

Royal Society response to CoRWM consultation on scores from specialist workshops

Summary

This report outlines the Royal Society's comments on the results produced by the Committee on Radioactive Waste Management's (CoRWM) specialist workshops, which were held in December 2005. These workshops assessed how well specific waste management options, identified in earlier consultations, performed against a range of criteria. Scores were assigned against each criterion, for each of the management options and also for each type of waste, with low scores indicating a poor performance. This response details our concerns and makes suggestions as to how the scores might be affected.

The Royal Society welcomes the opportunity to comment on the results from CoRWM's specialist scoring workshops. It is vital that this process is transparent and based on the best available scientific information.

However, as mentioned in our report in January (Royal Society 2006), many of the waste management options considered in the scoring are not mutually exclusive. It is therefore vital to consider how they can be combined to form a waste management strategy. In its final report, we urge CoRWM to present a systematic strategy that considers how these options can be combined over time.

Whilst we recognise the importance of CoRWM reporting to government in July 2006, we are concerned that the time allocated for commenting on the scores was too short, particularly given the huge amount of information and complexity of the collated information from the workshops. We question whether sufficient time was allocated to allow the workshops to consider all the criteria adequately against the various waste management options and the potential variants in the different waste streams (eg source of waste, packaging).

We have misgivings about the method of presentation of some of the scores. Did the summary documents give sufficient information on which to form a judgement? It is not always clear whether a range of scores is presented for a criterion because of uncertainty in the science, or because of disagreements about how each waste management option will perform.

In general we feel that scores gave a reasonable assessment of the different options. However, there are a few options and criteria where our respondents did not agree with the scores, or are not sure about the assumptions on which they are based. In addition, there appear to be inconsistencies between the assumptions used to evaluate different criteria.

Our main areas of doubt relate to the scores for the security criteria and the criteria concerning chemical and radiological pollution. With respect to the security criteria, no consideration appears to have been given to the attractiveness of particular types of wastes to terrorists, focussing instead on vulnerability due to distance travelled. A range of scores would be expected across the different waste streams, depending on how attractive they were to terrorists and therefore the level of risk they posed.

The geological disposal options perform poorly with respect to the *chemical pollution* criteria, but this appears to over estimate the impacts from the mining spoil that is produced. We would expect the scores for chemical and radiological pollution to be similar.

It is vital that as CoRWM continues its work, it seeks the best scientific and technical information and advice. This will ensure that those involved in any subsequent commenting on the scores within the criteria ('swing weighting' and sensitivity testing) are given sufficient information on which to make an informed judgement. In addition the scientific community should also be given the opportunity to provide its view of the scores, as part of the swing weighting process.

Specific comments on the scores, with suggestions for how these comments might affect the scoring. (Response to CoRWM's questions 1-3.)

Background

Our comments below relate to the scores produced by CoRWM's Specialist Scoring Workshops, which took place in December 2005. Following earlier consultations CoRWM has identified a short-list of three radioactive waste management options (with 14 variants) that it will take forward for assessment, including long-term interim storage, geological disposal. CoRWM is now undertaking its assessment of these options and how they perform for different types of waste.

To assess the waste management options CoRWM has designed a Multi Criteria Decision Analysis (MCDA) process. The scoring workshops in December were part of stage one, where groups of specialists in five workshops, assessed each waste management option against a range of headline criteria and sub-criteria, and for each type of waste. Each workshop produced a table of scores reflecting the views of the specialists involved. Details of the scores and associated discussions are presented in CoRWM's Catalyze report. A short overview of the results and table of the scores are provided in CoRWM's Briefing Papers 7 and 8.

The next stage of the MCDA process will be the 'swing weighting' stage, which will invite input from groups of stakeholders and members of the public, about the scores from the specialist workshops. In order to inform those involved in the swing weighting process CoRWM produced Briefing Paper 9, which outlines the scales used for scoring each of the criteria and sub-criteria. Our comments below relate to particular scores, how the scores were produced and how they are expected to be used in the MCDA process.

