Inspection of RWM's disposability assessment process for the management of HAW in Scotland

A joint report by the Office for Nuclear Regulation and the Scottish Environment Protection Agency

September 2017

Executive Summary

This report presents the findings of an inspection of Radioactive Waste Management Ltd's (RWM) disposability assessment process for the management of higher activity radioactive waste (HAW) in Scotland, carried out jointly by the Office for Nuclear Regulation (ONR) and by the Scottish Environment Protection Agency (SEPA).

This inspection focused upon finding answers to the following two key questions:

1. Is RWM's disposability assessment process, and the resultant packaging advice, suitable for HAW packaged in Scotland?

2. Is RWM's packaging advice implemented effectively by waste producers in Scotland?

The evidence gathered has enabled ONR and SEPA to answer both questions positively. In addition, the inspection has identified a number of recommendations for improvement.

ONR and SEPA are therefore able to conclude that our assertion that:

> "*packages conditioned in anticipation of geological disposal are also suitable for long-term management in near-surface facilities, as required by government policy in Scotland.*"

which we made in "The management of higher activity radioactive waste on nuclear licensed sites: Joint guidance from ONR, EA, SEPA & NRW" (February 2015) remains valid.

Contents

1 Introduction

This report presents the findings of an inspection of Radioactive Waste Management Ltd's (RWM) disposability assessment process for the management of higher activity radioactive waste in Scotland, carried out jointly by the Office for Nuclear Regulation (ONR) and by the Scottish Environment Protection Agency (SEPA).

1.1 Management of higher activity radioactive waste

Radioactive waste arises from activities such as the UK's historical and ongoing nuclear power, research and defence programmes. Higher activity radioactive waste (HAW) comprises intermediate-level and high-level radioactive wastes (ILW and HLW), but also some low-level waste (LLW) not currently suitable for disposal in existing LLW facilities. HAW can be solid waste, such as graphite or metal components, or liquids and sludges, such as acids or corrosion products.

Waste producers[1] treat and package HAW on nuclear sites, in a process termed "conditioning", to make it safe for handling, storage, transport and eventual disposal. As yet, there is no disposal solution for HAW in the UK, so conditioned HAW packages are placed into long-term stores, where they are monitored in closely controlled conditions, to ensure their integrity until a disposal solution is available.

1.2 Regulation of HAW management

In Scotland, the management of radioactive waste by nuclear site waste producers is regulated by ONR and SEPA (together referred to as "the regulators"). ONR regulates the safe and secure on-site management and off-site transport of nuclear materials and radioactive waste, as well as on-site health and safety, while SEPA regulates the disposal of radioactive waste to protect the public and the environment.

We (the regulators) have set out our expectations for the management of HAW in the UK in jointly-published guidance [1].

1.3 Scottish Government Policy on HAW management

Radioactive waste disposal is a devolved issue and policies differ across the UK. The policies of the UK Government [2] and the Welsh Government [3] are that HAW in England and Wales should be managed in the long-term through geological disposal, coupled with safe and secure interim storage and ongoing research and development, to support its optimised implementation.

The Scottish Government announced in 2007 that it does not support geological disposal, and in 2011 published Scotland's Higher Activity Radioactive Waste Policy [4]. This policy ("Scottish Policy") states that:

[1] For the purposes of this report we use the term 'waste producer' to include waste producers and waste packagers, noting that in some instances the waste packagers may not necessarily be waste producers.

> "*the long-term management of higher activity radioactive waste,[2] […] should be in near-surface facilities. Facilities should be located as near to the site where the waste is produced as possible. Developers will need to demonstrate how the facilities will be monitored and how waste packages, or waste, could be retrieved. All long-term waste management options will be subject to robust regulatory requirements*."

Scottish Policy identifies three principle long-term waste management options currently available: treatment, storage and/or disposal.

1.4 Disposability assessment for HAW

The Nuclear Decommissioning Authority (NDA) is responsible for implementing UK Government policy for the management of HAW. RWM has been established as a subsidiary of NDA to deliver a geological disposal facility (GDF) and provide waste management solutions [5].

It will be decades before a GDF is constructed, and its operational and environmental safety characteristics sufficiently defined to enable specification of comprehensive waste acceptance criteria (WAC). In the interim, progress must continue with retrieving and conditioning HAW to reduce hazards and to enable decommissioning and clean-up of redundant facilities.

In advance of the availability of an operational GDF, RWM has developed a generic disposal system safety case (gDSSC) [6] and a process of disposability assessment based on waste package specifications derived from the gDSSC [7], to minimise the risk that conditioning of HAW now, results in packages that are incompatible with geological disposal in the future.

