Office for Nuclear Regulation

Environment Agency

Regulatory scrutiny and engagement for geological disposal

Annual report 2018 to 2019

Issue 1, October 2019

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Foreword

This is a joint Environment Agency and Office for Nuclear Regulation publication that summarises our work relating to the geological disposal of radioactive waste. As regulators for these wastes, we are working together to make sure that any future geological disposal facility (GDF) will meet the high standards for environmental protection, safety and security that the public expects.

We have established agreements with Radioactive Waste Management Limited (RWM), the organisation responsible for developing a GDF, to provide regulatory advice and to scrutinise its work. We are engaging with RWM early, before regulation starts, so that when a site is identified RWM already clearly understands what it needs to do as part of the regulatory process. We also liaise regularly with RWM to make sure that it gives the right advice to waste producers about packaging radioactive waste for future disposal at a GDF.

We have no regulatory role in selecting potential sites for a GDF. However, we will offer our support on matters relating to our respective areas of regulation to communities that are considering hosting a GDF.

We continue to speak openly with RWM. This helps RWM understand what it needs to do to meet environmental, safety and security regulations. It also helps us better understand RWM's work, and lets us prepare in advance for any permit or licence application we might receive from RWM, so that we can respond promptly and knowledgeably.

As independent regulators, we are committed to making our work open and transparent. This report will help us to continue to do this.

Executive summary

Government policies in England and Wales state that higher activity radioactive waste (HAW) will be managed in the long term through geological disposal. This is currently being progressed alongside ongoing interim storage of waste and supporting research.

Radioactive Waste Management Limited (RWM) is the organisation responsible for implementing government policy on geological disposal of HAW and for providing advice on managing radioactive waste. It is currently carrying out 'generic' preparatory work for a geological disposal facility, as no sites have yet been identified.

This report summarises the work the Environment Agency and the Office for Nuclear Regulation (ONR) have carried out to scrutinise RWM's work and our interactions with the public during 2018 to 2019. Our oversight of RWM is helping it to develop a good understanding of the regulatory requirements and associated regulatory submissions required to apply for environmental permits and a nuclear site licence for geological disposal activities

The main outcomes from our work during 2018 to 2019 are detailed below.

- RWM has significantly improved its generic Disposal System Safety Case and has taken our earlier advice into account in its preparation. Whilst we did not identify at this early stage any fundamental regulatory issues that would prevent RWM from developing a fully scoped safety case in the future, we identified a number of areas that RWM will need to improve when it does. RWM still has a significant amount of work to do to develop a comprehensive, site-specific safety case and many aspects can only be fully evaluated once a site has been selected and specific designs produced.
- Through our discussions with RWM we are satisfied that its approach to identifying and addressing new legislative requirements and its internal system for interpreting them are adequate. We are satisfied that RWM liaises with government and regulators to establish common understanding and manages any necessary changes through its change control process.
- RWM has made significant progress towards addressing the need to protect groundwater resources and human health from the non-radioactive component of the inventory for disposal, and is providing the necessary advice to waste producers. RWM and the wider nuclear industry now recognise that improving the information available on the non-radioactive contaminant inventory is a priority. As a result, the 2019 UK Radioactive Waste Inventory template now includes data fields for all significant contaminants of concern identified by RWM.
- The Environment Agency provided advice on RWM's generic programmes for surface-based site investigation. We asked RWM to clarify several areas relating to its proposals, associated with the link between land-use planning and environmental permitting.
- During 2018 to 2019 the Department for Business, Energy & Industrial Strategy (BEIS) consulted on a draft National Policy Statement for geological disposal infrastructure and a draft 'Working with Communities' policy for England. Also, RWM consulted on its proposals for evaluating sites in England and Wales. The Environment Agency attended stakeholder events, associated with these consultations, to answer questions on our role as an environmental regulator and statutory consultee, and we also responded to the consultations.

- ONR continued to work with BEIS on the legislative changes needed around the disposal of radioactive waste. The result will be that a nuclear site licence must be in force before any work to build a future GDF starts.

Contents

1. Introduction

Radioactive waste has been and continues to be produced from the UK's historic and current nuclear power, research and defence programmes, as well as from industries, hospitals and universities that use radioactive material.

