



Office for
Nuclear Regulation



Environment
Agency

Geological disposal of radioactive waste

Pre-application advice and scrutiny of Radioactive Waste Management Limited

Annual Report

April 2017 to March 2018

Issue 1

November 2018

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For information on how we regulate geological disposal, and for copies of this and other reports in the series, visit the joint regulators' web pages at:

<https://www.gov.uk/government/collections/scrutiny-of-radioactive-waste-management-directorates-rwmd-work>

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Foreword

This is a joint publication by the Environment Agency and the Office for Nuclear Regulation to inform others about our oversight of Radioactive Waste Management Limited's (RWM) work relating to geological disposal of radioactive waste. Prior to the start of formal regulation, we have established agreements with RWM to provide regulatory advice in relation to geological disposal. The regulators are working together to make sure that any future geological disposal facility (GDF) will meet our high standards for environmental protection, safety, security, radioactive materials transport and safeguards.

We are engaging with RWM for two reasons. Firstly, to ensure that any future applications for a GDF take full account of our permitting and licensing requirements. Secondly, to ensure that the advice RWM currently provides to waste producers, about how they should package their radioactive waste for future geological disposal, is appropriate.

We maintain an open and constructive dialogue with RWM. This is beneficial in building RWM's understanding of our regulatory expectations. It also gives us an awareness of RWM's work in relation to geological disposal, allowing us to prepare for any licence or permit application that we might receive from RWM, in order to respond in an informed and timely way.

We have no regulatory role in the decision-making process for selecting potential sites for a GDF. However, separate to our oversight of RWM reported here, we also provide advice and comment on matters within our regulatory remits to inform that decision-making process.

As independent regulators, we are committed to making our work open and transparent. We trust that this report will be useful to others in introducing our standards and requirements for a GDF and in providing insight into how we will ensure that these will be met in the future.

Executive Summary

Government policy, in England and Wales, for managing higher activity radioactive waste (HAW) in the long term is through geological disposal. This is currently being progressed alongside ongoing interim storage and supporting research. Radioactive Waste Management Limited (RWM) is responsible for implementing government policy on geological disposal of HAW and for providing radioactive waste management solutions. It is currently undertaking preparatory work to plan for geological disposal - work described as 'generic', as no sites have been identified yet. Scottish Government policy does not support geological disposal, and instead favours near-site, near-surface management of HAW. Scottish Government Policy at the present time is that long-term storage [in a near-surface storage facility] is still the primary long-term management option.

Our dialogue with RWM is helping it to develop a good understanding of the regulatory requirements and associated regulatory submissions required to enable environmental permitting and the granting of a nuclear site licence for geological disposal activities.

This report summarises the work carried out by the Environment Agency and the Office for Nuclear Regulation to scrutinise the work of RWM during the financial year 2017-18. The main outcomes from our work in this reporting period are as follows:

- RWM has developed a good high-level understanding of the regulatory permissions required for its anticipated activities relating to a GDF. Further work is needed to ensure that all the permissions that may be required can be properly addressed.
- Currently RWM is undertaking various work streams that contribute towards developing a comprehensive programme of work to design, construct, operate and close a GDF. However, RWM needs to communicate this in a way that is clear and that can be used by regulators and others to assess progress and to understand what needs to be done at each point in the programme.
- RWM has used our earlier feedback on its 2010 generic Disposal System Safety Case (gDSSC) to produce an improved 2016 gDSSC, however improvements in some important areas will be required in order to produce a site-specific safety case that is fit-for-purpose. Details of our findings in relation to the 2016 gDSSC are presented in a separate report.
- RWM is making significant progress towards identifying hazardous substances and non-hazardous pollutants of significance in wastes destined for geological disposal, and is working with the Nuclear Decommissioning Authority and waste producers to improve reporting of these substances and to obtain the necessary information in a timely manner. RWM will need to continue its work and efforts in this area to ensure that full and proper information is available to support a future safety case.
- RWM has made good progress towards being able to assess how hazardous substances and non-hazardous pollutants associated with radioactive waste in a GDF may impact on post-closure safety and protection of people and the environment. RWM needs to continue its work in this area to demonstrate in any future site-specific safety case compliance with the relevant legislation.
- RWM needs to integrate its R&D with its wider programme, to demonstrate how the outcomes contribute towards the evidence base supporting important safety claims and arguments.
- RWM has made good progress in developing its requirements and guidance for waste producers on waste package records to enable disposal at a GDF. RWM needs to continue to work with the nuclear industry to ensure the information needed to support safe interim storage and future disposal at a GDF is obtained and managed for the long-term. Any waste package without a comprehensive and agreed waste package record would not be acceptable for disposal at a future GDF.
- As part of its work this year, RWM has undertaken a comprehensive review of all regulatory recommendations and its progress in addressing these.

