

Regulatory Inspection of the Provision of Disposability Assessment and Waste Packaging Advice in the UK to Provide Confidence that Higher Activity Waste Stored on Licensed Sites will be Suitable for Safe Handling, Transport and Disposal – 15088

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ABSTRACT

Radioactive Waste Management Limited (RWM), the developer and future operator of a geological disposal facility (GDF) in the United Kingdom, operates a disposability assessment process to minimise the risk that current conditioning and packaging of higher activity wastes (HAW) will result in packages incompatible with geological disposal in the future. Specialists in nuclear and environmental safety from the Office for Nuclear Regulation (ONR) and the Environment Agency (EA) in 2013/14 completed an inspection of the RWM's process of disposability assessment. The inspection gave the regulators confidence that RWM has in place a systematic process to provide an important means of reducing risks associated with waste packaging in advance of an operational GDF and that the process of disposability assessment is providing the necessary information for licensees to assure future HAW disposal to the GDF. This work forms part of our continuing programme to review RWM's work related to geological disposal of higher activity radioactive waste (HAW).

INTRODUCTION

Geological Disposal Oversight

Radioactive waste arises from the UK's historical and on-going nuclear power, research and defence programmes. UK Government policy for the long-term management of HAW in England comprises geological disposal preceded by safe and secure interim storage. HAW comprises a number of categories of radioactive waste – HLW, ILW, and LLW that is not suitable for near-surface disposal in current facilities.

As a pioneer of nuclear technology, the UK has accumulated a legacy of higher activity waste and material. Some of this has already arisen as waste and is being stored on an interim basis at nuclear sites across the UK. More will arise as existing facilities reach the end of their lifetime and are decommissioned and cleaned up, and through the operation and decommissioning of any new nuclear power stations.

A European Directive [1] establishing a framework for the responsible and safe management of spent fuel and radioactive waste recognises that deep geological disposal represents the safest and most sustainable option as the end point of the management of high level waste and spent fuel considered as waste. Geological disposal of HAW became UK government policy in 2008, through the White Paper “Managing Radioactive Waste Safely – A Framework for Implementing Geological Disposal” [2]. The UK Government recently restated its commitment to the policy of geological disposal in a White Paper “Implementing Geological Disposal” in July 2014 [3]. The White Paper sets out the role of RWM as the developer of a GDF. Radioactive waste management is a devolved policy issue. Therefore, the Welsh Government, Northern Ireland Executive and Scottish Government each have responsibility for this issue in respect of their areas^a.

^a The Welsh Government and Northern Ireland Executive are each reserving their positions on geological disposal and therefore do not confirm that they will support future implementation. At the time of writing the Welsh Government was reviewing its policy on the disposal of HAW. Scottish

ONR is responsible for the safety and security regulation of the nuclear sector across the UK. ONR grants licences that allow licence holders to use nuclear licensed sites for specified activities. ONR also regulates the safety of transport of radioactive materials. The EA is responsible for the enforcement of environmental protection legislation in England, regulating radioactive and non-radioactive discharges and disposals to air, water (both surface and groundwater) and land, including disposal by transfer to another site. This responsibility sits with Scottish Environment Protection Agency (SEPA) for Scotland and Natural Resources Wales (NRW) for Wales. Regulatory guidance on the management of HAW is provided jointly by ONR, the EA, and SEPA [4].

The Nuclear Decommissioning Authority (NDA) are the body tasked with managing the effective and efficient clean-up of the UK's nuclear legacy, implementing government policy on HAW, the LLW strategy, and providing advice on the decommissioning plans for current and planned nuclear power stations. The NDA has established RWM as its delivery organisation for geological disposal of HAW and for development of waste management solutions. RWM is a wholly owned subsidiary of the NDA, and was previously RWMD, NDA's Radioactive Waste Management Directorate. RWM is undergoing a period of organisational development so that it can evolve into an organisation capable of holding the necessary environmental permits and nuclear site licence(s) to develop and operate a GDF. Throughout this period RWM will need to continue to provide appropriate packaging advice to waste producers to minimise the risk that conditioning and packaging of HAW now results in packages that are incompatible with geological disposal in the future. This will help avoid the need for repackaging and 'double handling' wastes.

