

# Geological Disposal

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## Further information on R&D for West Cumbria MRWS Partnership

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July 2011



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## **Bibliography**

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## **Feedback**

Readers are invited to provide feedback to the NDA on the contents, clarity and presentation of this report and on the means of improving the range of NDA reports published. Feedback should be addressed to:

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## Executive Summary

In Spring 2011, NDA-RWMD published the first issue of our R&D Programme document. Following a presentation on the programme at the West Cumbria MRWS Partnership meeting on 14th April 2011, the Partnership asked Professor Stuart Haszeldine to critique the R&D Programme and RWMD in turn prepared a draft response. This note responds to points raised by Professor Haszeldine on this draft response.

This note considers the points made by Professor Haszeldine and sets out our response together with the actions that we propose to take. RWMD is committed to transparency and to continuing to engage with others as our R&D programme develops. The actions that we propose, set out below, recognise the need for continued interaction with stakeholders within a framework of review and scrutiny of our programme by Regulators and Government.

1. We invite feedback from stakeholders on all our publications and we would welcome comments on our R&D programme document. (Ongoing action.)
2. If, through feedback, we find that there are areas where there is significant disagreement about the R&D needs or our assessment of the priority, we will discuss these with stakeholders through workshops or other mechanisms and explore the range of views and the reasons for them. (Ongoing action.)
3. We hold periodic meetings where we seek stakeholder input on our programme. One such is the workshop on the Current Status of Science and Technology underpinning Geological Disposal of Higher Active wastes to be held at Loughborough University in October of this year. (Meeting will be held during October 2011.)
4. We will record any changes to the scope or content of our R&D programme document through a series of addenda to the document. (First set will be added by March 2012.)
5. We have improved the way in which we procure our work from suppliers in order to give the technical specialists a greater involvement in shaping our forward programme. We call this 'solution-based' contracting. (Implemented from April 2011.)
6. In response to a number of comments received, we will improve access to our technical information by making more of our reports directly downloadable from the Bibliography. (This action will be progressed over the next year, but may take longer to complete in full.)
7. We are starting the process of development of the R&D programme for MRWS stage 5. We will consider ways in which we can engage stakeholders on the overall approach to identifying and prioritising R&D needs. This could take the form of a series of technical workshops. We envisage that we would involve the Learned Societies in this process, acting as an independent voice to ensure that our approach is based on sound scientific processes for document development and peer review. (Outline plans for producing an R&D programme for MRWS stage 5 for discussion will be produced by December 2011.)
8. From this year, we will publish the values of the R&D contracts we award. (A list will be produced during October 2011 and updated regularly. Information will also be available via the Government "contracts finder".)

9. We recognise the specific technical issues raised by Professor Haszeldine as what we call “potential issues”, which we will address using our issues management process. (Issues have already been added and will be considered by March 2012.)
10. As part of our issues management process, any potential issues will be evaluated to see whether there is an R&D need and then these will be prioritised and added to the R&D programme document as an addendum. (Issues have already been added and will be considered by March 2012.)
11. During MRWS Stage 5, we will develop plans for the underground research that will be required during Stage 6. These plans will include consideration of whether or not a stand alone rock laboratory is required. (Action will be progressed during MRWS Stage 5.)

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## 1 Introduction

1.1 In Spring 2011, NDA-RWMD<sup>\*</sup> published the first issue of our R&D Programme document [1]. A presentation on the programme was made at the West Cumbria MRWS Partnership meeting on 14<sup>th</sup> April 2011 [2]. The Partnership asked Professor Stuart Haszeldine [3] to critique the R&D Programme and RWMD in turn prepared a draft response [4].