There is currently no way of disposing of higher activity radioactive waste (HAW), the most radioactive category of waste, so it is stored on nuclear sites until a solution can be found.

UK government policy for the long-term management of HAW in England is described in the 2018 policy document [1]. This sets out the framework for managing HAW through geological disposal, focusing on how a geological disposal facility (GDF) would be implemented in England. Similarly, the Welsh Government has adopted a policy of supporting geological disposal for the long-term management of HAW [2]. Scottish Government policy does not support geological disposal[1]. 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 delivering geological disposal.

The Environment Agency and the Office for Nuclear Regulation (ONR) are responsible for making sure that any future GDF in England meets the high standards necessary to protect 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 roles of environmental protection, safety, security, radioactive materials transport and safeguards. Our regulatory partner Natural Resources Wales (NRW) has similar environmental protection responsibilities for Wales, and we keep them aware of matters arising and important outcomes from our work.

Regulatory control of a GDF is likely to be required for at least a century. We are engaging with RWM now to make sure that any future applications to develop a GDF take account of all permitting and licensing requirements. We also want to make sure that RWM gives the right advice to waste producers, so that radioactive waste packaged at their sites is suitable for future disposal. Discussions at this early stage will also help us prepare in advance for any permit or licence application we might receive from RWM, so that we can respond promptly and knowledgeably. At this stage, before considering issuing a permit or licence, we are providing regulatory advice about our requirements and standards rather than making regulatory decisions.

We have no regulatory role in selecting potential sites for a GDF. However, we will offer our support to communities that are considering hosting a GDF and will advise on matters relating to our respective areas of regulation. We are developing our approach to supporting community discussions by understanding RWM's own plans and proposals for working with interested parties. We are also providing regulatory advice to BEIS and RWM to make sure that our needs are recognised in the policy, plans and tools they are developing to help implement geological disposal.

[1] Scottish Government policy advocates near-site, near-surface management of HAW, and that long-term storage in a near-surface storage facility is the primary long-term management option.

2. Organisational development

RWM must take full account of the range of regulatory permissions it needs to develop and operate a GDF. Before we issue a permit or licence we need to be confident that the applicant is, and will remain, competent and capable of complying with it. RWM must develop its structure and management arrangements so that it is a competent organisation capable of holding the necessary environmental permits and nuclear site licence. We monitor RWM's progress as a prospective duty-holder by carrying out inspections and meetings, and reviewing specific documents.

RWM has continued to make progress in addressing the two specific areas for improvement (corporate health, safety, security, environment, quality structure and workforce capability) that we identified following our inspection in 2014 [3] and our review of its data and modelling procedures as applied to the 2016 generic Disposal System Safety Case [4]. We will continue to monitor progress through RWM's responses to the two Regulatory Issues (RI) [Annex A: GDF_RI_009 & GDF_RI_012] and the associated work, to determine when we can close the matters.

We are liaising with RWM to make sure its understanding and interpretation of the full range of regulations and guidance are consistent with our expectations, and to make sure RWM recognises new and emerging regulations. We discussed with RWM its approach to identifying and addressing new legislative requirements and its internal system for interpreting them. We consider its approach is suitable and we are satisfied that RWM engages with government and regulators to establish common understanding and manages any necessary changes through its change control process. We provided advice previously on RWM's Permissions Schedule for Implementing Geological Disposal [5,6,7] and will continue to advise on any future developments to make sure RWM maintains a complete and appropriate understanding of the permissions it needs to have in place and any interactions between them.

3. The 2016 generic Disposal System Safety Case

Any application for an environmental permit to dispose of solid radioactive waste must be able to demonstrate environmental safety and protection. The Environment Agency's guidance sets out its expectations of an environmental safety case (ESC) to support any application for a geological disposal facility [8]. Similarly, any application for a nuclear site licence to construct and operate a GDF will also need to adequately demonstrate safety and security [9]. ONR has set out its expectations specific to a future GDF in a Technical Assessment Guide [10]. We want RWM to understand clearly what we require it to demonstrate, and when, during these application processes.