As part of this process, RWM carries out formal assessments on submissions from waste producers for specific HAW conditioning proposals. These assessments test the submissions against RWM's detailed waste packaging specifications and the gDSSC. The main outputs of this process are disposability assessment reports which provide advice on the compliance of a HAW conditioning proposal with RWM's specifications and safety case. If a proposal is judged compliant by RWM it issues a Letter of Compliance (LoC), which provides waste producers, NDA and other stakeholders, with confidence that HAW conditioned, stored, monitored and transported in the manner proposed will be consistent with current plans for geological disposal. For more detail on this process, please see the Appendix.

In addition to our role of regulating waste management on nuclear sites through regulation of waste producers, we also maintain a joint programme of scrutiny and challenge to the work of RWM, to ensure its processes are suitable.

1.5 Suitability of RWM's process and advice for HAW in Scotland

Following Scottish Government's 2007 announcement it was necessary for the regulators to determine whether RWM's disposability assessment process and advice remained suitable for HAW being managed in Scotland. The regulators examined the available evidence and

[2] It should be noted that the Scottish Policy applies only to ILW and LLW, as there is no HLW in Scotland.

concluded that HAW packaged in accordance with RWM's advice would be suitable for long-term, near-surface management, but undertook to keep this position under review.

In 2010, the regulators and Scottish Government together reviewed this position and re-affirmed that RWM's disposability assessment process was suitable for the long-term management of HAW in Scotland. It was also recognised that RWM's disposability assessment process does not foreclose other waste management options.

This position was reflected in the regulators' joint guidance [1] which asserted:

"*packages conditioned in anticipation of geological disposal are also suitable for long-term management in near-surface facilities, as required by government policy in Scotland.*" In 2016 we considered it timely to begin a formal, in-depth inspection of RWM's process and advice for HAW management, and its application in Scotland. The report that follows describes the inspection's objectives, methodology and key findings.

2 Objective and Methodology

The primary objective of our inspection was to test the conclusion, reached by the regulators in 2007, and reaffirmed by the regulators and the Scottish Government in 2010, that waste packages conditioned in anticipation of geological disposal are also suitable for long-term management in near-surface, near-site facilities, as required by government policy in Scotland.

We considered that this was best achieved by answering two key questions:

1. Is RWM's disposability assessment process, and the resultant packaging advice, suitable for HAW packaged in Scotland?
2. Is RWM's packaging advice implemented effectively by waste producers in Scotland?

Our inspection did not cover the broader question of how well RWM's arrangements for disposability assessment and the provision of waste packaging advice are functioning. This has already been addressed in an inspection by EA and ONR [8] in 2013 which found:

> "*RWMD's disposability assessment process is generally robust and;*
>
> - *provides confidence in the advice it gives to waste producers and reduces risks associated with packaging waste before a GDF is available,*
> - *is subject to continuous improvement, and*
> - *supports progress in decommissioning and clean-up.*"

The 2013 inspection highlighted several areas where improvements could be made, such as on the scheduling and prioritisation of assessments and the assessment of innovative packaging proposals. RWM has made progress on those improvements and has closed out several regulatory issues since the 2013 inspection.

Our approach to planning and conducting this inspection was informed by the inspection undertaken in 2013, but was tailored to answering the two key questions above. An Environment Agency officer assisted with our planning and participated in our inspection,

helping to provide continuity with the 2013 inspection, and to avoid unnecessary duplication of effort.

To assess the suitability of RWM's packaging advice for the management of HAW in accordance with Scottish Policy, we carried out our inspection in two main phases. First, we inspected two Scottish nuclear sites to investigate waste producers' experience of RWM's disposability assessment process, and how RWM's packaging advice is being used in the management of HAW at these sites. Second, we inspected RWM's processes for disposability assessment and provision of waste packaging advice, to investigate how these take into account Scottish Policy.

The two nuclear sites we selected for inspection were Dounreay (operated by Dounreay Site Restoration Ltd, or DSRL) and Hunterston A (operated by Magnox Ltd), as together they represented diversity in the type of HAW being managed and the maturity of waste conditioning and storage programmes. Dounreay has a wide range of challenging HAW, with a substantial volume of waste already conditioned and placed in storage. Hunterston A has a smaller range and volume of HAW, which it has recently begun to condition and store.

The two nuclear site inspections followed a similar format. We held discussions with a range of staff involved in waste management, from senior directors to operational staff. The discussions covered the general incorporation of RWM's packaging advice into waste management arrangements and then explored the implementation of this in detail for some selected waste streams. Similarly, the RWM inspection involved discussion with senior directors and a range of specialist assessors and other staff.