This response has been informed by independent experts on radioactive waste, including authors of the recent Royal Society report on the long-term management of radioactive waste (Royal Society 2006). Some of those who provided comments were involved in the CoRWM scoring process, but their comments included here are addressed only to the workshops that they did not attend.

Comments relating to specific criterion

Security –attack pre- emplacement criterion

A distinction has not been made between different waste streams during transportation relating to their attractiveness to terrorists (Catalyze report p54, 55). Highly Enriched Uranium (HEU), for example, is much more attractive to terrorists and therefore poses a greater security threat than Reactor Decommissioning Wastes (RDW) or Depleted Uranium (DU).

The scores for geological disposal options are surprisingly low compared to those for central above ground stores. These low scores appear to arise from an assumption that any waste destined for geological disposal will be stored for a long period prior to moving to and placing into the geological disposal site. However, it is inevitable that surface stores, of similar standards to options 2 and 4, will be part of any geological disposal option whilst the disposal site is being prepared, so the low scoring of geological disposal options is not justified. After placing the waste in the geological disposal sites the security will then be greatly enhanced, as reflected in the higher post-emplacement scores. Geological disposal options would therefore be expected to

have higher scores for this criterion. The higher scores for above ground storage facilities, compared to geological disposal options, also imply a great deal of confidence in current protection methods over the 300 year timescale being considered.

Assigning scores to the geological disposal options for the Reactor Decommissioning Wastes and Depleted Uranium waste streams seems inappropriate. Considering geological disposal options as candidates for these wastes would be excessively cautious.

Security – attack post-emplacment criterion

In contrast, for *attack post-emplacment*, no explanation appears to have been given as to why High-Level Waste has not been scored for local storage options (2, 4 and 6). Given that other waste streams have been scored regardless of whether the option is valid for that type of waste, it would seem necessary that this one should be scored.

Environment – Radiological pollution, Chemical pollution (chemical and radioactive releases harmful to ecosystems, flora, fauna and/or the built environment) criteria

The main reason given for geological disposal options scoring low for chemical pollution appears to relate to uncertainty regarding the construction impacts. However, the scores do not reflect the range of uncertainty expressed at the workshops. We agree with the assessment on page 72 of the Catalyze report, that states ‘digging deep holes causes a large environmental impact due to excavation...but not necessarily chemical pollution’. Much of the excavation will be in good quality rock with low mineral content and will therefore require less effort, when handling the spoil, to meet the permitted pollution limits. Geological disposal options would therefore be expected to be given a higher score for chemical pollution than they do in the Catalyze report.

It is not clear why, for geological disposal options of Spent Nuclear Fuel, High-level Waste and Plutonium, *chemical pollution* receives a lower score than *radiological pollution*. Pollution from implanted waste is not expected to occur unless there is some mechanism that allows dispersion. If dispersion occurs, then both radiological and chemical effects will follow. Whilst it is noted on page 72 of the Catalyze report, that long-term radiological impacts have been assumed as a proxy for *chemical pollution*, we would still expect, over the short-term, that the scores would be similar.

Socio-economic – employment, spin-off criteria

For the storage options it is not clear to what extent the employment figures have considered the ongoing need for security, safety and monitoring, repackaging and other enduring long-term tasks. Whilst the effect on the scores may be small, this clarification would be helpful.

It is also not clear for the geological and phased geological disposal options, whether potential spin-off jobs, for example in mining technology, geophysics and earth sciences, have been considered in addition to those relating to engineering, construction and operation. This benefit has been shown in other countries that have made progress towards geological disposal, especially where it has involved underground laboratories.

Amenity – land take and transport criteria

The scores for borehole disposal assume an exclusion area of 8km² for 100 years, after 80 years of construction (Catalyze report p111). We do not accept that the land would necessarily be precluded from all other uses during this 100 year period. We believe that boreholes should score no lower than geological disposal options.

