CoRWM Visit to the German Federal Office for the Safety of Nuclear Waste Management, 25-26 June 2018

1 Introduction

1.1 As part of CoRWM's outreach activities for 2018-2019, the following CoRWM members visited Germany to tour the Konrad Mine and discuss approaches to siting a geologic disposal facility. The visit took place on 24-25 June 2018.

Stephen Newson

Andy Hall

Paul Davis

Richard Shaw

Gregg Butler

Andrew Walters

Melissa Denecke (Konrad visit only)

1.2 CoRWM chose Germany because like the UK and other countries has a geological repository programme defined by fits and starts and, like the UK, is currently in a new site identification and site selection process.

1.3 CoRWM was hosted primarily by Kai Möller of the Federal Office for the Safety of Nuclear Waste Management (BfE), headquartered in Salzgitter, Germany.

1.4 In addition to Mr. Kai Möller, Mr. Johannes Schneider of the Federal Company for Radioactive Waste Disposal (BGE) led the underground tour of the Konrad Mine and Ms. Martina Herold, Mr. Ingo Bautz, and Mr. Matthias Mohlfeld, all BfE, participated in discussions and gave presentations on the German radioactive waste disposal program[1]. Presentations and discussions focused on the roles and responsibilities of organisations involved in radioactive waste disposal, the status of geological disposal, public participation, and siting and site selection for the UK and Germany geologic repository programs. In addition, Mr. Möller discussed the post-closure safety assessment of the Konrad mine and Mr. Davis of CoRWM presented an overview of the roles and responsibilities of CoRWM and a bit of history about CoRWM's involvement in the UK's radioactive waste programme.

2 The German Radioactive Waste Repository Programme

The following is a description of CoRWM's understanding of the Germany radioactive waste disposal programme based on this visit with the BfE.

[1] Viewgraphs can be found on the CoRWM Huddle Site

2.1 Roles and responsibilities

The roles and responsibilities of organisations responsible for implementing the German waste disposal programme are revealed in the following diagram:

Note should be taken that while BGE leads site selection, BfE will make the final choice of a site for heat-generating waste. Also, the Federal Institute for Geosciences and Natural Resources, the BGR, plays much the same role as the British Geological Survey in the UK GDF programme by providing country-wide down to local scale information on geological attributes related to safety.

2.2 Waste Disposal and Waste Classification

One of the most interesting aspects of the German radioactive waste disposal programme is that all classes of waste (low-level, intermediate, and high-level) are to be disposed of in geological repositories. The only distinction is between heat-generating and non-heat-generating waste.

2.2.1 Non-heat-generating waste

2.2.1.1 Non-heat-generating waste is to be disposed in the Konrad former iron ore mine. This choice was fortuitous, with the iron ore miners petitioning for their site to be considered when it became obvious that iron ore mining was uneconomic, and closedown would lead to job losses. Mining stopped in 1976, and site characterisation activities for radioactive waste disposal carried on until 1982. A licence application was submitted in 1989, with a licence granted in 2002, with emplacement scheduled for 2022 (but with 2027 mentioned as a new possible date).

2.2.1.2 To CoRWM, it appears that the licence for the Konrad mine is very prescriptive with respect to how the safety calculations are done and the associated waste acceptance characteristics of the waste for both radiological and chemical wastes. Whether or not

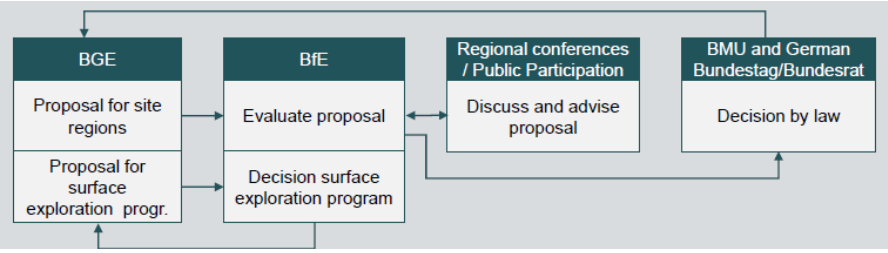
these prescriptions reduce the flexibility of Konrad receiving a wider range of wastes is a critical issue that the Germans may want to revisit.

2.2.2 Heat Generating Waste

2.2.2.1 Radioactive wastes that generate significant amounts of heat are to be disposed of in an as-yet unidentified geologic repository. The process for siting such a repository is described below.

2.2.2.2 CoRWM's main impression of the German process for finding a heat-generating-waste GDF site in Germany is that it is 'law-based within policy' rather than the UK approach of 'policy-based within the law'. The key attribute of the German policy is to find the best possible geology for a GDF while in the UK the policy is volunteerism followed by assessing and assuring that any chosen volunteer site is safe. The German stages in site selection outlined are:

- *As in the UK, the Germans seek to find a repository in either salt, clay, or crystalline rock.*
- From a 'blank map' of Germany, Sub-Regions are chosen by the application of
    - 'Exclusion Criteria (Active Fault Zones, Seismic Activity, Groundwater Residence Time etc)
    - Minimum Criteria (Permeability of rock formation, area of repository, etc)
    - Geological Consideration Criteria (No or slow transport through groundwater in the Excavation Caution Zone (ECZ), good spatial characterisability, low propensity to form water pathways in the host rock formation and in the ECZ.
    - These evaluations are carried out based on all available geological information.
- BGE then produces a report which is discussed at 'Subarea Expert Conferences.'
- Based on these Subarea Assessments, regions for surface exploration are selected by the process illustrated below, after the application of Planning consideration criteria.



