue Barrel Magnox design of waste container for the manufacture of disposable waste packages containing ILW.

A number of issues have been identified in the assessment that have been noted as Action Points and are summarised at the end of the report. These will need to be addressed in any subsequent interim LoC submission.

In the case of the Blue Barrel SNT design, the waste container meets the Level 2 Generic Specification for robust shielded waste packages. However the RWMD Disposability Assessment Aim and Principles (DAAPs) Principle 4 states that *'innovative packaging proposals will be assessed against the Generic Specification for the relevant waste type (Level 2 of the hierarchical RWMD Packaging Specifications) and, subject to satisfactory conclusions and confirmation that the necessary changes to the disposal system concept and safety case are feasible and appropriate'*. RWMD understands that at the present time no waste producer is considering the Blue Barrel SNT design to package a waste stream. It is therefore judged under principle 4 that making changes to the disposal system concept and safety case is not appropriate. Therefore, as previously agreed with SNT, RWMD will not consider progressing this container design through the Change Control process until a waste producer comes forward with proposals to package a waste stream in the container.

As referred to above, the key issue for RWMD at present is the impact accident behaviour of DCICs. RWMD requires a fuller understanding of the impact accident performance to make a judgement as to whether DCIC waste packages can be safely transported to, moved in the GDF and stacked in the GDF vaults as 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 case exists to change its packaging specifications and/or GDF designs to accommodate waste packages manufactured using designs similar to the Blue Barrel DCI waste containers. A formal change control process is underway, which should result in the publication of the draft Level 3 WPS for *Type 1060/1500 robust shielded waste packages transported as Type IP-2 transport packages*. This has been used to assess the future requirement at interim LoC stage for development of the proposed designs of Blue Barrel waste container. A future interim stage submission would be assessed against the published Level 3 WPS.

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 Blue Barrel Magnox 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.