Transport scores for non-geological disposal of Reactor Decommissioning Wastes (RDW) in shallow vaults are higher in central stores than in local sites. This is in contrast to the storage options (options 1 to 6) where

local options score higher than central options. No explanation is offered as to why this should be, although it may be a simple transposition error.

Cost criterion

It seems inappropriate to allocate costs to borehole disposal for all the different waste streams, when this disposal option is not being considered for certain waste streams, such as RDW, DU, ILW and LLW.

There are also inconsistencies between the workshops about the number of boreholes on which the scoring appears to have been based. The costs workshop considered 41 boreholes (p 156) whilst the *Socio-economic employment* criterion considered 25-34 (p92). The latter number is similar to that used for *Public safety – long term radiation* criterion (p 33) and also in the accompanying Briefing Paper 3, which indicated that 25 would be required. This variation in the number of boreholes would have implications for the costs and the scoring.

Comments on the process by which the scores were generated (CoRWM question 4)

It is vital that the process used to generate scores and help inform a radioactive waste management strategy is transparent, flexible and takes account of stakeholders views while engaging the public in debate. We recognise the importance of the multi-criteria decision analysis (MCDA) process. However we have concerns about the process by which the scores were generated.

As indicated in the Royal Society (2006) report, many of the waste management options are not mutually exclusive, so it is vital to consider how options can be combined to form a waste management strategy. These combinations must also be flexible enough to respond to changing circumstances over many decades. In addition, the scores for these options and the scores for the combinations will be influenced by the management decisions that affect them. Some of these decisions will be made after initial proposals have been agreed and sites have been selected. We urge CoRWM to present a systematic strategy that considers how these options can be combined over time.

Catalyze report and Briefing Papers

We did not feel that CoRWM's Briefing Papers 7, 8 and 9 gave adequate information regarding the uncertainties and discussions between the specialists that decided the scores. Whilst the Briefing Papers refer the reader to the Catalyze report, this volume, 187 pages in length, is cumbersome and it requires extensive analysis in order to determine the basis of the scores given. As with other similar public and stakeholder consultation exercises it is important that the uncertainties and misgivings within the process are presented clearly. There is a danger that these uncertainties could be obscured in any successive consolidations, so potentially misleading anyone using the scores.

In Briefing Paper 7, *Preliminary overview of scores*, the lack of detail about what is being scored, is particularly concerning. For example, the *geological* and *phased geological* disposal options are shown to score lowest against the *short term safety, non-radiation* criterion. This could easily give the impression to a casual reader that these waste management options are intrinsically 'not safe' in the immediate term. In fact, the low score relates entirely to differences in the number of road transport miles for shipping materials, as explained in the Catalyze report.

Where a spread of scores is presented rather than one single score, it would be helpful if the reason for this range is clarified in the Briefing Papers, so as to inform anyone using the scores. Analysis of the Catalyze report indicates that these ranges occur for a number of reasons, such as uncertainty in the science, disagreement between the specialists about the performance of an option against a criterion or sub-criterion, or it might indicate different scores for discrete variants of the option in terms of waste stream or design

detail. Although such distinction might not be significant in most cases, there may be cases where it should be distinguished.

It is vital that groups involved in swing weighting are given the appropriate balance of the raw scores and the qualitative discussion of uncertainties that helped to decide the scores. It is possible that peoples' opinions and conceptions about certain options may be erroneously affected by a lack of appropriate information. For example, in briefing paper 9, for sub-criterion 2 (*Safety short-term - non-radiation*) it is difficult to make an informed judgment unless you know the number of statistical deaths per route-mile of road/rail transport. A more complex issue arises with Sub-criterion 10 (*Chemical pollution*), where there is a need to understand the degree to which precautionary considerations are built into the requirements of the Pollution, Prevention and Control (PPC) and Greenhouse Gas (GHG) regulations. Specialists should be on hand to clarify such issues during the swing weighting process.