3 Outputs from review of RWM's disposability assessment process and waste packaging advice for the management of HAW in Scotland

3.1 Recognition and incorporation of Scottish HAW Policy in the RWM process

RWM has published its Disposability Assessment Aim and Principles (DAAP), in a high level document, which presents the primary aim of the disposability assessment process and the general principles against which the assessments are carried out [9]. The DAAP indicates that the primary aim of the RWM disposability assessment process is to minimise the risk that the conditioning and packaging of radioactive wastes results in packages incompatible with geological disposal, and thereby enables the production of packages that can be disposed of in a GDF. However, the DAAP also states that the process is recognised in the current regulatory framework as providing advice applicable to the management of HAW more generally, including for the long-term management of HAW in Scotland under Scottish government policy.

The disposability assessment process [7], includes a formal policy evaluation step [10] which documents the requirements for the evaluation of the consistency of new conditioning submissions with RWM principles indicated in the DAAP [9]. RWM's DAAP explicitly notes the need to consider Scottish Policy requirements in Principle 11. We found evidence, from sampling some disposability assessments for HAW in Scotland and discussion with RWM

assessors, that the process had taken appropriate account of Scottish HAW policy in most of these assessments.

However, we found an example where this was not the case. In discussions with RWM it emerged that policy evaluations only tend to be carried out on conceptual stage submissions. If a waste producer's initial submission occurred prior to the recognition of Scottish Policy in RWM's process, there will have been no check for consistency with that policy. Also, if a final stage LoC was issued prior to the change in policy in Scotland, RWM's periodic review process would also fail to check consistency with policy. We consider that RWM's process is not sufficiently comprehensive in this respect.

Recommendation 1: RWM should update its arrangements, including its Assessment Quality Plan, to ensure all waste-streams that fall under Scottish Policy have undergone a policy evaluation, irrespective of assessment stage.

In general, we found little evidence that the disposability assessment process had encountered or contributed to problems arising from differences in policy between Scotland and other parts of the UK.

RWM does not have nominated specialists in relation to Scottish Policy. This reflects that the assessment process is carried out for geological disposal and does not formally require a specific technical assessment in relation to Scottish Policy. However, from discussions with a range of RWM staff, including directors and assessment managers, we found that they were generally aware of Scottish Policy and its requirements. In the disposability assessment process, responsibility for ensuring appropriate consideration of Scottish Policy in the assessments lies mainly with the Senior Waste Management Specialists who manage the disposability process and chair key project and decision meetings. Additionally, the specialist technical assessors engage closely with waste producers in Scotland and so get direct exposure of issues surrounding management of HAW in line with Scottish Policy.

We found that RWM appears to have appropriate strategic engagement with NDA and Scottish Government, to understand and contribute to NDA strategy and Scottish HAW policy development.

3.2 Applicability of the disposability assessment to long-term management in near-surface facilities

The RWM disposability assessment process can be described as a risk management process to give confidence that conditioned HAW packages are suitable for handling, storage, transport and disposal. Whilst it is carried out in the context of geological disposal, we found that the technical review of waste conditioning and packaging proposals against the requirements of the geological disposal system covers, in general, all the aspects that are relevant to other management options. Therefore, the disposability process should be able to show the proposed waste conditioning process and packaged product to be compatible with other waste management options, including long-term management in near surface facilities [11].

Our inspection focused upon testing the assumption that the general RWM disposability assessment process is suitable for use for HAW in Scotland, because waste conditioned for geological disposal is expected to be suitable for long-term management in near-surface facilities [1] [11].

We found that the technical elements of the assessment process are appropriate for HAW in Scotland. The general requirements for long-term management of waste are well established and embodied in the regulatory requirements and expectations, such as Licence Conditions [12], Safety Assessment Principles (SAPs) [13] and good practice such as the regulators' joint guidance [1]. These encourage waste producers to condition HAW into a passively-safe state as early as reasonably practicable, to store HAW in a suitable package that provides effective containment, and to subject HAW packages to an appropriate inspection regime to monitor their performance and condition and provide assurance that they continue to meet requirements. We found that the RWM disposability assessment process explicitly includes rigorous assessment of these aspects, which are relevant for long-term near-surface storage [14]. In particular, the assessment covers long-term package performance and the requirements for interim storage of waste packages.

The RWM package specifications express an expectation that HAW packages shall maintain integrity for 150 years, and should maintain an appropriate level of integrity for at least 500 years (although it is acknowledged that they may need to be handled by means which do not involve the use of the integral handling features) [15]. Thus, the packages assessed through the RWM process would be expected to maintain integrity over the duration of long-term near-surface storage anticipated in Scottish Policy and its Implementation Strategy [16]. The DAAP also recognises where the requirements for assessment may differ in relation to long-term near-surface management, for instance in relation to extended periods of storage and some aspects of the assessment process (e.g. transport and post-closure safety for the GDF), and provides for an appropriate degree of flexibility within the process to accommodate this.