Existing HAW must be stored pending geological disposal. Early conditioning of this waste into an appropriate form for storage is a significant part of its management. This is designed to reduce its hazard and to make wastes passively safe as soon as practicable, such that they are physically and chemically stable and stored in a manner that minimises the need for control and safety systems. This requirement is specifically outlined in ONR's Safety Assessment Principles (SAPs) [5].

Disposability Assessments and Letters of Compliance

The RWM disposability assessment process considers the performance and safety of waste packages during their transport to a GDF, handling and emplacement at the facility, and in the longer-term post-closure period. The assessment process also considers interim storage of waste packages prior to transport to a GDF, as far as this may influence their subsequent performance and safety. The disposability assessment process [6] aims to assist nuclear sites in carrying out their clean-up and hazard reduction mission. It consists of a series of technical evaluations and safety assessments (Figure 1) and described in a previous WM conference paper [7]. Where a waste producers packaging proposals are compliant with RWM's packaging specifications, associated safety, and environmental assessments, it endorses their approach with a Letter of Compliance (LoC). A LoC indicates that RWM considers that, to the best of their knowledge, the packaged waste is likely to meet the waste acceptance criteria for disposal in a future GDF.

Government Policy is that the long-term management of HAW should be in near-surface facilities, located as near to the sites where the waste is produced as possible.

