National Geological Screening Guidance: Providing information on geology

RWM Response to Independent Review Panel Comments on the draft National Geological Screening Guidance

September 2015

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Radioactive Waste Management (RWM) has developed the draft national geological screening Guidance, which was submitted to the Independent Review Panel (IRP) for their comment. This document provides a log of the comments received from the IRP and our responses, including revisions incorporated in the revised Guidance document.

The 2014 White Paper 'Implementing Geological Disposal' sets out the process to be followed by RWM in developing the proposals for national geological screening Guidance. The White Paper also includes the approach to be followed for reviewing the Guidance and the outputs of the screening exercise.

The IRP was established by the Geological Society, on behalf of Government, to assess whether the national geological screening Guidance was technically robust, whether it could be implemented using the existing geological information available, and whether it provides an appropriate assessment of the prospects for developing a robust long-term safety case in a range of geological settings to accommodate the UK inventory of higher activity waste. The White Paper also stated that the assessment should be achieved through open discussion and engagement with the developer, the public and interested stakeholders.

In April 2015, RWM provided a draft document to the IRP for initial comment. RWM then updated the document and submitted it for review. You can access a copy of the document submitted to the IRP for review at:

http://www.nda.gov.uk/publication/implementing-geological-disposal-draft-national-geological-screening-guidance-a-document-for-the-independent-review-panel/

Summary written comments from the IRP were provided by the Secretary by email on June 16th. A meeting with the IRP was held in public in London on June 23rd. A video recording of the meeting is available and a written report has been prepared by the independent facilitator. Some IRP members provided written copies of their questions to the Secretary after the meeting and these were also provided to RWM. These compilations included both the questions the IRP asked at the meeting and some additional questions which it had not been possible to discuss on the day due to time constraints.

Presented below is a log of the compiled comments and RWM's responses. These comments have been considered and where appropriate, the Guidance has been updated. In some instances it has not been appropriate to modify the Guidance and where this is the case, RWM has provided their reasoning.

Summary Comments provided by the Panel Chair

Comment 1

IRP Comment

The Panel is encouraged that RWM has taken into consideration a number of its earlier concerns, and that the screening exercise will potentially rule out some sites.

RWM Response

Whilst the purpose of screening is to provide information, it is expected that the exercise will result in some locations being identified as obviously unsuitable for geological disposal. We have made this point specifically in the Consultation document at Paragraph 1.3.

Comment 2

IRP Comment

The document is too long.

RWM Response

The Guidance needs a suite of documents to enable it to be presented to different audiences. The material presented in Section 4 (the Guidance) will be common to all the documents. For the Independent Review Panel it was accompanied by the supporting information on the development of the approach and context on the GDF siting programme to aid the IRP's review. For the public consultation it will be accompanied by background and contextual information and consultation questions. To enable application, the final Guidance will be accompanied by contractual information including timescales and deliverables.

In preparing the Consultation document, we have sought to address the IRP's comments by keeping the background information to a minimum.

Comment 3

IRP Comment

The document could benefit from clearer signposting to relevant research papers/studies upon which assertions/claims are made.

RWM Response

In preparing the Consultation document, we have kept the background information to a minimum and so scientific references are not included. For this reason we have not acted on this comment. Interested readers can find further information and references in other RWM documents in the public domain.

Comment 4

IRP Comment

There is some inconsistency between the language used in the guidance and that in the White Paper. For the sake of credibility and continuity the language across the two documents should be consistent. It should be prescriptive rather than descriptive, and maintain the essence of what is written on the process in the White Paper.

RWM Response

In updating the document, we have gone back to the White Paper to check that the language is consistent. We have also added paragraph 3.2 to explain about attributes early in the Guidance.

We have added more information on the approach. We explain why we are not setting targets in Paragraph 3.8.

On the advice of DECC Legal Department and the Consultation Institute, we have continued to present the approach as proposals so that it is clear that we are open to changes as a result of the Consultation.