1.2 This note has been prepared in response to an e-mail request from Rhuari Bennett, 3KQ on behalf of the Technical Review Group (TRG) of West Cumbria MRWS Partnership, to Elizabeth Atherton, NDA-RWMD on 26<sup>th</sup> May 2011, saying:

*“You will know that the Partnership asked for a critique of the R&D Programme from Prof Stuart Haszeldine (doc 146) and that the NDA has responded to this. In turn, the Partnership asked Stuart to consider the extent to which his concerns have been addressed. This is attached. You will see that it is very critical of the NDA's response in a number of ways. The TRG considered this today and wish to request that.*

1. *The NDA clarify if, when and how they can address the concerns raised in the next draft of the R&D Programme, in particular the issues of clarity of presentation around priority, budget allocation, importance and timescale etc.*
2. *The NDA clarify how the issues raised could be linked to, or addressed by, the issues register conversation that is due to take place on 28th June. If at all possible the TRG would request that the NDA view this as a positive way of addressing the concerns raised, as well as taking them on board in the next draft of the R&D Programme.”*

1.3 This note responds to the points raised by Professor Haszeldine and outlines the actions that RWMD plans to take. The comments have been grouped as indicated below<sup>†</sup>:

- Scope and schedule – points 5 and 13;
- Stakeholder involvement and peer review - points 8 and 12;
- Access to supporting references –point 9;
- Prioritisation of R&D – points 10-12;
- Programme costs – points 14 and 15;
- Funding for communities to carry out independent research and scrutiny – points 16 and 25;
- Specific technical issues – points 17-19, 21 and 22.
- International repository – point 20
- Underground research laboratory – point 23
- Geology - points 24 and 26.

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<sup>\*</sup> Nuclear Decommissioning Authority Radioactive Waste Management Directorate.

<sup>†</sup> Points 1-4 do not require a response. 6 and 7 are not used.

In each of sections 2 to 11 below, we have reproduced Professor Haszeldine's comments and we then provide our response immediately below. We have highlighted specific actions we will take **in bold**. In our response we use the terms 'we' or RWMD to refer to the directorate of NDA that is responsible for geological disposal.

## 2 Scope and schedule

*Point 5. The NDA state that their report attempts to be comprehensive, but yet state that the issues itemised as research areas in their report do not all need to be completed in the preparatory phase, before detailed site investigations have begun. It is still not possible for a reader to determine which research areas need to be completed and to what standard.*

*Point 13. MRWS 146 pointed out that the NDA research document has 52 areas of research which need to be resolved before sites can be chosen. This NDA reply appears to contradict that by stating that it is not necessary for all issues to be resolved. Consequently it remains completely unclear how much research, on what, by whom, and by when, is needed before the site selection process can securely proceed. A community asked to host a Repository has no viable information with which to judge the progress of essential research.*

- 2.1 The programme to implement geological disposal in the United Kingdom is in its early stages. We are still many years from producing a final design and safety case for a geological disposal system. There is international consensus that the scientific basis is sufficiently developed to demonstrate the viability of geological disposal [5,6,7] and we already have sufficient confidence to justify supporting progress of the programme to the stage of surface-based investigations, when site-specific features and processes will be identified for further research work.
- 2.2 Internationally, a number of countries are progressing with producing safety cases for site-specific geological disposal facilities, for example Sweden has just submitted a licence application. Our aims in stages 1-4 of the site selection process are to carry out generic R&D that will inform and underpin the process of specification, design and assessment that is needed in order to produce the safety case that will be required to seek permission to undertake intrusive surface-based site investigations and to prepare for site-specific work. This includes carrying out work to develop the tools and capabilities that we expect to need in stages 5 and 6 of the MRWS site selection process.
- 2.3 In order to demonstrate the safety of a geological disposal facility at a specific site in the UK, we will need to undertake significant site specific research and this will require a substantially expanded R&D programme. Many of our R&D needs cannot be identified until we have this site-specific data. In practice, an assessment of the significance of issues can only be made in a design and site-specific context. As geological disposal will be implemented through a voluntarism and partnership approach, we will be able to work with the local communities to develop technical understanding and community support in parallel as the project proceeds.