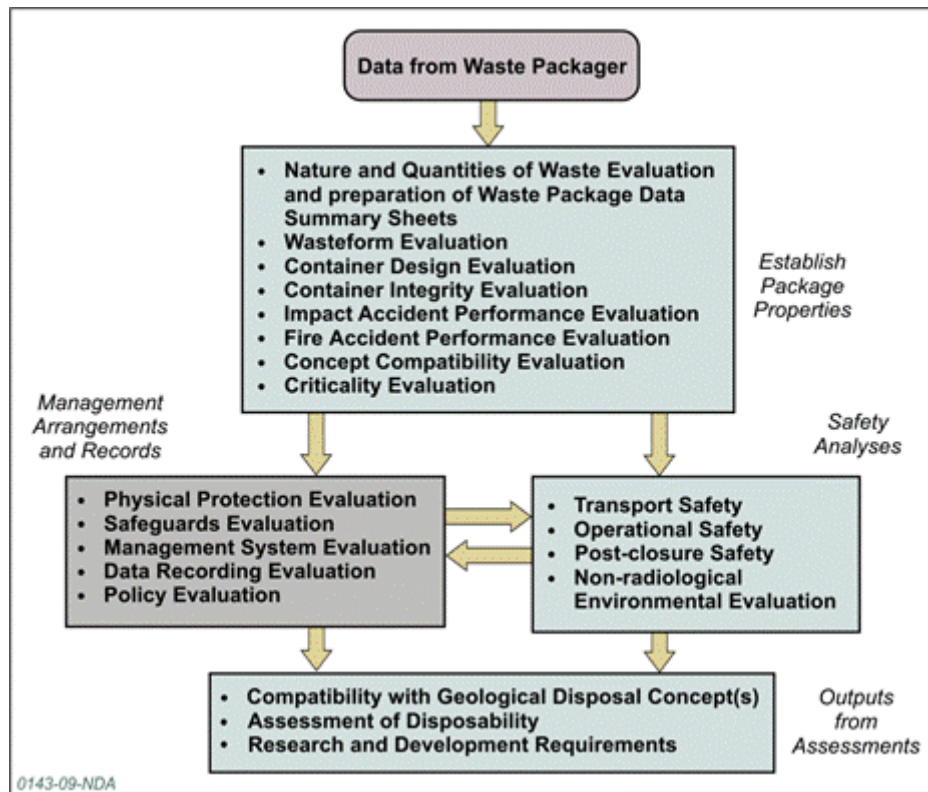


Fig. 1. Schematic overview of RWM's disposability assessment process

RWM has established a standardised approach for staged disposability assessment based on the development of a waste packaging project, and broadly follows the regulatory milestones required for safety cases (Figure 2). At each stage (Conceptual, Interim and Final), the primary output is an Assessment Report that may be accompanied by a LoC if RWM are satisfied that the implementation of the packaging proposal would result in the production of waste packages that are compliant, at the assessment stage, with the relevant packaging specifications and with the geological disposal concept and its associated safety cases. The assessment report may contain action points that need resolution before an LoC can be issued, or that should be resolved at the next LoC stage. In addition to this, RWM provides 'packaging advice' within an Assessment Report which can also be issued at a pre-conceptual stage. RWM conducts a periodic review on final stage LoCs (fLoCs) to make sure they are appropriately implemented and remain consistent with RWM's packaging specifications.

Engagement is an important part of the Disposability Assessment process. RWM is keen to promote early, sustained and positive engagement with waste packagers, before the preparation of a formal submission or they undertake assessment. This is aimed early identification of any key issues to facilitate the assessment process and endorsement of the waste package.

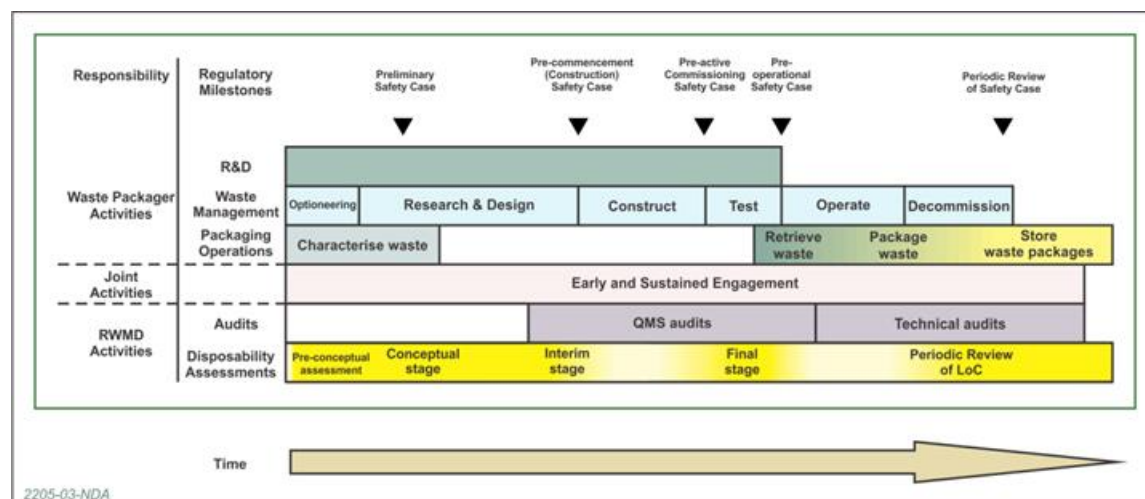


Fig. 2. Indicative interactions between RWM and the waster packager on an idealised packaging project

The expectation for waste producers to follow the LoC process is specifically stated in the regulatory Joint Guidance [8]. Waste producers use RWM's disposability assessment advice to inform their safety cases and they include it as part of their Radioactive Waste Management Case (RWMC) for a particular waste stream. The RWMC is a recommendation of the Joint Guidance to produce a transparent summary document of how the key elements of long-term safety and environmental performance will be delivered for the management of a waste stream. It is expected that this should include arguments and evidence to provide confidence that the proposed or on-going waste conditioning and storage operations will result in disposable waste products. The regulators recognise RWM as the appropriate body to advise licensees on the packaging and conditioning for geological disposal of HAW, 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.

The disposability assessment helps support the development of plans for the implementation of geological disposal in the UK as it allows consideration of 'real waste' packages and their performance against the safety cases for the proposed GDF. At the end of March 2014, final stage LoCs encompass some 48,000m³ of intermediate level waste, representing around 13% of the UK total [9]. Furthermore, RWM has issued early stage LoCs and/ or assessment reports covering a further 155,000m³, for which packaging strategies are being developed. As of March 2014, RWM has therefore considered approximately 54% of UK intermediate level waste within its Disposability Assessment process. RWM is committed to keeping stakeholders informed of progress that is being made in recovering and packaging HAW. Annual reports of interactions on waste packaging matters, in particular identifying the assessments undertaken, have been published since 2001.