Developing a safety case for a GDF is complex. It will need to contain the claims, arguments and evidence that support the safety of the facility over very long timeframes. It is recognised internationally that continual dialogue between the regulators and the developer, from the very early design stage, is essential.

RWM issued its 2016 generic environmental, operational and transport safety cases in 2017 [11]. These, together with supporting documents, make up the 2016 generic Disposal System Safety Case (gDSSC). We assessed the 2016 gDSSC, in particular to determine changes RWM had made in response to our previous recommendations [12],

aspects that would transfer into a site-specific safety case, and new areas included in the 2016 gDSSC.

3.1. Assessment of the 2016 gDSSC

In summary, we consider that the 2016 gDSSC is significantly improved compared with the 2010 gDSSC, and we are pleased that RWM has taken our earlier advice into account. In particular, we note the following:

- improved presentation, including a more succinct, logical and readily auditable structure
- more uniform consideration of the different geological environments
- greater emphasis on the role of environmental safety functions
- improved consideration of inventory variant scenarios and presentation of inventory uncertainty
- improved clarity on how RWM intends to develop the DSSC in the future
- use of safety case methodology in line with good practice
- demonstrable understanding of the importance and characteristics of a good safety culture

However, it is important to note that the 2016 gDSSC is not a fully scoped safety case. Instead it presents information on how RWM intends to make a safety case once a suitable site has been found. We identified a number of areas where RWM needs to improve to provide further confidence in geological disposal, for example:

- make important safety arguments clearer
- identify significant uncertainties and how it will address them, including linking to relevant tasks in the Science and Technology (S&T) Plan [13]
- develop the inventory of non-radioactive contaminants and construction/operational materials, and assess the associated impacts
- expand the scope of the generic Operational Environmental Safety Assessment to include all the information that we would expect at this stage
- develop understanding of risk from the gas pathway
- substantiate the assumptions about copper container failure in the illustrative concept for disposal of high heat generating waste (HHGW) in higher strength rock
- further develop the process to assess disposability of HHGW packages to consider endorsement of packaging proposals for HHGW
- improve the knowledge base and developing safety arguments relating to evaporites, if they are to be considered further as a potential host rock
- improve the approach to fire safety assessment by developing a fire protection strategy to make sure fire-engineered design solutions can be applied

As a result of our assessment of the 2016 gDSSC, we raised 3 new Regulatory Issues and 2 new Regulatory Observations (RO) [see Annex A], as follows:

- GDF_RI_013 Characterisation and assessment of the non-radioactive component of waste in the inventory for disposal
- GDF_RI_014 Operational environmental safety assessment
- GDF_RI_015 Approach to fire safety assessment

- GDF_RO_007 Auditable evidence in support of an ESC
- GDF_RO_008 Defining waste package fissile levels

In addition, we presented 38 new recommendations to help RWM better understand our requirements when developing its DSSC for a GDF [4] and the Environment Agency provided further detailed advice and comments [14, 15, 16, 17, 18].

We did not identify any fundamental regulatory issues that would prevent RWM developing a safety case in the future. However, this position is subject to the above reservations relating to areas where RWM needs to improve to provide further confidence in geological disposal. RWM still has a significant amount of work to do to develop a comprehensive, site-specific safety case and many aspects can only be fully evaluated once a site has been selected and specific designs produced. We advised RWM to continue the constructive dialogue with us and to take steps to address our feedback as it progresses this work.

3.2. Development of a DSSC

Our 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 it is confident enough that the gDSSC is no longer needed. RWM has no current plans to publish another set of gDSSC documents. Instead, it will use its safety case tool, ViSI (Visualisation of System Information), to keep its generic safety case understanding up to date, supported by site-specific DSSCs, if and when required.

RWM will continue to use the gDSSC to support its waste package disposability assessments to manage the risk of waste packages being produced that are incompatible with geological disposal until it can align its disposability assessments with a site-specific DSSC.

We examined RWM's approach to managing and quantifying uncertainties when implementing geological disposal. Its approach includes uncertainties that may occur when waste is being transported, during disposal facility operations, and in the post-closure phase, as well as wider programme and financial uncertainties. We consider that RWM's approach and tools are appropriate at this stage.