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1. Introduction

Radioactive waste has arisen and continues to arise from the UK's historic and ongoing nuclear power, research and defence programmes. To date there is no disposal route for the waste generated that is termed Higher Activity Radioactive Waste (HAW). Instead, HAW is stored on nuclear sites awaiting a disposal solution. HAW continues to be produced from nuclear sites and in smaller amounts from other users of radioactive material such as industry, hospitals and universities.

UK government policy for the long-term management of HAW is described in the 2014 White Paper [1], which sets out the framework for managing HAW through geological disposal, focussing on how a geological disposal facility (GDF) would be implemented in England.

The Nuclear Decommissioning Authority (NDA) is responsible for implementing government policy on the long-term management of radioactive waste, and its subsidiary, Radioactive Waste Management Limited (RWM), is responsible for implementing government policy on geological disposal of HAW.

The Environment Agency (EA) and the Office for Nuclear Regulation (ONR) are responsible for ensuring that any future GDF in England meets our high standards for protecting people and the environment when it is being developed, while it is operating, and after it has closed. We will be responsible for granting the necessary environmental permits and nuclear site licence and for our respective regulatory remits of environmental protection, safety, security, radioactive materials transport and safeguards. Currently, disposal is not a prescribed activity requiring a nuclear site licence to be in force. However, it is expressly stated in the 2014 white paper that it is Government intent that any future GDF will be a nuclear licensed site. The regulators have advised Government on suitable mechanisms to prescribe disposal of HAW as a licensable activity.

Regulatory control is likely to be required for at least a century. We are engaging with RWM now to ensure that any future applications for the development of a GDF we receive will take full account of our permitting and licensing requirements and to ensure that the advice RWM currently provides to waste producers, about how they should be packaging their radioactive waste for future geological disposal, is appropriate. This early engagement will also allow us to prepare for any licence or permit application that we might receive from RWM, in order to respond in an informed and timely way.

1.1. Managing our advice to RWM

At this early stage, before formal licensing or permitting begins, we are providing regulatory advice to RWM as opposed to making regulatory decisions. We scrutinise RWM and provide this pre-application advice through an ongoing programme of work, the scope of which is agreed each year with RWM. We keep our regulatory partner Natural Resources Wales (NRW) aware of matters arising and important outcomes from our Pre-application Advice and Scrutiny Programme (PAAS).

We have established systems and controls to ensure that our advice throughout the pre-application period is auditable and that RWM's work to address regulatory matters is monitored. RWM tracks the advice we provide from our scrutiny work through its recommendations log, and uses that to demonstrate progress. As part of its work this year, RWM has undertaken a comprehensive review of all regulatory recommendations and its progress in addressing these.