DESCRIPTION OF INSPECTION

The EA and ONR will be responsible for issuing the necessary permits and licences to develop and operate a GDF in England, and are working together to make sure that a future GDF will meet the required high standards for environmental protection, safety, security and radioactive waste transportation. Prior to any formal applications to develop or operate a GDF, the EA and ONR role is to provide oversight of RWM's work through on-going Technical and Organisational scrutiny. This includes consideration of RWM's provision of advice and assessment of disposability.

The joint inspection reported here is part of work to provide the regulators with confidence that RWM is operating an appropriate process of disposability assessment to minimise the risk that conditioning and packaging of HAW at the current time results in packages that are incompatible with geological disposal in the future.

This inspection considered RWM's arrangements for disposability assessment including linkages to the GDF design, the provision of packaging advice to waste producers, and its periodic review process. This was supplemented by discussions with waste producers to assess how they are taking appropriate account of advice provided by RWM in their arrangements to package and store HAW in accordance with their safety cases.

In conducting our inspection, we considered the evidence we collected against the following areas:

- Programme fit: does the packaging advice support preparation for the implementation of geological disposal?
- Efficiency of advice: Does packaging advice contribute to HAW management by facilitating efficient and timely packaging of wastes?
- Impartiality of advice: Is packaging advice sufficiently protected from undue influence and conflicts of interest?
- Robustness of process: Is the disposability assessment process underpinned by an appropriate management system?
- Currency of advice: Does RWM's periodic review of fLoCs provide appropriate assurance on the continuing suitability of packaged wastes for geological disposal?
- Assurance of advice: Is packaging advice maintained to a high standard?

Our inspection of RWM included the following activities:

- To inspect RWM's assessment of waste packaging proposals and provision of packaging advice.
- To assess how RWM's periodic review process provides assurance that where a fLoC has been granted it remains appropriate, so that packages already generated remain in a disposable form and that future packages will meet the requirements of the fLoC.
- To assess how RWM manages the integrity of the packaging advice it provides to waste producers during changes to the proposed geological disposal system and revisions to packaging specifications.
- To assess RWM's arrangements for managing discussions and interactions with interested parties concerning packaging proposals and its assessments of them.

Prior to undertaking the inspection we identified areas to focus on during the inspection. To assist us with this preparation we requested and reviewed information from RWM. This information included RWM's procedures related to undertaking disposability assessments, as well as information on internal assurance and examples of quality assurance documentation. We also observed a meeting of RWM's Nuclear Safety and Environment Committee, which provides advice to RWM in relation to the more significant waste packaging proposals.

In undertaking the inspection we interviewed staff from across RWM, from Directors to Packaging Assessment Managers responsible for specific disposability assessments. We sampled a selection of packaging assessment work to consider in more detail. This sample included wastes we would be discussing in the later engagement with waste producers, and represents a cross-section of the types of packaging advice provided by RWM.

Following the inspection of RWM, we undertook a series of meetings at waste producer sites to assess how well they are interacting with RWM and what value they place on the advice

provided to them with respect to their arrangements to package and store HAW. Our discussions with waste producers included the following:

- Arrangements for consideration of RWM's waste packaging advice and linkages to HAW management at plants.
- Procedures for agreeing, and modifying, a Waste Product Specification^b, and implementing it.
- Arrangements for introducing a new waste stream through a packaging plant, and implementing it.

DISCUSSION

Key Positive Findings

We found RWM's disposability assessment process is generally robust. We found clear evidence, from Director level to the individual Packaging Assessment Managers, that the disposability assessment process is applied in a manner that should not fundamentally restrict potential designs of the GDF in the future. To ensure that it does not endorse packaging proposals that could compromise the GDF's nuclear safety and environmental performance, RWM has developed a set of arrangements for disposability assessment. RWM's stakeholders need to recognise the importance of maintaining an appropriate level of rigour and understand why the process can take a relatively long time to complete. Our examination of files from a number of disposability assessments indicated that generally there appeared to be good evidence of compliance with the Quality Management System for the process.