We will continue to oversee RWM's DSSC as it develops further, taking into account the findings and recommendations from our review of the 2016 gDSSC and learning from our ongoing dialogue. Topics of particular interest include RWM’s near-term work plans, roadmaps for the development of an integrated safety case, development of ViSI and RWM's Requirements Management System.

3.3. Non-radioactive contaminant assessment

RWM’s 2010 generic Environmental Safety Case [19] did not adequately address the need to protect groundwater resources and the public's health from chemo-toxic and hazardous substances. 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 the entry of hazardous substances to groundwater and limiting the entry of non-hazardous pollutants. We issued a Regulatory Observation in 2013 [Annex A: GDF_RO_ 001 Protection against non-radiological hazards] in order to establish a common understanding of the regulatory expectations and to understand RWM’s planned work to address the matter.

Informed by our ongoing dialogue with RWM and our review of the 2016 gDSSC, we consider that RWM’s approach for assessing the non-radiological component of the waste

to be disposed of is appropriate. It shows good progress towards identifying the significant non-radioactive contaminants to be disposed of and for assessing their impact on safety after the facility has closed. Consequently, we closed GDF_RO_ 001 in June 2018. Subsequently, we issued Regulatory Issue [Annex A: GDF_RI_013 Characterisation and assessment of the non-radioactive component of waste in the inventory for disposal] to encourage RWM to provide guidance to waste producers on the information that it needs, and to further improve its understanding of the impacts of the non-radioactive component of the waste to be disposed of.

We will continue to engage with RWM as it makes further improvements in how it assesses the non-radioactive component of the inventory for disposal, including providing advice on developments in groundwater protection legislation and guidance. We are continuing to press the NDA and waste producers to improve reporting of non-radioactive substances in the UK Radioactive Waste Inventory (UKRWI). In 2018, NDA acknowledged that this was one of its improvement priorities for the 2019 UKRWI. The 2019 UKRWI template now includes data fields for all contaminants identified of significance by RWM.

3.4. Waste package fissile levels

In 2013, we asked RWM to present its revised process for defining waste package fissile limits and to work with waste producers and others to implement it [Annex A: GDF_RO_004 Defining waste package fissile limits for disposal]. From our ongoing liaison and review of the 2016 gDSSC, we concluded that RWM had made significant progress, and adequately addressed the specific actions. As a result, we closed GDF_RO_ 004 in September 2018.

However, we identified some new matters in this area, so we raised a new RO [Annex A: GDF_RO_008 Defining waste package fissile levels]. We asked RWM to work with waste producers to identify all wastes where the fissile content means it may be challenging to meet criticality safety limits across all lifecycle stages (packaging, storage, transport and disposal). We also asked RWM to assess the impact from proposed changes to the IAEA Transport Regulations, confirming how it would apply its revised approach, or whether it may need to further develop its approach. We are monitoring RWM's progress in addressing these matters and will report in due course.

4. Site evaluation and characterisation

We expect RWM to have appropriate plans and procedures in place to carry out the site investigation and characterisation work needed to implement geological disposal, and to inform the safety cases, GDF design and construction (for example, Guidance on Requirements for Authorisation - Requirement 11 [8]). In particular, we want to make sure that RWM’s plans and actions for future site investigations are consistent with our permit requirements and would not compromise the integrity of potential GDF sites.

4.1. Borehole sealing

Before it applies for permits to carry out site investigation using boreholes, RWM needs to provide evidence that it can successfully seal the boreholes. The Environment Agency discussed with RWM its research into sealing surface-based site investigation boreholes once they become redundant, and we advised RWM [20] on the proposals for the next phase of research in this area. While recognising the main focus of work in this area is on higher strength rocks and lower strength sedimentary rocks, we advised RWM to be clear on its current ability to adequately seal boreholes in evaporite rocks. We noted that RWM

will need to consider a number of factors when identifying existing boreholes that it could use to develop and demonstrate its sealing capability. We also advised RWM to be clear on the aims and objectives of the next phase of research compared to work already completed, so that it is sufficient to support an application for a permit for intrusive studies. We consider RWM should set out how it will identify and respond to any new developments in borehole sealing technology once this current period of research, development and demonstration has ended.