For long-term near-surface storage, the environmental conditions in the stores will be of particular importance in maintaining the integrity of the waste packages. RWM is actively engaged in work to improve understanding of store conditions and effect on package integrity. For example, RWM has been working with waste producers to generate monitoring data on chloride deposition on packages in stores to refine its predictive models of package corrosion. RWM also chairs the Store Operations Forum (SOF), which has recently updated the NDA's guidance on interim storage of HAW [17], based upon the SOF's technical understanding of package performance and on operational experience. This guidance will be of particular value in establishing appropriate requirements for operating near-surface storage facilities over the long-term.

It should be noted that near-surface storage facilities for HAW will continue to be subject to nuclear and environmental regulation, to ensure that the wastes are stored appropriately and safely. The regulators expect that advice from RWM's assessment process will provide a useful input to safety cases and other regulatory requirements for the long-term storage of HAW.

3.3 Flexibility and non-foreclosure of options

RWM's mission is to deliver a GDF and provide waste management solutions. The second part of this mission involves services that together are intended to facilitate the flexible and optimal management of HAW in line with both UK policy in England and Wales, and with Scottish Policy in Scotland. At the time of our inspection RWM stated that it aims to deliver this through its disposability assessment process and provision of packaging advice [7]. RWM also informed us that NDA has recently requested it to take on a complementary role, to provide advice on a wider range of appropriate waste management options and disposal routes. We did not investigate this new role, given its infancy.

RWM's disposability assessment process supports conditioning of waste to a passively safe state as soon as reasonably practicable, but also accommodates cases where achieving the final packaged form requires more than one waste processing step. This enables a tailored approach to the assessment for a particular waste stream based on the understanding of the properties of the waste, the maturity of the proposed waste container and conditioning process etc. RWM's process also accommodates the use of innovative approaches to the packaging of wastes, embodied in principle 7 of the DAAP, so enables the use of package types other than the current RWM standard types [9].

We sampled a number of diverse waste streams at both Hunterston A and Dounreay to review the range of waste management options being used for HAW in Scotland. We found that the disposability assessment process provides a flexible framework for establishing waste conditioning and packaging approaches, and for gaining confidence in their suitability for long-term near-surface storage.

3.4 Changes to the generic disposal system safety case

The RWM disposability assessment is conducted against the RWM packaging specifications and the gDSSC, which together form the basis on which RWM provides advice on conditioning wastes for geological disposal [7, 14]. In our inspection we assessed the impact of revisions to the gDSSC on disposability assessments for HAW in Scotland.

The original gDSSC was produced in 2010 [6] and recently updated in 2016 [18]. RWM states that it will continue to maintain the gDSSC for as long as it is needed to support disposability advice.

The 2016 gDSSC is based upon an inventory for geological disposal, derived from the 2013 UK radioactive waste inventory. The inventory is assumed to be disposed of in a GDF and is the basis for RWM's designs and assessments. In response to Scottish Policy, HAW covered by the Scottish Policy is explicitly excluded from the inventory for disposal. However, as part of the 2016 gDSSC RWM has also considered a number of different inventory scenarios that have the potential to impact on RWM's design and safety cases. RWM stated it considers that the characteristics of HAW in Scotland are within the bounds of the uncertainty of the inventory for disposal, and within the safety envelope of the gDSSC.

The changes to the 2016 gDSSC have generally expanded the safety envelope, for example by covering a broader range of package types and waste conditioning options, and so it is unlikely to change further such that it would fail to cover management options for HAW in

Scotland. RWM expressed confidence that, despite recent changes, the gDSSC remains relevant to HAW in Scotland, and indicated that this will be kept under review.

RWM noted that the 2016 gDSSC would contain a more balanced consideration of safety assessment across the three generic geological environments being considered for the GDF than the previous version. RWM also stated that the safety arguments in the gDSSC and the technical areas covered in the disposability assessment process, particularly those relating to package performance, waste conditioning, monitoring and records adequately cover relevant safety and environmental aspects, for long-term near-surface storage. Thus RWM considers the gDSSC is an appropriate basis against which to carry out assessments on HAW in Scotland.

However, as the gDSSC continues to evolve, and especially when the eventual transition to a site-specific DSSC is made, we are uncertain as to whether advice based on these safety cases will remain suitable for the management of HAW in Scotland. Therefore, we judge that it is necessary to keep the suitability of the RWM disposability assessment process and packaging advice for the management of HAW in Scotland under review. We consider that such reviews should be done periodically, perhaps at 10 yearly intervals, or in response to developments which may impact on the relevance to HAW management in Scotland. RWM should alert the regulators of any such developments.

Recommendation 2: RWM should communicate to regulators any developments regarding the gDSSC, which could influence the fitness-for-purpose of the disposability assessment process for HAW in Scotland.

3.5 HAW information recording

The RWM disposability assessment process includes requirements for the establishment of a data recording system to provide information to support all stages in the long-term management of conditioned HAW packages [7, 19, 20]. Such records are an essential element of maintaining knowledge on waste packages to inform future management and disposability. As such, RWM expects waste producers to have a robust data management system in place and to use reasonable endeavours to record information for each waste package that will enable subsequent assessment against the requirements for safe and cost-effective handling, transport, storage and disposal [20].