### 3 Stakeholder involvement and peer review

*Point 8. A comment was made by MRWS 146, that there is no audit trail to understand how, and by whom, the NDA have arrived at categorisation of their research topics, and how the NDA have arrived at the assessment of the complete list of research in each research topic. This reply by NDA states that these choices were reviewed internally, and by the NDA research advisory panel. This in no way meets the level of external peer review and scrutiny which would be expected of such an important research programme. Consequently the NDA have conceded the point that there is insufficient and open peer review and discussion of their research programme.*

*Point 12. The comparison of NDA priorities with other external stakeholders is 'welcomed' [is] by the NDA. However there is no commitment to act upon any comments received, to try and understand if external commentators have made valid points which will cause a UK research programme led by the NDA, to adapt.*

3.1 We do not agree that there has been insufficient peer review and discussion of the research programme. We have a structured approach to ensuring that there is appropriate review and scrutiny of our programme as follows.

- The NDA-RWMD R&D Advisory Panel. We seek advice and guidance on our programme from this panel of five independent university professors with expertise in geological disposal. The panel reports to the NDA's Research Board. The panel may also access other independent subject matter experts as required. The panel were involved in advising on the development of our R&D programme and reviewed a draft of the document.
- The NDA Research Board. The NDA research board provides high level scrutiny of all NDA's research activities. It is independently chaired and has representatives from Regulators, Government, Research Councils, and other waste owners (e.g. MoD, EdF). Development of the R&D programme was described to the NDA research board by the Chair of the NDA-RWMD R&D advisory panel.
- The Committee on Radioactive Waste Management. This Government advisory committee provides scrutiny of our R&D programme. CoRWM was involved in discussions about the developing R&D programme document and provided informal review comments on a draft document.
- Regulators. Our work is subject to voluntary regulation by the appropriate regulators. As part of a process of early engagement on key issues, we discussed an early draft of the R&D programme document with regulators.
- Peer review. The majority of the output of our R&D programme is independently peer reviewed and this is funded by NDA. The series of Status Reports were reviewed by subject experts with an international profile, involving around 20 experts overall. This process was managed by the R&D advisory panel, which also provided high level oversight of the peer review process. The peer reviewed status reports were then used to identify knowledge gaps that require R&D and these form the basis of our R&D programme.
- Inviting feedback. **We invite feedback from stakeholders on all our publications and we would welcome comments on our R&D programme document [Action 1, ongoing action].**

- Responding to feedback on R&D needs. As we stated in the R&D Programme document, **if, through feedback, we find that there are areas where there is significant disagreement about the R&D needs or our assessment of the priority, we will discuss these with stakeholders through workshops or other mechanisms and explore the range of views and the reasons for them. This could lead to a reassessment of our R&D needs. An example of this approach is a recent workshop on colloids. We would publish the output of any such workshop and record any changes to our assessment of R&D needs [Action 2, ongoing action].**
- Programme of ongoing engagement events **We hold periodic meetings where we seek stakeholder input on our programme. One such is the workshop on the Current Status of Science and Technology underpinning Geological Disposal of Higher Active wastes to be held at Loughborough University in October of this year [Action 3, a meeting will be held during October 2011].** We also held a stakeholder event in November 2008 as part of the preparation of our R&D Strategy. We published a summary of the feedback we received on our draft R&D strategy, including the views expressed at the workshop and our response to it [8]. Publication of the R&D programme is a response to the feedback from this workshop.

3.2 **We will record any changes to the scope or content of our R&D programme document through a series of addenda to the document [Action 4, first set will be added by March 2012].** Stakeholders will thus be able to see the actions taken in response to peer review and feedback.

3.3 **We have improved the way in which we procure our work from suppliers in order to give the technical specialists a greater involvement in shaping our forward programme. We call this ‘solution-based’ contracting [Action 5, implemented from April 2011].** Instead of a traditional approach of specifying requirements in terms of specific tasks, inputs or deliverables our current approach is to define and clarify the purpose of a particular work stream (what is the problem we are trying to solve?) and its context within the RWMD Programme. Researchers are then invited to submit a proposal for a programme of work that delivers a solution to the problem that achieves a resolution appropriate for RWMD’s context and objectives. Through this approach, researchers are free to propose their approach and the format of the deliverables. In this way we aim to make maximum use of the supply chain’s capabilities for innovation and value delivery. The work carried out under these programmes is and will continue to be subjected to independent peer review.