We have also established a Regulatory Issues Resolution Process (RIRP) which is designed to ensure RWM addresses in a timely manner important regulatory matters that we identify and to document an audit trail to their resolution. The RIRP complements our routine dialogue with RWM - it does not capture all matters that we identify or discuss as

a result of our regulatory interactions. Nor does it contain every important regulatory matter that a developer of a GDF will need to eventually resolve. We classify matters that we consider important for regulatory decision-making as either Regulatory Issues (RIs) or Regulatory Observations (ROs). We require RWM to resolve RIs within a specified timescale. We recognise that some matters (ROs) cannot be fully addressed in the current generic context and might require information that RWM can only obtain at a future stage in the programme once a site has been identified. Nevertheless, we require RWM to progress work to address and resolve ROs at the earliest stage possible in the programme. A list of all RIs and ROs current at the time of publication can be found in Annex A.

Separately, RWM records and tracks, on its own issues register, matters raised by its external stakeholders that may affect the implementation of geological disposal. RWM's issues register includes some of our Regulatory Issues and Observations for completeness, but contains many more issues from a range of stakeholders. RWM has published and updates its issues register on its website and we consider this to be a significant step towards transparent decision-making.

2. Organisational Development

Before we issue a permit or licence we require confidence that the applicant is, and will remain, competent and capable of complying with it. RWM must develop and evolve its structure and management arrangements appropriate for an organisation capable of holding the necessary licence and environmental permits to develop and operate a GDF. We monitor RWM's progress as a prospective environmental permit and nuclear licence holder through periodic inspections and meetings.

2.1. GDF Development programme

To support a permit application for site investigation boreholes and other regulatory submissions in the future, we will expect RWM to demonstrate a clear and comprehensive plan of work for implementing geological disposal and its progress against it. This will give us confidence that RWM understands the work it needs to undertake to achieve its goals and consequently its organisational requirements (including competence and capability), at each phase of its work.

We note (and have provided advice on) various items that may contribute to this overall implementation plan (such as RWM's Provisional Implementation Plan; Permissions Schedule; Science & Technology plan and programme; its environmental, operational and transport safety strategies; and its research status reports).

We will continue to engage with RWM, through our ongoing PAAS programme, to help address this.

2.2. Regulatory issues

Two RIs are currently in progress relating to RWM's organisational development:

- GDF_RI_009 (Corporate structure of Environment, Health, Safety, Security and Quality) [2] arose as a result of our inspection in 2014 of RWM's data and models supporting its waste packaging and assessment activities. In order to fully address this RI, RWM is taking a wider look at supplier evaluation and will provide a response in due course.
- GDF_RI_012 (Workforce Capability Plan) [3] arose from our inspection, in 2016, of RWM's data and modelling procedures as applied to the 2016 gDSSC. It sets out our expectations of the developer of a GDF with respect to resources and competences and notes our concern that, at any one time, there can be areas of competency covered by only one expert, or in some cases none. RWM provided an initial response to the RI in April 2018 and we will evaluate its further responses in subsequent periods.

2.3. Permissions Schedule

As an organisation, RWM must take full account of the complete range of permissions it must seek to develop and operate a GDF. We are engaging with RWM to ensure its understanding and interpretation of the full range of regulations and guidance are consistent with our expectations, and to ensure RWM has cognizance of new and emerging regulations.

In its Permissions Schedule for Implementing Geological Disposal (“the Permissions Schedule”) [4], RWM sets out diagrammatically and explains the expected sequence of the regulatory and land-use planning permissions that it must obtain and other regulatory approvals it is expected to apply for. The Permissions Schedule covers environmental protection, safety, land-use planning, nuclear security, nuclear safeguards and non-proliferation, and transport. We consider that RWM has developed a good understanding of the regulatory permissions required for its anticipated activities in support of GDF development, but we identified areas where further work is needed to ensure that RWM has a full understanding of the permissions it requires and the potential interactions between the permissioning processes. [5], such as:

- providing greater clarity and detail for the early stages of surface-based and underground investigations
- identifying the full range of permissions that may be required under the Environmental Permitting Regulations (for example, for flood risk activities and groundwater activities) and other legislation (for example, the Water Resources Act)
- developing a programme which balances securing permissions or approvals and maintains momentum in implementation
- understanding the interfaces between local planning authorities and environmental permitting
- managing wastes arising from construction and decommissioning.