Our inspection found that, generally, RWM's requirements and expectations for waste records are appropriate for HAW in Scotland. We sampled record specifications for a number of wastes at Hunterston A and Dounreay and gained confidence that the records contained sufficient information to support long-term management and maintain knowledge on the wastes to inform on future disposability.

DSRL and Magnox both noted that, while there had been problems over clarity of RWM's requirements in the past, RWM had worked effectively with waste producers in revising its documentation, resulting in much clearer guidance.

DSRL noted RWM's pragmatic approach to working with the waste producer in helping to implement the waste package record requirements. Magnox also noted RWM's generally

helpful approach, but highlighted one recent instance in which it found these requirements still lacked clarity, and RWM's advice on them lacked consistency.

A general observation (applicable throughout the UK) was that currently the RWM expectation for the data and information to be collected for waste packages to demonstrate their compliance with all recognised specification documents (so-called class C records) is conservative, tending to expect retention of all information on a waste stream that may be needed in the future. The RWM requirements on records are not prescriptive and waste producers are required to propose and justify an appropriate data recording strategy and record specification. However, we found that RWM's conservative approach was leading waste producers to take a precautionary approach to retain all information. This creates a significant burden on waste producers in terms of the volume of records to maintain and store, with associated cost implications. RWM were receptive to the need to provide more clarity on records requirements, particularly those class C records relating to compliance, and to explore options to ensure that permanently retained records are fit for purpose. For instance, some information may be limited to recording exceptions from a known baseline, for example on storage conditions and excursions from documented expected environmental conditions; similarly, for waste packages, recorded information on the manufacturing and QA process could be supplemented by limited sampling evidence on manufactured waste packages and records on any excursions from specifications etc. We also noted that some information may be superseded through the waste lifecycle. For instance, information on retrieval operations may be irrelevant once that waste is fully characterised and conditioned into packages.

Recommendation 3: RWM should continue to work with waste producers to ensure that RWM's waste package record requirements are sufficiently clear, and that RWM's advice to waste producers remains consistent.

During our inspections at Dounreay and Hunterston A, we also noted the use of radioactive waste management cases (RWMCs) by waste producers as a tool in the management of waste streams, consistent with expectations in the joint guidance [1]. We found that RWMCs were used as an integral part of the management of wastes and means to retain relevant knowledge on the cradle to grave management of waste streams. In this regard they complemented the disposability records maintained for compliance with RWM's requirements. The RWMCs were also highlighted as a means to describe, maintain visibility on and communicate risks and liabilities to the risk owners, which may include NDA for certain risks, particularly those relating to on-going and future liabilities.

3.6 Periodic review

Final stage LoCs (fLoCs) are subject to periodic review by RWM [21]. This is essentially a re-assessment of the disposability of a waste package, through the standard disposability assessment process [7], taking into account any changes in the development of the gDSSC since the original assessment and fLoC endorsement was carried out. Its purpose is to gain assurance that the endorsed fLoC remains valid and aligns with the requirements of the gDSSC, and to review records on packages and ensure they are being managed in line with the requirements of the fLoC. The periodic review typically takes place 10 years after issue of the fLoC, or in response to a relevant trigger such as cessation of the packaging

campaign for that waste stream, entry of the site into care and maintenance, or where there is a significant change to the documented disposal system concept or update to the gDSSC.

RWM has applied the standard periodic review process to some fLoCs for HAW in Scotland [21]. There is currently limited experience of the periodic review process for HAW in Scotland as only a small number of fLoCs have qualified for review. However, we found that experience to date has not highlighted any particular problems in the process. The process contains sufficient flexibility to prompt periodic reviews for HAW in Scotland at appropriate times and when the relevance of the disposability assessment may have become challenged.

We noted that periodic reviews are focussed on packaged wastes endorsed with fLoCs. However, some HAW in Scotland may have been through the disposability assessment process but found not to be fully compliant with RWM specifications for reasons related to its management under Scottish HAW policy (e.g. not meeting the post-closure or transport requirements), or its stage in the waste management lifecycle (e.g. being placed in containerised storage, awaiting final conditioning at a later date). Such waste streams would not have a fLoC and would therefore not be subject to the periodic review process.

The regulators recognise the primary role of RWM's Disposability Assessment process as a risk management tool, to ensure waste packages continue to conform with RWM's disposability requirements. But we consider that the exclusion of waste streams, which do not receive a fLoC because they do not fully conform to those requirements, from periodic review, gives rise to a potential gap in the management of the risks they present to the liability owner (primarily NDA, but some liabilities are owned by EDF or MoD). It is these non-conforming waste streams which need to be drawn to the attention to the liability owner. Because these waste streams do not conform with RWM's disposability requirements, they represent a higher level of risk to the liability owner, which means that they require appropriate attention to ensure that they are ultimately disposable. We therefore recommend that RWM should consider how best to include non-conforming waste-streams in its periodic review process, so as to facilitate visibility by the liability owner of the associated risks.