Comment 5

IRP Comment

The document would benefit from having a clear and succinct statement of its purpose and objectives right at the beginning. This should relate back to the White Paper. Knowing who the readership is will help guide this. An illustrative presentation of the process with additional (but brief) text could help the reader better visualise this. Tables 1 and 2 and Figures 1 and 2 express this to some degree but may be confusing to some people. They could be merged into one.

RWM Response

As we updated the draft Guidance and prepared the Consultation document, our aim has been to ensure that the purpose of the Consultation is clear and the objective of the national geological screening exercise is clearly stated at the beginning of the revised draft Guidance document.

Tables 1 and 2 and Figures 1 and 2 formed part of the contextual information provided to the IRP. We provided information about the process at meeting in public on the 23rd June in London. The tables and figures have not been included in the Consultation document but have been replaced with written descriptions in appropriate sections which we hope present the information more clearly.

Comment 6

IRP Comment

In some areas the document sets targets that are too ambitious e.g. relating to groundwater information since the amounts of data available are extremely small. The document (and by extension RWM and Government) needs to be credible so over-promising and under-delivering will be detrimental to this.

RWM Response

This comment was discussed at the meeting on the 23rd June. We have updated the screening methodology and now specify a less ambitious treatment in some topics. Fewer maps of groundwater information are now planned. Some geological features which give indications about where distinct groundwater regimes may be effectively kept separate at depth will be discussed in the regional narratives instead of being identified on maps.

IRP Comment 9 is also relevant and the response can be read in conjunction with this response.

Comment 7

IRP Comment

There could be more explicit reference about what is expected to be mapped. There should also be more of a discussion about uncertainties and risk, and what will be done to alleviate them. What is unknown is as important as what is known.

RWM Response

We have sought to be more explicit about maps in the updated draft Guidance.

Uncertainty and risk were discussed at the meeting on the 23rd June. We have added more information on the approach and about uncertainty in Paragraphs 3.8 and 3.19.

Comment 8

IRP Comment

The BGS need to be given clear guidance by RWM about the process they are being expected to undertake and deliver.

RWM Response

This topic was discussed at the meeting on the 23rd June, particularly focussing on expert judgement and managing uncertainty.

We will apply the screening Guidance working closely with the British Geological Survey (BGS) and specialist contractors. Detailed technical instructions will be developed by the BGS and RWM team, setting out specifically how to capture information about the attributes from the available datasets. These detailed technical instructions will be reviewed by the IRP. This is described in Paragraph 3.9 in the updated draft Guidance.

Questions and comments from individual IRP members

Comment 9

IRP Comment

The draft guidance promises several maps that require quantitative criteria in order that they can be drawn. At what point in the proposed timetable and in what forum are these quantitative criteria going to be established?

Possible additional question in response to 1- are you likely to propose any sort of external consultation on these criteria before contracting BGS to draw said maps?)

RWM Response

As discussed during the 23rd June meeting, expert judgement will be used to produce maps rather than hard numerical criteria. As explained in response to comment 8, the detailed technical instructions, including the expert judgement to be used in producing any map outputs, will be developed by RWM and BGS and shared with the IRP before they are applied by the BGS. The updated Guidance describes the qualitative approach to be used in Paragraph 3.8.

Comment 10

IRP Comment

Excluding maps of potential host rocks, the draft guidance proposes 5 types of map for each of the 13 regions (1 structural, 2 groundwater and 2 resources). Is RWM intending that these will be constructed for all of the 13 regions?

RWM Response

Yes, maps will be produced for each region, but the revised Guidance for Consultation proposes for each region only 1 map for rock structure, 1 map for groundwater and 1 map for resources. The main consideration for production of a map will be the availability of information including the presence of the features to be mapped. For some regions or parts of regions there may be insufficient information to enable every map to be generated. These cases will be clearly indicated in the outputs and discussed in the regional narratives.

Comment 11

IRP Comment

Given that RWM appears to place a high level of importance on the concept of describing three host rock types, it is regarded as unacceptable that the descriptions of them in the Screening Guidance Document differ from those in one of the key references cited, namely the Generic Environmental Safety Case.