We also advised RWM [6] to consider reference to a commissioning phase between the construction and operations phases, and to include further detail on necessary permissions associated with first emplacement of different waste categories resulting in a step change in the hazard profile of the site. The Permissions Schedule anticipated each permission required from ONR would be in the form of a Licence Instrument; we advised RWM to consider scope for using a flexible permissioning regime, where appropriate, to provide ONR with the flexibility to exercise proportionate regulatory control and to discharge this control in an efficient and effective manner.

3. Developing the Regulatory Submissions

An application for an environmental permit relating to a proposed disposal of solid radioactive waste must be supported by a suitable environmental safety case [7]. Similarly, any application for a nuclear site licence to construct and operate a GDF will need to be supported by adequate demonstrations of safety and security [8]. A safety case should contain the collection of the claims, arguments and evidence that support the safety of a facility. Development of a safety case for a GDF is complex. It is recognised internationally that continual dialogue between the regulators and the developer, from the very early design stage, is essential.

We want RWM to understand clearly what we require it to demonstrate, and when, through the regulatory submissions needed to gain the necessary nuclear site licence and environmental permits to implement geological disposal. ONR has set out its regulatory expectations specific to a future GDF in a new Technical Assessment Guide, published in March 2018 [9].

In August 2017, RWM submitted to the ONR Transport Competent Authority a revised application for a UK Certificate of Approval for a design of material as Fissile Excepted, and associated documentation required to support the application. This application will be considered in 2019/20 owing to resource prioritisation of work associated with materials consolidation from Dounreay to Sellafield.

3.1. Review of RWM's 2016 generic Disposal System Safety Case

RWM issued its 2016 generic environmental and transport safety cases to us in January 2017 and its 2016 generic operational safety case in July 2017. These safety cases, together with other documents, comprise the 2016 generic Disposal System Safety Case (gDSSC). We began assessing the 2016 gDSSC during 2017/18. The scope of our assessment addresses, in particular, changes RWM has made in response to our recommendations on the 2010 gDSSC as set out in 2011 [10]; aspects that would transfer into a site-specific safety case; and new areas included in the 2016 gDSSC. Overall, we are content that RWM has taken our feedback on its 2010 gDSSC into account to improve the 2016 gDSSC. In this generic context and stage of implementing geological disposal, our assessment of the 2016 gDSSC does not form the basis of any regulatory decision, but it provides advice to RWM to help it develop a safety case in the future. We will publish a report on our findings and recommendations in autumn 2018 [11] and will engage with RWM on important regulatory matters identified, through our ongoing scrutiny programme.

3.2. Development of the Disposal System Safety Case

Our ongoing dialogue with RWM has helped us understand its plans for future development of the gDSSC and site-specific submissions. RWM intends to maintain the gDSSC in parallel with any site-specific DSSC until there is sufficient confidence in the site-specific DSSC that it is judged that a generic DSSC is no longer required. That is, RWM would continue to use the disposability assessment process based upon the generic case to manage the risk of production of waste packages which are incompatible with geological disposal, until it was appropriate to align its assessment basis with a site-specific DSSC. RWM confirmed that many of the approaches and methods used in the development of the gDSSC will be applied when it develops a site-specific safety case. We will continue to engage with RWM on the development of the DSSC, taking into account the findings and recommendations from our review of the 2016 gDSSC.

As a result of our previous inspection of RWM's (and its contractors') use of data and models we issued a Regulatory Observation (GDF RO_006) on building confidence in data and modelling [12], which requires RWM to address areas for improving its management of data and models. RWM intends to address the matter by setting out in its response to the RO:

- an overview of its current data and modelling processes and procedures
- how it aims to address regulatory expectations towards building confidence in its current data and modelling processes through its current management arrangements
- how it has addressed recommendations from a joint Regulatory Inspection in October 2016 [13]
- how its data and modelling procedures will need to develop as it moves towards site-specific safety cases

We will assess whether RWM has adequately addressed the matter when we receive its response (in 2018/19).