Recommendation 4: RWM should consider how best to include in its periodic review process waste streams covered by a final stage Assessment Report, but not endorsed with a fLoC.

A general point on the periodic review process emerged during our inspections at Dounreay and Hunterston A that may be relevant throughout the UK. Both waste producers agreed that RWM's guidance and current programme provides an effective basis for commencing a periodic review, but the waste producers raised separate time-related issues. DSRL noted that waste producers may organise waste packaging in short-term campaigns, with project teams disbanding before a periodic review is begun, potentially compromising the review process and outcomes. But DSRL acknowledged that the existence of good waste package records should mitigate this risk. Magnox's concern was over the time required to complete all objectives from a periodic review, or for extensions to agreed scope, having unforeseen impacts upon site schedule, particularly entry into Care and Maintenance.

We therefore recommend that RWM continues to work with waste producers to ensure that its periodic review process and programme is suitably aligned with sites' decommissioning timescales.

> Recommendation 5: RWM continues to work with waste producers to ensure that its periodic review process and programme is suitably aligned with sites' decommissioning timescales.

RWM recognises that the purpose and nature of the periodic review will change over time and stage of the site lifecycle and we consider that the criteria for triggering periodic reviews are sufficiently flexible to reflect this. Once wastes are conditioned and placed in interim storage the emphasis of the periodic reviews should be on compliance with the storage requirements, package inspection, store maintenance and the management of associated records.

3.7 Research programme and development of disposal concepts

RWM has an extensive research programme with a 10 year horizon, outlined in its science and technology plan [22]. The research programme is focused on geological disposal and to support the technical elements of the disposability assessment, covering research areas such as engineered barriers, biosphere, pathways, waste package accident performance and criticality safety. It does not include any work explicitly in relation to long term storage or disposal in near surface facilities, although in general research on package performance, waste conditioning and evolution etc. will be relevant to near surface storage. RWM recognises that there are research needs in relation to wastes that may not be suitable for near surface disposal. Discussions have been held, and RWM would expect to be involved in implementing a programme for NDA and Scottish Government, when requested to do so.

In addition, in order to inform Government policy development, RWM maintains a watching brief, through literature review and engagement with other organisations on alternatives to geological disposal, including near surface disposal and waste treatment technologies. This is published periodically in synthesis reports [23], and may be useful for the implementation and further development of Scottish Policy.

3.8 Visibility and governance of on-going / future liabilities and risks

Our inspection noted that there may be on-going and future liabilities and risks in relation to making all HAW in Scotland disposable. Specifically, some HAW may require further treatment to be disposable at some future time. There are also the future wastes that will be generated in later stages of decommissioning and final site clearance.

These risks need to be communicated to the liability owner (primarily NDA, but some liabilities are owned by EDF or MoD). We noted that RWM does not have a formal process for doing this, although there are some means in place, for instance RWM may provide this information to NDA through the senior strategy committees and from "path to closure" research work to close out issues. Some mitigation might be provided through our regulatory expectation that waste producers will record such information and capture requirements for the cradle-to-grave management of waste streams in RWMCs [1]. Nevertheless, we highlighted this as an issue that RWM, liability owners and the regulators

should consider further to ensure that appropriate risk communication and governance is in place.

Recommendation 6: RWM should work with liability owners and the regulators to consider how to establish formal processes to ensure appropriate visibility and governance of risks associated with HAW that may require further treatment to be disposable.

3.9 Engagement between RWM and waste producers

The disposability assessment process recognises the value of early and sustained engagement with waste producers and includes it as an integral part of the disposability assessment process [14]. In our inspections at Dounreay and Hunterston A, we observed evidence that this is being implemented in practice and has led to the development of good collaborative working relationships between RWM and waste producers. This is enabling the waste producers to take full ownership of the issues and risks around long term management of their waste streams and manage them appropriately.

The engagement was found to be effective at all levels and aspects of the disposability assessment process, from management of shared programmes for disposability assessments, to working level interactions. In general, we saw that this close engagement was an important aspect of underpinning and establishing confidence in waste management decisions and understanding associated risks and provided valuable information to support waste producer's decisions on waste management.

We confirmed that both waste producers are utilising a range of formal and informal engagement and advice from RWM to support their waste management decisions. Both waste producers had made use of the formal "expert advice" service recently introduced by RWM, which provides technical consideration of the risks associated with pursuing a particular packaging proposal, in advance of formal LoC submissions. We reviewed examples where waste producers had used such expert advice to gain confidence to implement a particular waste management approach. Where a fLoC cannot be given (for instance due to lack of compliance with transport requirements or post-closure performance), RWM may issue the fLoC with qualifications, or may provide only an assessment report. In any case, relevant advice in relation to conditioning and packaging will be provided.