The reason why RWM have chosen to use these three "illustrative geological settings" as a significant part of the National Geological Screening Guidance is not explained in the Guidance Document. RWM should explain their thinking in using these illustrative geological settings in their screening guidance, and also provide an explanation of why they have chosen to change the descriptions of these host rock types in their Screening Guidance from those that they defined in their Generic Environmental Safety Case.

RWM should be asked to explain why they have adopted a very different approach for the utilisation of the three host rock types in the screening process and why they have ignored the results of the Environment Agency Report.

RWM Response

As discussed on June 23rd, the approach to screening is based on the three potentially suitable host rocks discussed in the 2010 generic Disposal System Safety Case (DSSC). Since the publication of the generic DSSC, RWM has received feedback on the approach from a number of stakeholders, including regulators and CoRWM. In response, we have updated the definitions we use to improve clarity and alignment with the disposal concepts. The revised definitions are being used in the generic DSSC update which will be published in 2016 and in the screening Guidance. We have added a footnote to the updated Guidance to make this clear.

The use of illustrative geological settings was also discussed on 23rd June. There are a number of documents which use 'illustrative settings' to support discussion on the feasibility of geological disposal. In order to capture all suitable settings, and in line with the 2014 White Paper, the screening methodology considers the geological attributes (characteristics of geological environments relevant to long-term safety). The suitability of any setting depends on a combination of favourable characteristics, of which the host rock type is one. It is expected that the approach in the Guidance will capture all the areas that match the "illustrative geological settings" specified by the Environment Agency and also any other areas that may be favourable.

Comment 12

IRP Comment

In order for RWM to provide these outputs [of screening], it is presumed that any areas in England, Wales and Northern Ireland where there are no prospects for GDF development because there is no suitable host rock will be clearly identified as unsuitable for GDF development in order to avoid communities wasting their time thinking about areas which are clearly unsuitable. RWM should consider how they are to address this issue.

RWM Response

Yes. We will make clear in the outputs where we consider that there are no prospects for GDF development. The lack of a suitable host rock is one of the factors that would make an area unsuitable.

Comment 13

IRP Comment

RWM is requested to provide a clear statement of the basis that they propose to adopt for the National Geological Screening in relation to "rock type". In particular, they are requested to clarify the apparent discrepancies between the current version of their National Geological Screening Guidance, the White Paper, and existing reports published by RWM, including the Generic Environmental Safety Case, and the Geosphere Status Report

RWM Response

Please refer to IRP Comment 11 for our response.

Comment 14

IRP Comment

It would be expected that RWM would provide some understanding of the likely minimum thicknesses that would be necessary for locating a GDF in both the lower strength sedimentary host rock, and the evaporite host rock. In this way, communities would avoid thinking about possible GDF development in host rocks that were of inadequate thickness.

RWM Response

The likely minimum thickness of a potential host rock will depend on the geological setting, including dip of layers, uniformity of formations and the nature of adjacent rock types. Additionally, in some regions thicknesses of specific rock types may have large uncertainties attached. For these reasons we do not propose to specify firm requirements on thickness of the host formation, but information on the thicknesses of possible host rock types will be collated as part of screening. However, we can give an indication of the volume of interest and the updated Guidance does now include a statement in Paragraph 3.18 that host rock bodies would need to be at least a few tens of metres thick.

Comment 15

IRP Comment

It is recommended that RWM be more specific in the Guidance as to the properties of the rock formations surrounding the potential host rocks that may contribute to safety.

RWM should clearly indicate why they have chosen to include such a simplistic description of the site characterisation activities in the Geological Screening Guidance. It is recommended that the descriptions in the Guidance be revised to be consistent with the White paper and the relevant reports previously published by RWM.

RWM Response

We recognise the important contribution to safety from rock formations surrounding the host rock and have moved the paragraph describing this contribution nearer to the top of the section so it is clearer. We have not been more specific about properties as there are a number of different ways in which the environment could contribute and we consider it is more appropriate to discuss this once the information was available.