3.3. Review of RWM's generic environmental assessment

RWM's generic environmental assessments, which comprise a strategic (non-radiological) environmental assessment, a socio-economic assessment and a health impact assessment, are included in the 2016 gDSSC. We reviewed these documents separately from our assessment of the 2016 gDSSC because RWM considers that they do not add to the safety arguments made in the 2016 gDSSC. Our review [14] concentrated on the generic environmental assessment, which we consider is generally of a good technical standard. We advised RWM to clarify the relationships between its generic environmental assessments, and the gDSSC and siting process, and to clarify how it intends to use the assessments to inform future decisions.

3.4. Assessment of impacts associated with the non-radioactive component of the inventory for disposal

The Water Framework Directive (2000/60/EC) and the Groundwater Daughter Directive (GWDD, 2006/118/EC) require EU Member States to protect groundwater against pollution and deterioration by preventing or limiting entry of pollutants to groundwater. Certain provisions of the Directives have been given effect in England and Wales through the Environmental Permitting (England and Wales) Regulations 2016 (commonly referred to as EPR 2016).

We have monitored RWM's work in this area through GDF_RO_001 (Protection against non-radiological hazards (chemotoxic and hazardous substances in radioactive waste destined for geological disposal) [15]. RWM's 2010 gESC [16] did not address the need to protect groundwater resources and human health from chemotoxic and hazardous substances in detail, but it did identify some substances from the UK Radioactive Waste Inventory (UK RWI) at the time that warranted further investigation [17]. We issued the RO in 2013, in order to establish a common understanding of the regulatory expectations and understand RWM's planned work to address the matter. We advised RWM on developments in groundwater protection legislation and guidance and its ongoing assessment of the non-radioactive component of the inventory for disposal. We consider RWM's chosen approach for assessing the non-radiological component of the disposal inventory is appropriate and shows good progress towards identifying the non-radioactive contaminants of significance in the inventory for disposal. We are continuing to press the NDA and waste producers to improve reporting of these substances in the next iteration of the UK RWI in 2019. RWM has made good progress towards being able to assess how hazardous substances and non-hazardous pollutants associated with radioactive materials in a GDF may impact on post-closure safety and protection of people and the environment and we are confident that RWM's ongoing work in this area takes into account our dialogue and advice to date [18].

We are continuing to monitor RWM's progress towards addressing this matter, in particular through our assessment of the 2016 gDSSC, and we will revisit the matter when we receive a response to the RO from RWM. We are aware that RWM is developing a total system model to assess the impact of selected non-radioactive contaminants and will consider that, and provide any necessary advice, through our future scrutiny work.

3.5. Demonstration of criticality safety

RWM needs to demonstrate that waste destined for a GDF will not present a significant criticality hazard during the transport, operational and post-closure phases. In 2013 we issued GDF_RO_004 [19], which asks RWM to provide information on its new process for defining waste package fissile limits and its implementation schedule. We received RWM's response to the RO in early 2017. Our assessment of RWM's response recognised the progress made. However, setting package fissile limits to manage criticality risks yet avoiding excessive safety margins continues to be a challenging topic when considering safety requirements across the full waste lifecycle. A large safety margin would impose burdens on both the numbers of packages generated at sites and the degree of waste characterisation required, whilst insufficient consideration of long-term impacts would not be consistent with regulatory guidance [7]. We consider that RWM needs to carry out further work to understand the nature and quantity of radioactive waste that could cause a challenge with respect to post-closure criticality. We discussed the matter further with RWM and it agreed to arrange a workshop with regulators and waste producers in 2018 to explore the scale of the potential problem. We are considering RWM's transport, operational and post-closure criticality safety cases in our assessment of the 2016 gDSSC [11].