Other issues

We understand that options 1–6 (*long-term interim storage*) are not scored for long-term safety and environment (long-term radiation pollution) beyond 300 years because interim storage is defined as up to 300 years. However, it is concerning to note that the differences in timescales and the reasons for not scoring the long-term storage options for safety and environment (radiation pollution) beyond 300 years, are not clearly explained in the Briefing Papers.

It is not clear to what extent the scoring workshops considered the actual radionuclide content of certain waste types and the uncertainties in those inventories. This is particularly relevant for reactor decommissioning waste. If different waste streams were to be characterised and separated, as is being considered in Germany for reactor decommissioning waste, it would produce a number of different wastes and therefore alter the scoring for this category. Whilst in some cases this has been taken into account in the scoring it is not clear if this is the case across all the workshops.

Clarification is also needed regarding apparent inconsistencies over the mode of long-term storage of Spent Nuclear Fuel (SNF) that has been assumed in the scorings. For example, wet storage of SNF is assumed in scorings of the environment criteria (p74) whilst dry storage appears to be assumed in the scoring of safety criteria (p20). Similar inconsistencies appear to exist in assumptions about option 6 (underground storage). For example *The Burden on Future Generations* scoring workshop assumed the BNFL Millennium Store design (p115) whereas the Safety workshop assumed a simpler engineered store (p17). Some differences in scores might be attributable to these different assumptions.

The scores for the headline criterion *Burden on future generations* are based on assumptions about the packaging of the waste and the need for re-packaging during future storage (outlined on p116 of the Catalyze report). These appear rather vague on how different packaging will perform and the implication for the different options. However, these considerations have potentially significant implications for comparison between the options for various sub-criteria, such as *distribution over time of environmental impacts* (p129), as well as for many other sub-criteria such as safety and costs. Given the importance of these assumptions it would be helpful to have a briefing document that clarifies how they are used across the sub-criteria, to inform anyone involved in swing weighting this headline criterion.

It is not clear to what extent the effect of the current condition of some existing wastes and how the waste is packaged, particularly for spent nuclear fuel and high level wastes, will affect the geological arrangements and the design of the geological disposal repositories.

Timescale for consultation

Whilst we recognise the importance of consulting with the scientific community, several respondents commented on the short time (5 weeks) given for commenting on and responding to the scores from the

specialist workshops. As the briefing papers noted, details of how the scores were derived can be found in the full Catalyze report. However, as this report is so large and complex report, it would have been helpful to have a summary at the beginning of each section outlining the assumptions used in each workshop.

Concern was raised by those who contributed to this response over whether the workshops had been given sufficient time to consider all the criteria in detail against all the options and waste streams. Whilst it is difficult to conclude what effect such constraints might have had on the scores, it is vital that this critical stage of CoRWM's work gives adequate consideration to the scientific issues, so that the nuances associated with each option and waste stream are fully understood.

Other comments (CoRWM question 5)

Security issues, as with many other issues, are complex and interwoven, requiring an understanding of both real and perceived threats. We agree with concerns expressed in the full report that a lack of priority is given to security in the present modes of waste storage. It would therefore be very helpful if a way could be found of addressing security issues during public engagement processes.

References

Royal Society 2006. *The long-term management of radioactive waste: the work of the Committee on Radioactive Waste Management (CoRWM)*. Policy document 01/06. Royal Society: London, UK

Catalyze report 2006. *CoRWM Specialist workshops- scoring. Report CoR004*. CoRWM document number 1502

Briefing paper 7. *Preliminary overview of scores from CoRWM's specialist workshops*. CoRWM document number 1498

Briefing paper 8. *Consolidated scores taken from the specialist workshops scoring report*. CoRWM document number 1499

Briefing paper 9. *Scoring scales for weighting*. CoRWM document number 1500

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