We accept that the background information in the document provided to the IRP was misleading on the point of site characterisation. This was clarified during the meeting on the 23rd June. The Consultation document does not provide detail describing site characterisation activities.

Comment 16

IRP Comment

Both the proposed maps of faults and anomalous groundwater plus the map of "distinct isolated deep groundwater systems" require judgements and some would require considerable debatable interpretation. How does RWM intend to square these new, unpublished interpretations with the stated objective of national geological screening, "to provide authoritative information…"?

Within the draft guidance, RWM are promising maps of "isolated deep groundwater systems" beneath "shallow potable groundwater". What is the nature of the 'positive' evidence on which these maps will be based?

Possible additional question in response to 3- is it sufficiently widespread to provide maps of significant areal coverage?

RWM Response

This comment is related to IRP Comment 6. We accept the IRP's comments and have scaled back the amount of mapped information that we will provide for groundwater attributes.

Comment 17

IRP Comment

RWM are promising maps of "anomalous groundwater flows bringing deep-sourced water to the near-surface". An obvious example is the Bath thermal springs whose source is generally accepted as the Mendip Hills. Would the intended map exclude the whole area between the Mendip Hills and Bath or, just Bath?

Possible additional question in response to 4-How would the map be drawn where the thermal flow system is less well known?

The identification of soft sedimentary layers as potential host rocks will inevitably result in the identification of candidate areas beneath major English aquifers. Does RWM recognise the difficulty of mining beneath aquifers such as the experience of Selby coalfield? If so, is there not a case for identifying areas where practical difficulties would rule out possible repository development?

RWM Response

The map of anomalous groundwater flows will show only the location of the springs (and other

sources of possible flow anomalies). Information about flow paths, where known, will be discussed in the narrative.

The aim of screening is to provide information. The locations of features such as thermal springs and their sources are relevant to safety and would need to be considered at siting but are not exclusion criteria for an area.

Whilst the focus of screening is long-term safety, there was discussion amongst the experts about constructability. Whilst there may be construction issues associated with locating a GDF in a suitable geological setting below a major aquifer, construction of a GDF is very different from a mining operation. Therefore construction issues would be considered during any siting process.

Comment 18

IRP Comment

RWM are proposing maps of "major faults and fault zones and areas of folded rocks with complex properties". Both the current Scandinavian repository proposals include major faults within their immediate vicinity. How are RWM intending to ensure that all areas are treated equally by this exclusionary process (i.e. screening out) at this stage? Might it be on the basis of mapped length, mapped areal density, average interpreted throw, or what?

Additional question in response 5 – might this not lead to unfortunate comparisons in the future when a site is chosen (that is bound to have faults nearby)?

RWM Response

We do not intend to treat faults above a certain size as a criterion for exclusion. In the revised Guidance, we distinguish between mappable zones of multiple faults and/or folds which lead to unpredictable groundwater flow and repeatedly juxtaposed rocks of strongly contrasting properties, and individual faults. The former areas are not suitable to host a GDF while the latter features may delimit suitable rock volumes but are unlikely to exclude large areas. Protocols for effectively defining structural features will be developed as part of the detailed technical instructions.

Comment 19

IRP Comment

All lines on all maps are interpretations. For example, lines on stratigraphic maps are used to separate rocks of different ages, which nonetheless may have different properties in different places. In the specific case of the national screening, the maps will show lines that separate rocks with different physical properties (e.g., strength, hydraulic permeability, etc). However, the physical properties of rocks cover a continuous range of values from very low to very high. The cut off values that separate different categories from each other (e.g. low strength from high strength) is arbitrary and involves "expert judgement". The expert judgements that RWM and the BGS make could result in some areas being excluded and other included. In order for the public to have confidence in the judgements made, this Independent Review Panel (IRP) has been appointed by the Department of Energy and Climate Change to determine if the judgments are geologically and technically sound. Will the IRP be given an opportunity to review the criteria that the BGS will use when deciding to draw lines on maps?