4. Research & Development

We want to be assured that the best scientific knowledge and engineering practice will underpin any future GDF. We expect RWM to undertake a comprehensive research and development (R&D) programme, informed by wider national and international research or implementation programmes. RWM will need to identify and address, in a timely manner, the issues that require R&D to meet our requirements. This will help RWM to avoid unnecessary delays when requesting regulatory approval for the various stages of geological disposal and it will reduce the likelihood of us needing to specify R&D actions part-way through any licensing or permitting process.

4.1. RWM's status reports

During this reporting period we revisited the suite of RWM's status reports [20, 21, 22, 23, 24, 25, 26, 27], on which we provided advice in the previous period [28], in the context of our assessment of the 2016 gDSSC. In general we consider that they provide a structured review and a good overview of RWM's R&D programme and its current scientific understanding. This will serve as a useful source of reference to help someone with a broad knowledge of geological disposal understand the subject. However, in the present format (as part of, but not expressly linked to, the 2016 gDSSC) it is not easy to understand how they will contribute towards demonstrating safety of geological disposal. We expect RWM to demonstrate these links.

4.2. Nature and significance of voidage in a GDF

We continued our oversight of RWM's work relating to the nature and significance of voidage in a GDF, particularly with respect to the implications for long-term GDF performance and short-term waste package disposability advice. We consider RWM has made good progress towards developing an understanding of the nature, causes, and extent, of the different types of voidage in a GDF. Its level of understanding is appropriate in the current generic context and should help it implement any necessary changes to its packaging advice in a timely manner. We advised RWM of the need to establish a broader and more comprehensive understanding of the nature and significance of voidage together with some more specific recommendations [29] such as to:

- clarify how its work has, or may, affect disposability advice
- develop an understanding of Best Available Technique (BAT) for minimising voidage in waste packaging
- develop suitable advice for waste packagers
- clarify the significance of voidage in GDF design

We consider that RWM's ongoing work is taking our advice into account [30] and we will continue to engage with RWM to better understand its proposals for integrating the outputs from R&D in this area. In particular, we are reassured that RWM's developing guidance on waste package voidage, together with its disposability assessment approach, should provide proportionate optimisation guidance for waste packagers for those packages with the potential to affect long-term GDF performance.

5. Site Evaluation and Characterisation

We expect RWM to have appropriate plans and procedures in place to undertake the site evaluation and site characterisation activities necessary to implement geological disposal and to inform the safety cases, GDF design and construction [e.g. GRA Requirement 11]. In particular, we want to ensure that RWM's plans and actions for future site investigations are consistent with our permit requirements for intrusive site investigations and are such that they do not compromise the integrity of potential GDF sites.

5.1. Sealing deep site investigation boreholes

RWM will need to satisfy us that its plans for sealing deep investigation boreholes are suitable, before we allow it to start drilling the boreholes. Phase 1 of RWM's borehole sealing work was a scoping study with some small scale experiments; Phase 2 (which was completed in March 2017) included the development of bench scale experiments; and Phase 3 will involve larger scale experiments and potentially a field demonstration. We met with RWM to get an update on the programme of work in advance of submission of Phase 2 reports and to develop a programme of engagement for Phase 3. We will review the Phase 2 work in 2018-19 and continue to engage with RWM and its contractors to maintain an overview of the Phase 3 work.

5.2. Preparations for site characterisation

RWM is identifying design and safety case information requirements from a future site characterisation programme and developing illustrative programmes for surface-based investigations in generic host rock environments. We received a number of relevant documents from RWM during this reporting period and we plan to engage further with RWM on this work in 2018-19.

6. Waste Packaging and Assessment

RWM has developed a process of disposability assessment to minimise the risk that the conditioning and packaging of radioactive wastes results in packages incompatible with geological disposal. Through this process RWM provides advice to waste producers on the packaging of their HAW.

We expect RWM to assess packaging proposals for HAW in a proportionate manner, against clear and consistent published specifications, to assure us that HAW is packaged in a manner suitable for handling and disposal in a future GDF, and to share good practice in waste packaging to avoid duplication of effort.