During the inspection we identified some areas of good practice concerning the interactions between RWM staff and also in their engagement with waste producers. From our discussion with RWM, it was clear that there was good interaction between the packaging assessment team and other parts of RWM. This helps to ensure that the disposability assessment process is kept aligned as far as possible with wider GDF design and safety case developments, and linked into the geological disposal system change management procedure.

In the disposability assessments we examined, it was common practice for the Packaging Assessment Managers to continue to engage with the waste producer, to explain the output of the assessment and help close out any action points that may have arisen from the assessment. RWMD explained that where issues could not be fully resolved they could be translated into caveats or exclusions, for example controls on the content of waste packages, where this was an appropriate way to progress the assessment. We were impressed by the positive, professional attitude of the Packaging Assessment Managers in helping waste producers progress package proposals at the same time as ensuring the nuclear safety and environmental performance of the GDF.

Development of RWM's newly structured packaging specifications has involved early engagement with NDA and waste producers, via a regular Waste Packagers Liaison Meeting. RWM believes that early engagement in developing the packaging specifications, giving waste producers the chance to influence proposed packaging specifications, has resulted in fewer issues being raised than has been the case in the past.

If a packaging proposal submitted to RWM for disposability assessment incorporates a waste container which is not included within the Disposal System Specification [10], RWM invokes the change management procedure to fully assess its acceptability. This involves a number of

^b A Waste Product Specification defines what the waste producer is setting out to manufacture and is assessed by RWM as part of the process of disposability assessment [4].

steps and research may be required to provide underpinning information for the assessment of the proposed change to allow acceptance of the package. This can increase the length of time required to undertake a disposability assessment. RWM considers that conducting the change management procedure in series with the disposability assessment process is not working effectively for novel or innovative packaging proposals. Therefore, RWM has now developed an improved process for the assessment of novel or innovative packaging proposals. This process considers upfront whether any change management is likely to be required as a result of the proposal. The regulators fully support the work that RWM is undertaking to ensure better engagement with waste producers as part of the disposability assessment process to minimise the chances of packaging proposals later being rejected. We were particularly impressed by an RWM initiative introducing an Upstream Optioneering programme [11] of work to realise improved HAW management opportunities that has made good progress in this respect.

Key Areas for Improvement

There are currently no clear criteria to prioritise the undertaking of disposability assessments. RWM expects that the number of packaging proposal submissions is likely to increase in the future. We consider that it would be beneficial to have a transparent prioritisation process that enables waste producers to understand the priority attached to their proposals. Some waste producers may have unrealistic expectations of timescales and do not fully understand what RWM needs to do before it can decide whether to issue a LoC. RWM recognises that early engagement with the waste producers makes the assessment process more efficient by helping to improve the quality of submissions and resolving potential issues before they arise. RWM has also identified that this early engagement with waste producers will help it better plan its disposability assessments in the future. We strongly encourage RWM to continue this early engagement, whilst ensuring that it does not compromise the integrity of its assessment process. There is currently a high level initiative within RWM to meet with waste producers at the management level to develop a more integrated schedule for disposability assessments between RWM and the waste producers. RWM has identified opportunities to improve the process which may help to ensure that disposability assessments do not hold up the progress of packaging projects. However, for this to be achieved, RWM needs to be confident that waste producers will deliver submissions for disposability assessment on time and to the required quality.