Given that no new data are to be collected, this exercise will involve merging datasets with significantly different spatial coverage and resolution, not to mention data quality. Data quality, coverage and resolution will vary between the chosen geographical regions, but also within a given geographical region. How does RWM propose that the BGS indicate the quality and resolution of the data that underpins each of the maps, in a way that is accessible by the intended audience?

It is very common to find, even in areas with multi-million pound oil industry datasets, that multiple potential interpretations of the geology are possible that honour the data. It is imperative that this screening process does not close in to a single "most valid" interpretation, when in fact multiple interpretations are possible. The screening process should ideally identify a range of interpretations and point out what data are needed to distinguish between these. How will RWM ensure that this

happens. Will they be checking interpretations part-way through and encouraging BGS not to settle on a single interpretation too soon?

RWM Response

The roles and responsibilities of RWM, BGS and others have been made clearer in the revised Guidance (see responses to Comments 8 and 9) The detailed technical instructions to BGS will be shared with the IRP for comment as noted above. At the level of detail at which it is possible to carry out screening, we do see significant uncertainty in some interpretation of concealed geology; this is discussed in response to Comment 7 and the remaining uncertainties will be made clear in the narratives. In many cases, the uncertainty would not affect whether or not an area had favourable geology to host a GDF but it would have a major impact on the design and layout and so would have to be resolved at the siting stage.

Comment 20

IRP Comment

Even in an area with the best quality, most complete coverage and highest resolution of data, significant uncertainties will remain in the attributes that RWM have chosen to highlight. What will RWM do to ensure that these uncertainties are communicated to the public in such a way as to:
Explain carefully what these uncertainties mean,
Reassure the public that this exercise is worthwhile (there is often a narrative that "uncertainty" means "we don't know what we are doing"),
Demonstrate to the public that it will be possible, should a particular site go forward, to collect data to reduce these uncertainties,
Explain what the implications of these new data collection stages would mean for the local community?

RWM Response

The uncertainty in the data and information and the potential for alternative interpretations will be addressed in each narrative on a region by region basis. Much of the uncertainty would need to be resolved at an early stage in any siting process, and this will also be made clear in the narratives. RWM will work with stakeholders to produce the outputs in the best way to communicate this uncertainty.

Comment 21

IRP Comment

The draft guidance promises one structural map, primarily faults that have been identified at surface by mapping. The geophysics can identify deep structures that do not come to surface and that can impact on the safety of a deep geological disposal facility (GDF). The aeromagnetic coverage provides country-wide coverage that could be interpreted for deep structural features consistently over the whole area. Will geophysical data such as aeromagnetic data be used to interpret these structures? If this interpretation has already been done, was it undertaken for all 13 regions with an intention of identifying deep structures such as those that could compromise the safety of a GDF? Could the reference for this published work be provided for those that wish to seek more information?

RWM Response

The information on deep structures in the GB3D model for the UK is based on a combination of detailed mapping, especially in mining districts, interpretation of geophysical surveys, including aeromagnetic maps, and deep drilling. The geophysical maps of the UK are also available part of the BGS dataset. We do not propose re-interpreting original datasets such as aeromagnetic data as part of screening as they have already been taken into account in the selected information sources.

Comment 22

IRP Comment

RWM should clearly indicate how they intend to deal with areas of underground mineral resources in the outputs from the National Geological Screening.

RWM Response

In screening maps will be produced showing areas of current and historic deep mining. RWM recognises these may have the potential for future human intrusion, and they are also likely to impact on groundwater flow throughout the mined depth interval.

Any assessment of potential future resources is much more subjective as there will be considerable uncertainty in the extent of the potential resources and whether the deep ground conditions are suitable for them to be exploited, as well as in the economic conditions that would be needed for them to be considered for exploitation. The possible existence of such resources will be discussed in the regional narratives. The Guidance has been modified to make this approach clear.