We shall continue to explore with RWM matters related to borehole sealing.

4.2. Site investigation and characterisation

The Environment Agency provided advice on RWM's generic programmes for surface-based site investigation [21]. We identified several areas in the scope, timing and alignment of RWM's proposals to seek Development Consent Orders and environmental permits for surface-based site investigations that need to be made clearer. We advised RWM to address these by continuing to speak with us and by liaising with the Planning Inspectorate. We advised RWM to present the entire scope of its site characterisation activities, including underground characterisation, and to clarify when, during site evaluation or characterisation, it could determine whether a site-specific underground research laboratory would be needed.

This work will become of increasing interest as RWM's preparations for site characterisation gather pace.

5. Other activities related to geological disposal

As well as providing regulatory advice to RWM on its generic work programmes, we are also providing regulatory advice to BEIS and RWM to make sure that our needs are recognised in the policy, plans and tools they are developing to help implement geological disposal.

Liaising with BEIS and RWM on geological disposal at an early stage will also allow us to prepare for any environmental permit or nuclear site licence application that we might receive from RWM, so that we can respond promptly.

5.1. Input to policy and methodology development

From January to April 2018 BEIS consulted on a draft National Policy Statement for geological disposal infrastructure and a draft 'Working with Communities' policy within England. From December 2018 to April 2019 RWM consulted on its proposals for the evaluation of sites in England and Wales. The Environment Agency attended stakeholder events, associated with these consultations, to answer questions on its role as an environmental regulator and as a statutory consultee, and we responded to the consultations.

5.2. Preparations to support communities

On 19 December 2018, BEIS launched a new national consent-based process in England[2] to find a suitable site for a GDF. Under this process, there is a partnership approach to working between local communities and the developer, and there must be support within the host community before a GDF can be built.

We have no regulatory role in selecting potential sites for a GDF. However, we will offer our support on matters relating to our respective areas of regulation to communities that are considering hosting a GDF. With this in mind, we planned our resources and developed communications materials to support potential future community engagement.

5.3. Preparations for future regulatory activities

ONR continued to work with BEIS on the legislative changes needed around the disposal of radioactive waste. The result will be that a nuclear site licence must be in force before any work to build a future GDF starts.

6. Conclusions

Our discussions with RWM are helping it to better understand the regulatory requirements and associated regulatory submissions it needs in order to obtain environmental permits and a nuclear site licence. Significant progress has been made in a number of areas, as this report has summarised. However, RWM still has a significant amount of work to do to develop a comprehensive, site-specific safety case for a GDF, and many aspects can only be fully evaluated once a site has been selected and specific designs produced.

Our work in other areas is helping ongoing policy and siting methodology development as well as our own continuing preparations for regulating geological disposal of radioactive waste.

[2] A siting process was launched in Wales on 16 January 2019

Annex A: Regulatory Issues and Observations

Regulatory Issue	Title	Status
GDF_RI_001	Leadership and governance	Closed
GDF_RI_002	Organisational capability	Closed
GDF_RI_003	Control and 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

Regulatory Observation	Title	Status
GDF_RO_001	Protection against non-radiological hazards	Closed

Regulatory Issue	Title	Status
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
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

List of abbreviations

BEIS	Department for Business, Energy & Industrial Strategy
DSSC	Disposal System Safety Case
ESC	Environmental Safety Case
GDF	Geological disposal facility
gDSSC	generic Disposal System Safety Case
GWDD	Groundwater Daughter Directive
HAW	Higher activity radioactive waste
HHGW	High heat generating waste
HSSEQ	Health, safety, security, environment and quality
IAEA	International Atomic Energy Agency
NDA	Nuclear Decommissioning Authority
NRW	Natural Resources Wales
ONR	Office for Nuclear Regulation
RI	Regulatory Issue
RO	Regulatory Observation
RWM	Radioactive Waste Management Limited
S&T	Science and Technology
UKRWI	United Kingdom Radioactive Waste Inventory
ViSI	Visualisation of System Information

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