6.1. Waste package specifications

RWM is continuing to update its suite of waste package specification and guidance documents and sought industry views on how the guidance could be better structured and accessed on GOV.uk [<https://www.gov.uk/guidance/generic-waste-package-specification>]. RWM has recruited additional waste management specialists to support the provision of packaging advice; reviewing submissions to provide disposability assessments and where appropriate endorsement through Letters of Compliance. This was necessary to meet the demands of concurrent packaging submissions received from NDA sites undertaking waste retrievals and to avoid undue delays in the provision of advice, and it addresses one of the key issues we identified in our inspection of the Letter of Compliance (LoC) process [31].

6.2. Managing waste package information and records

Good quality waste package records are essential otherwise waste packages will not be accepted into a GDF. We have engaged with RWM and industry representatives in past years to inspect and review the national arrangements for making waste package records. In particular we participated in Defra's Radioactive Waste Policy Group sub-group on a national radioactive waste information management strategy from 2004 to 2010 which culminated in the document Managing NDA Information Requirements [<https://tools.nda.gov.uk/publication/imp06-managing-nda-information-requirements>]. More recently we are participating in the NDA's Community of Practice for waste

package records. These fora have helped the regulators, RWM and industry make progress in developing a common understanding of requirements.

RWM has made good progress with the further development of its requirements and guidance for waste producers on waste package records to enable disposal at a GDF, including introducing a new RWM package records approval process. RWM is implementing its waste package records approval process in a phased approach, targeting existing packages currently in storage and new waste packages being produced at nuclear sites. RWM has set up a new 'package assurance' team encompassing package records approval, technical audit, and LoC periodic review functions.

7. Summary and Conclusions

Our dialogue with RWM is helping it to develop a good understanding of the regulatory requirements and associated regulatory submissions required to enable environmental permitting and the granting of a nuclear site licence.

The main outcomes from our work in this reporting period are as follows:

- RWM has developed a good high-level understanding of the regulatory permissions required for its anticipated activities in support of GDF development. However, we have identified areas where further work is needed to ensure that all the permissions that may be required under the Environmental Permitting Regulations can be properly addressed and to plan for managing wastes arising from construction and decommissioning. We will continue to work with RWM to ensure that all the permissioning activities and requirements to develop and operate a GDF are addressed.
- RWM should demonstrate its readiness to hold an environmental permit and a nuclear site license by summarising clearly and comprehensively its intended programme of work, and by showing progress against it. RWM is undertaking various work streams that contribute towards demonstrating the complete programme of work necessary to develop and operate a GDF. However, RWM needs to communicate this in a way that is clear and that can be used by regulators and others to assess progress and to understand what needs to be done at each point in the programme. We will continue to engage with RWM to achieve this overall complete picture of what it needs to do to develop and operate a GDF and to establish a means of monitoring RWM's progress towards achieving it.
- RWM has used our earlier feedback on its 2010 gDSSC to improve the 2016 gDSSC. From our review of RWM's 2016 gDSSC, we have identified some important areas for RWM to improve in order to produce a site-specific safety case that is fit-for-purpose. Details of our findings will be presented in a separate report. Our discussions with RWM about the future development of its site-specific Disposal System Safety Case has given us an understanding of how the approaches and methods used in the development of the gDSSC will be applied to the site-specific context.
- From our assessment of the non-radioactive component of RWM's inventory for disposal, we consider that RWM is making significant progress towards identifying non-radioactive hazardous substances and non-hazardous pollutants of significance in wastes destined for geological disposal. RWM is working with the Nuclear Decommissioning Authority and waste producers to improve reporting of these substances in the next iteration of the UK Radioactive Waste Inventory in 2019. RWM will need to continue its efforts in this area to ensure that full and proper information is available to support a future environmental safety case. We will continue to scrutinise RWM's work in this area and we will liaise with the nuclear industry to encourage timely delivery of the necessary information.
- RWM has made good progress towards being able to assess how hazardous substances and non-hazardous pollutants associated with radioactive materials in a GDF may impact on post-closure safety and protection of people and the environment. RWM is developing a total system model for this and needs to continue its work in this area, including consideration of the inventory of non-radioactive contaminants in materials of GDF construction and operation as well as of the wastes and waste packages, to demonstrate in any future site-specific safety case compliance with the relevant legislation. We will continue to engage with RWM to provide advice and scrutiny of RWM's work in this area.
- RWM's research status reports provide a useful source of reference to help people understand the broad areas of research covered. However, RWM needs to integrate its R&D with its wider programme, specifically its safety