In addition, waste producers reported that RWM actively engages with them through frequent meetings and site visits. This enables RWM specialists to fully understand the site- and waste-stream specific issues to be taken into account for management of a particular waste stream and the implementation of pragmatic approaches.

One issue highlighted by waste producers was that sometimes a RWM assessment report contains action points on matters that could have been more readily resolved through the established modes of interaction (both formal and informal) between RWM and the waste producers, before the assessment report is finally issued. Once an action point is raised in a finalised assessment report, its formal status requires the waste producers to apply their full

resolution process to it, with associated costs in terms of time and effort, which might otherwise have been avoided.

The regulators recognise and commend the general efficacy of communications between RWM and waste producers throughout the Disposability Assessment process, but we recommend that RWM considers sharing a draft assessment report, or possibly the draft action points, with a waste producer ahead of formal delivery of the report, to ensure "no surprises" and effective use of time and resources.

> Recommendation 7: RWM should consider sharing a draft assessment report, or possibly draft action points, with a waste producer ahead of formal delivery of the report.

One waste producer noted that it had occasionally had cause for concern over the consistency of RWM's assessment process. DSRL perceived that a combination of recruitment of new staff and utilisation of outside contractors by RWM, to support its disposability assessments, may have contributed to different outcomes (e.g. different action points) being raised regarding different submissions for similar packaging proposals for similar waste streams. Magnox, on the other hand, reported no such concern. Nevertheless, we are sufficiently persuaded by DSRL's concern, to recommend that RWM should review its processes to ensure it carries out sufficient cross-checking between assessments, so as to minimise the potential for inconsistencies in outcomes, before finalising assessment reports.

> Recommendation 8: RWM should review its processes to ensure it carries out sufficient cross-checking between assessments, so as to minimise the potential for inconsistencies in outcomes, before finalising assessment reports.

The regulators regard as good practice the sharing of knowledge regarding radioactive waste management between practitioners. We note that RWM has systems in place to encourage such sharing of knowledge i.e. providing access to executive summaries of assessment reports and a database of existing packaging submissions and assessments [24]. Our discussions with both DSRL and Magnox revealed that individuals in both organisations find it challenging to access the information that they would like to obtain via these methods. We are also aware that RWM continues to work with waste producers through forums such as the Waste Packagers Liaison Meeting. As such, we encourage RWM and waste packagers to continue to work together to review and improve existing means of sharing knowledge effectively.

3.10 Incorporation of RWM's process into waste management on site

In our inspections at Dounreay and Hunterston A, we were assured that the use of RWM's disposability advice is appropriately incorporated into waste producer processes and arrangements for the long-term management of their wastes.

Both waste producers have an agreed programme for disposability assessments with RWM. From our discussions, it appeared that the disposability assessment programme is sufficiently flexible to be aligned with site waste management plans and to be responsive to

changes in waste producers' priorities etc. and does not delay waste management activities. We noted that RWM's programme does not distinguish disposability assessment work for HAW in Scotland from HAW elsewhere in the UK, and so Scottish waste producers are not disadvantaged in any way.

We found that both waste producers used RWM's advice as an important input into waste management decisions. We were assured that the waste producers understood the status of RWM's disposability assessments and LoCs as indicated in the joint guidance [1], and used this advice appropriately. They understood that RWM is not a regulator and its advice does not represent regulatory endorsement and, in particular, LoCs are not necessarily a prerequisite to obtaining regulatory consent for waste conditioning [1].

We did find, however, that both the waste producers we inspected have a presumption that they will achieve final LoC endorsements for conditioned HAW into their waste management processes and forward-looking plans. In discussions we found that this reflected a requirement in the NDA contract client specification relating to decommissioning the sites.

While this can be seen as a positive indication that RWM's disposability assessment process is recognised as a key enabler for waste management decisions and approaches, we investigated whether this presumption unduly constrained waste producers in their consideration of a comprehensive range of options for conditioning HAW.

We sampled a number of examples, which demonstrated that both waste producers exerted an intelligent customer function on RWM advice, challenging it and also working collaboratively with RWM to develop optimal waste management solutions. We found no evidence that the presumption of the need to obtain a fLoC was driving waste producers toward sub-optimal HAW conditioning options in Scotland.

Nevertheless, we perceive a need for waste producers to discuss with NDA the issue of contractual terms (e.g the Client Specification requiring fLoCs for all HAW), to ensure they do not inhibit the waste producer achieving optimal solutions. We will pursue this issue separately.