At the time of our inspection RWM had completed six periodic reviews, and several more were on-going or planned over the following months. All these reviews relate to waste packages that have been produced and previously endorsed by RWM's predecessor, Nirex in the late 1980s, and cover the majority of the UK's packaged HAW. However, RWM had no specific procedure covering the process of periodic review at the time of the inspection. RWM has, to date, completed periodic reviews following its standard disposability assessment process, and paying particular attention to package records (noting that package records are produced at the site only after a fLoC is issued). It is important to note that RWM's periodic review is a re-assessment of the disposability of a waste package in the GDF, taking into account any changes in the development of the GDF concept since the original assessment. The waste processing, storage conditions and management of waste packages on a site are important inputs to this re-assessment, which are provided by the waste producer. Waste producers must ensure that their waste packages are managed in accordance with regulatory requirements and that the relevant safety cases are periodically reviewed.

The regulators considered that RWM should document and implement a specific procedure for the periodic review of fLoCs and that this procedure must address the important matter of timeliness of its periodic reviews and whether and how to differentiate between routine periodic review and those triggered by events that may affect the quality of waste packages. We also identified a number of specific challenges arising from the periodic reviews that had

been undertaken that RWM should consider in developing its process for periodic reviews, these included:

- Underpinning of package evolution during storage.
- Non-conforming packages.
- Operational experience and feedback.
- Extensions to waste streams covered by fLoCs.

None of the periodic review assessment reports we inspected had resulted in the fLoC being re-issued; this means there are conditions from the fLoC that have not been addressed or new issues have emerged. In such cases, RWM and the waste producer need to work together to close out the Action Points and allow re-issue of the fLoC. RWM told us that only one periodic review assessment has resulted in the reissue of the LoC. We consider that the current status of the fLoCs that have been subject to periodic review is unsatisfactory, not least because it may undermine confidence in the wider disposability assessment process. RWM should clarify the status of these fLoCs and the waste packages under them and ensure that any lessons learned are taken into account for its developing periodic review procedure. Several action points relating to some fLoCs and periodic reviews remain open. It is important that RWM works with waste producers to close these out.

As previously stated, new packaging proposals that fall outside, or challenge, the existing suite of packaging specifications are reviewed through RWM's change management procedure, which is initiated by the relevant Packaging Assessment Manager submitting a concept change request. Generally the Packaging Assessment Manager drives the request through the change management procedure and ensures that enough time is allocated for their assessment to allow for this, and manages the expectations of the waste producer who has made the submission. We examined some good examples of this during the inspection, such as the submissions for the use of Ductile Cast Iron Containers (DCICs). RWM dealt with these submissions using a modular disposability assessment approach that addressed specific issues (such as gas generation and impact performance), common to the range of waste streams to be placed in the containers. Once these were completed, they fed into waste stream specific iLoC assessments.

RWM is currently assessing novel or innovative waste package proposals that require use of the change management procedure, at the same time as it is revising its suite of Waste Package Specifications. This presents a risk that advice to different waste producers will be inconsistent, as they are being assessed against a constantly changing baseline. Several Packaging Assessment Managers told us that it is challenging to ensure consistency between the assessments being undertaken, and they try to ensure consistency of advice by regularly discussing matters and assessments amongst themselves. However, we noted that this is being carefully managed by RWM, and we found no evidence of mistakes being made. RWM has defined packaging specifications requirements on the basis of the 'limiting' case (such as waste package stack height and impact performance). RWM accepts that there are a number of pessimisms in defining packaging specifications on this basis, and that packages might eventually be found to retain margins of safety. However, given the absence of a disposal site and host geology, RWM believes this approach is necessary to provide confidence to the public and industry. The regulators identified that on occasion this approach may cause problems for waste producers meeting RWM's requirements.

RWM's assurance function is not mature, but is developing as the organisation progresses with respect to being the delivery organisation for the GDF and evolving into a future nuclear licensee. The Assurance function has a forward programme of work which covers a range of activities, including an audit of disposability assessment files, to be conducted by a

contractor. RWM is well advanced in resolving findings from recent internal assurance reports. Examples of these findings are:

- Consider the potential to improve clarity of record keeping requirements to increase the efficiency of future periodic reviews as part of the update of the disposability assessment scrutiny process.
- Clarify the requirements for review/ sign-off of Assessment Quality Plans in the update the disposability assessment scrutiny process.