- After the Subareas for surface assessment have been chosen, a similar process is carried out to define Subareas for sub-surface assessment, after which a re-application of the various criteria is used to select the 'best' site. Note that at each stage the decision is ratified by law the Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety (BMU) and Bundestag/Bundesrat levels.
- The key rider to this 'law-based' approach is the *'the participation of the regional and supra-regional public',* with the prime responsibility for public participation being held by the Federal Office for the Safety of Nuclear Waste Management (BfE). The process is to be mediated by a National Support Body (NBG), which offers:
    - *Independent mediation of site selection procedure, especially of public participation,* and

- *Support and implementation of the participation procedure in dialogue with the public and other players involved*

2.2.2.3 The plans for these public activities appeared to be at a fairly early stage, with 'Expert Conferences' at each stage, with '*Commenting procedures and Public hearings*', all with the prospect of '*Possibilities to file legal action*'. Methods to be used included 'face-to-face' (with a caravan outside a Town Hall as an illustration), 'information (hard copy) material, and an on-line presence 'including publishing all essential documents'.

3 CoRWM's Comments and Observations

3.1 The German methodology for finding a site for a GDF can be summarised as:

1. An expert commission defines what the best geology in Germany would be for meeting a safety case
2. Enshrine the definition of 'best geology' in law
3. Gather all available information on the defined geologic attributes
4. Choose sites that meet the Minimum Geologic Criteria and have none of the Exclusion Criteria
5. Evaluate combinations of the Geological Consideration Criteria and choose two sites for characterisation. Then screen out some and do sub-surface examination of the rest
6. Choose one site based on site characterisation studies.

3.2 CoRWM and the 2014 government white paper recognised the difficulty, impossibility, of finding the 'best geology' based on, among others, the following considerations:

1. Geology does not play the same role in ensuring safety in different rock types and geologic settings. For example: the safety for the Swedish repository is set in very permeable rock and only relies on the geology to maintain geochemical conditions around long-lived copper canisters, the WIPP site in the US relies on bedded salt to close around and seal off radioactive waste from the environment, and the Yucca Mountain site relies on very dry conditions in very permeable rock. Simply stated many geologies could provide the conditions for a safe repository but none could be called 'best.'
2. Individual criteria can never account for the combinations of conditions that lead to a safe repository.
3. There is no direct correlation between safety and individual geological criteria.
4. Starting only with geology, the overall safety of a repository, which includes the waste package and the engineered barrier, are not considered and therefore undervalued.

3.3 That said, the German program will have to proceed and in doing so is faced with choosing or developing a method to evaluate multiple, disparate criteria.

3.4 CoRWM and our German counterparts discussed the possibility of using Multi-Attribute Decision Analysis (MADA). In MADA, several criteria are set up (see above for a selection of those chosen to date), and individual Areas, Sub-areas and sites would be 'scored' on how well they conform to the criteria ('Score 10 = good, score 1 = bad). This will allow 'totalling up' to give a total 'score' for each Areas, Sub-areas etc.

3.5 The next stage in a MADA is to assign a 'weight' to each attribute, assessing its importance relative to other attributes. UK experience has underlined that, where stakeholders are involved, it is very difficult to reach consensus on the 'scores' given on different criteria, in in practice impossible to reach consensus on 'weights'.

3.6 Critically, even if consensus was reached on the combination of 'scores' and 'weights', there is no guarantee that safety, as assessed in a safety case, would be 'best' when performed for these parameters. CoRWM therefore recognises the difficulties and pitfalls associated with the use of MADA, most critically, that while MADA has the appearance of quantification, at its heart are subjective judgements by experts and/or stakeholders which may not correlate directly to safety parameters. This is another area where, viewed from a UK context, '*seeking the safest'* is likely to be a hostage to fortune.

3.7 Our German counterparts clearly recognise the difficulty they face in choosing and/or developing and in applying a method, any method to the choice of sites along their site selection process. It is CoRWM's view that this will be a very significant, time consuming, and difficult effort.

4 Role of the Public in the development of a GDF

4.1 In both the UK and German programme, public dialogue is pervasive throughout the development of a GDF.

4.2 That said, the remaining area of significant difference between the UK GDF programme and the German GDF program is the role of the public. In the UK the public starts the process through volunteerism, and controls the process through their right of withdrawal, and the test of public support. In Germany, the public has no such roles.

4.3 The only aspect of public involvement that approaches the role the public has in the UK process is through legal challenges – see the following diagram for the timing where such challenges could be raised.

4.4 In many ways, the UK process appears to seek to avoid legal challenge, whereas the German process, certainly when viewed through UK eyes, would seem to make challenge inevitable.

4.5 One of the most interesting statements made by Mr. Ingo Bautz, responsible for public participation for BfE, was that there would be no chance for a repository in Germany if Germany was continuing the development of nuclear power. In other words, if people perceive disposal as cleaning up old waste and not accommodating new, there is a chance for Germany to site and operate at GDF.

5 Conclusion

Continued communication with the German program is recommended given that on one hand, like the UK, they are starting over in site identification and selection and on the other, they are trying a different approach.