case development work, to demonstrate how the outcomes contribute towards the evidence base supporting important safety claims and arguments.

- RWM has made good progress in further developing its requirements and guidance for waste producers on waste package records to enable disposal at a GDF, including introducing a new package records approval process. RWM needs to continue to work with the nuclear industry to ensure the information needed to support safe interim storage and future disposal at a GDF is obtained and managed for the long-term. Any waste package without a comprehensive and agreed waste package record would not be acceptable for disposal at a future GDF. We will continue to engage with RWM and the nuclear industry to ensure the information needed to support safe interim storage and future disposal at a GDF is obtained and managed for the long-term.

ANNEX A: List of regulatory issues and observations

Current Regulatory Issues and Regulatory Observations:

RI Number	Title	Status at Oct 2018
GDF_RI_001	Leadership & governance	Closed
GDF_RI_002	Organisational capability	Closed
GDF_RI_003	Control & assurance	Closed
GDF_RI_004	Organisational learning	Closed
GDF_RI_005	Assessment of innovative packaging proposals	Open
GDF_RI_006	Resolution of Periodic Review Findings	Closed
GDF_RI_007	Assurance of packaging assessments and advice	Closed
GDF_RI_008	Board governance of important areas of risk/performance	Closed
GDF_RI_009	Corporate HSSEQ structure	Open
GDF_RI_010	Disposability Assessments and Endorsements sensitive to changes	Open
GDF_RI_011	Waste Package Records	Closed
GDF_RI_012	Workforce capability plan	Open
GDF_RI_013	Characterisation and assessment of the non-radioactive component of waste in the inventory for disposal	Open
GDF_RI_014	Operational environmental safety assessment	Open
GDF_RI_015	Approach to fire safety assessment	Open
RO Number	Title	Status at Oct 2018
GDF_RO_001	Protection against non-radiological hazards	Closed
GDF_RO_002	Optimisation	Closed
GDF_RO_003	Lessons from the Fukushima disaster	Closed
GDF_RO_004	Defining waste package fissile limits for disposal	Closed
GDF_RO_005	Lessons from the WIPP Incident	Closed

RO Number	Title	Status at Oct 2018
GDF_RO_006	Building confidence in data and modelling	Open
GDF_RO_007	Auditable evidence in support of an ESC	Open
GDF_RO_008	Defining waste package fissile levels	Open

ANNEX B: Glossary

BAT	Best Available Technique
DSSC	Disposal System Safety Case
EA	Environment Agency
EPR 2016	Environmental Permitting (England and Wales) Regulations 2016
GDF	Geological Disposal Facility
gDSSC	generic Disposal System Safety Case
GWDD	Ground Water Daughter Directive
HAW	Higher activity radioactive waste
LoC	Letter of Compliance
NDA	Nuclear Decommissioning Authority
NRW	Natural Resources Wales
ONR	Office for Nuclear Regulation
PAAS	Pre-application Advice and Scrutiny Programme
R&D	Research and Development
RIRP	Regulatory Issue Resolution Process
RI	Regulatory Issue
RO	Regulatory Observation
RWM	Radioactive Waste Management Limited (from 1 April 2014)
SLC	Site Licence Company

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