In addressing the findings the regulators suggested that RWM first tries to identify root causes for non-compliances, as they may point to more systemic factors that need addressing e.g. a poorly written or ambiguous procedure; that the same information is requested several times in different places; or time constraints from the Packaging Assessment Manager. We also encouraged RWM to continue to close out assurance findings and suggested more robust procedures to address: agreement on the actions that will resolve the issue; tracking of the progress of these actions; and a plan for formal close-out, would help. To achieve this we considered that it was important that RWM ensured that it has in place an appropriately resourced and integrated internal assurance function to manage the activities required of it. RWM has since reviewed and reissued its overarching internal assurance arrangements to reflect this feedback, although this has not yet been seen by the regulators.

Findings from Discussions with Waste Producers

The discussions with waste producers fully corroborated the findings from our inspection of RWM. Waste producers generally considered that RWM is supportive and accessible. RWM has become an organisation aiming to help industry resolve issues and it facilitates cross industry working by identifying waste producers with similar packaging problems. Several waste producers stated that this could be further improved by RWM considering whether establishing itself as the Design Authority for those containers adopted into its Disposal System Specification, would be useful in providing a single and enduring point of contact for waste producers (who are likely to use them over long timescales).

Waste producers reported that RWM's Assessment Reports are usually high quality technical outputs that provide waste producers with information necessary to minimise the risk that conditioning and packaging of HAW at the current time would result in packages that are incompatible with geological disposal in the future. However, RWM is also able to provide more generic packaging advice (without completing an Assessment Report) to support waste producers during optioneering exercises, internal project review milestones and engagement with regulators. Waste producers welcomed this flexibility in providing assessment output and packaging advice. The regulators considered that this feedback confirmed the good practice being applied by RWM.

Waste producers told us that significant delays have occurred in the provision of some packaging advice by RWM. Waste producers are now typically scheduling packaging advice like other contracted services and so RWM needs enhance its project management capabilities to manage these. These comments from waste producers align with the recommendation from our inspection of RWM that we considered that RWM should complete its initiatives to improve scheduling and prioritisation of disposability assessments and in doing so implement a transparent process to plan and prioritise its resources.

Evidence from our meetings suggested that on occasion parts of disposability assessment could be applied in a more proportionate manner, that more explicitly takes account of the hazard presented by the waste under consideration and the stage of the disposability assessment. Waste producers consider that the consistency of packaging advice from RWM is improving but that there is room for further improvement. Waste producers also told us of

occasions in which changes made by RWM to key data and assumptions provided in their submission had only become apparent once RWM's technical evaluations and safety assessments were completed. RWM should consider whether it could use packaging assessment launch meetings or other hold points to check its understanding of key data and assumptions submitted by the waste producer, and also to provide justification to the waste producer of any changes RWM made to the submitted data and assumptions. We raised additional recommendations with RWM as a result of these findings.

Waste producers told us that periodic reviews have value but that they are unclear of the current status of waste packaged under LoCs that have been through the periodic review process. These observations aligned with our findings and recommendations from the inspection of RWM.

CONCLUSIONS

Based on the information obtained during our inspection, we believe that RWM has in place a systematic process to provide an important means of reducing risks associated with waste packaging in advance of an operational GDF. We found RWM'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.
- Supports progress in decommissioning and clean-up.

During the course of our inspection we identified and reported some areas of good practice. However, we also identified some areas that could be improved, including, for example:

- The scheduling and prioritisation of disposability assessments.
- Establishing periodic reviews on the same basis as disposability assessment, and in particular resolving the uncertainty in the current status of fLoCs reviewed to date.
- The assessment of innovative packaging proposals.
- The delivery of internal assurance activities associated with RWM's provision of disposability assessments and waste packaging advice.

Our meetings at waste producer sites have also given us confidence that RWM's disposability assessment process provides waste producers with the information and advice necessary to minimise the risks that HAW stored on their sites may not be suitable for safe handling, transport, storage and disposal.

Since we undertook our inspection RWM have made significant progress in the areas that we identified for improvement. ONR and EA are continuing to encourage and support RWM in its work to improve the disposability assessment process further.

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