4 Conclusions and recommendations

4.1 Key findings

The key findings from our review are that:

- RWM's disposability assessment process (based on geological disposal), and resultant packaging advice are suitable for long-term near-surface management of HAW in Scotland; and
- RWM's advice is used appropriately by waste producers in Scotland.

We are therefore able to conclude that our assertion that:

> "*packages conditioned in anticipation of geological disposal are also suitable for long-term management in near-surface facilities, as required by government policy in Scotland*."

which we made in our joint guidance [1] remains valid.

We have, however, noted a number of recommendations which RWM should consider to improve the delivery of the advice and the robustness with which it is implemented. We will progress these recommendations either through our dialogue with RWM via our ongoing scrutiny programme, and if appropriate via our joint regulatory issues resolution process.

Our recommendations are:

No.	Recommendation
R1	RWM should update its arrangements, including its Assessment Quality Plan, to ensure all waste-streams that fall under Scottish Policy have undergone a policy evaluation, irrespective of assessment stage.
R2	RWM should communicate to regulators any developments regarding the gDSSC, which could influence the fitness-for-purpose of the disposability assessment process for HAW in Scotland.
R3	RWM should continue to work with waste producers to ensure that RWM's waste package record requirements are sufficiently clear, and that RWM's advice to waste producers remains consistent.
R4	RWM should consider how best to include in its periodic review process waste streams covered by a final stage Assessment Report, but not endorsed with a fLoC.
R5	RWM should continue to work with waste producers to ensure that its periodic review process and programme is suitably aligned with sites' decommissioning timescales.
R6	RWM should work with liability owners and the regulators to consider how to establish formal processes to ensure appropriate visibility and governance of risks associated with HAW that may require further treatment to be disposable.
R7	RWM should consider sharing a draft assessment report, or possibly draft action points, with a waste producer ahead of formal delivery of the report.
R8	RWM should review its processes to ensure it carries out sufficient cross-checking between assessments, so as to minimise the potential for inconsistencies in outcomes, before finalising assessment reports.

5 Abbreviations

ALARP	As Low As Reasonably Practicable
BEIS	Department for Business, Energy and Industrial Strategy
cLoC	conceptual stage Letter of Compliance
DECC	Department for Energy and Climate Change
EA	Environment Agency
EDF	EDF energy
fLoC	final stage Letter of Compliance
GDF	Geological Disposal Facility
gDSSC	generic Disposal System Safety Case
GWPS	Generic Waste Package Specification
HAW	Higher Activity radioactive Waste
iLoC	interim stage Letter of Compliance
ILW	Intermediate Level radioactive Waste

LLW	Low Level radioactive Waste
LoC	Letter of Compliance
LTP	Life Time Plan
MoD	Ministry of Defence
NDA	Nuclear Decommissioning Authority
ONR	Office for Nuclear Regulation
R&D	Research and Development
RWI	UK Radioactive Waste Inventory
RWMC	Radioactive Waste Management Case
RWM	Radioactive Waste Management Limited
SEPA	Scottish Environment Protection Agency
SLC	Site Licence Company
SOF	Store Operations Forum
WAC	Waste Acceptance Criteria
WPrS	Waste Product Specification
WPS	Waste Package Specification

6 References

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[24] RWM, "www.gov.uk/guidance/our-work-with-radioactive-waste-producers," 2015 (updated 16 March 2017) .

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Appendix - Disposability assessment process

When requested by waste producers, RWM provides them with advice on the packaging of their HAW through its process of disposability assessment, in order to minimise the risk that waste packaged now will not be compliant with future transport and disposal system requirements.

RWM’s disposability assessment process consists of a series of 14 technical evaluation topics and three safety assessments. The range of the evaluations and assessments is wide, covering for example: container performance; operational safety; and post-closure safety. Where packaging proposals are compliant with its packaging specifications and safety cases, RWM endorses a waste producer's proposal with a Letter of Compliance (LoC).

A LoC indicates that RWM expects the packaged waste will meet the waste acceptance criteria for any future GDF. LoCs can be issued at conceptual, interim and final stage. In addition to this, RWM provides 'packaging advice' within an assessment report which can also be issued at a pre-conceptual stage. RWM reviews issued final stage LoCs (fLoCs) to make sure they are appropriately implemented and remain consistent with RWM's packaging specifications through periodic reviews with a periodicity of about ten years.

Waste producers use RWM's packaging advice to inform their safety cases and to inform their Radioactive Waste Management Case (RWMC) for a particular waste stream. However, it is important to note that a LoC itself has no regulatory standing and we carry out our own assessments of the adequacy of conditioning and packaging arrangements at sites.

When RWM receives a request for advice from a waste producer it initiates a disposability assessment and appoints a Waste Management Specialist to manage the assessment process. Figure 1 shows the sequence of steps in RWM's assessment process.

Figure 1: Schematic overview of RWM's disposability assessment process