#### **4 Access to supporting references**

*Point 9. MRWS 146 stated that referencing to original source materials was patchy, and incomplete [in] the NDA review. NDA do not dispute this, but refer a reader to a series of eight additional NDA reports, which are now available on their website. These reports are many tens of pages (up to 150 pages) in length, and so this rather defeats the objective of making an accessible summary review. But the NDA also concede a point made by MRWS 146, that not all relevant documents are available on their website. An offer is made that users can request documents to be provided, however this does require a user know that the document exists beforehand, which is not always possible, especially with the extensive and detailed*

*legacy information available from Nirex work, and current and legacy international work. This criticism of document availability has not been fully addressed.*

- 4.1 We recognise the challenge in making the audit trail accessible and we had sought to achieve this through presenting a well referenced summary of our current understanding of each topic together with the associated research needs in the series of Status reports. In addition, nearly all of the reports that have been produced by or for Nirex and NDA-RWMD are listed on the Radioactive Waste Management Directorate's Bibliography. This is available on the NDA's web site and contains almost 6000 references which can be searched in a variety of ways and relevant reports can be requested. During the last year we have made many of the reports of most interest to a general audience (so called Level 1 & 2 documents) directly downloadable from the Bibliography. **In response to a number of comments received, we will improve access to our technical information by making more of our reports directly downloadable from the Bibliography [Action 6, this action will be progressed over the next year, but may take longer to complete in full].** The most recent reports will be made available first and then over time, more historic reports will also be made available.

## **5 Prioritisation of R&D**

*Point 10. MRWS 146 stated that most of the NDA judgements of research priority were "medium", which did not enable discrimination of priority to be made in any logical way. This very simple classification was surprising considering that NDA claim to have used a matrix of seven different questions to provide multiple strands of additional information. The NDA reply simply states they consider this approach and lack of detail to be helpful to them. Consequently, the lack of prioritisation information critiqued by MRWS 146 has not been answered. The NDA document on research objectives remains not sufficiently useful or informative to anybody outside the NDA.*

*Point 11. MRWS 146 attempted to analyse and understand the relative importance of the diversity of research topics presented by the NDA. This resulted in some topics appearing to be much more important than others, because they included many categorisations of "high impact", "large" knowledge gaps, or "high" urgency. In reply, NDA they say that this categorization does not compare equally between topics, and state that their NDA research process can identify when and how to undertake the research effort. This reply clearly demonstrates that the NDA document remains very obscure, as these judgements are incapable of being made by any external reader. The NDA reply indicates that their categorisations cannot be compared from one topic to another, therefore the NDA research review does not communicate any meaningful information on priorities to a reader outside the NDA. This is totally unacceptable.*

- 5.1 We consider that the prioritisation process is appropriate for this stage of the programme. The approach to prioritisation was agreed with the NDA-RWMD R&D Advisory Panel. The prioritisation of the R&D topics was carried out and reviewed internally and also reviewed by the R&D Advisory Panel. The panel identified some potential gaps in R&D tasks in the earlier draft versions which we since sought to address in finalising the report.

- 5.2 **We are starting the process of development of the R&D programme for MRWS stage 5. We will consider ways in which we can engage stakeholders on the overall approach to identifying and prioritising R&D needs. This could take the form of a series of technical workshops. We envisage that we would involve the Learned Societies in this process, acting as an independent voice to ensure that our approach is based on sound scientific processes for document development and peer review and that this could be a useful way of balancing feedback from individuals against more formal interactions with Regulators, CoRWM, Government and the Partnership. We will include Professor Haszeldine's suggestions for alternative prioritisation within this process [Action 7, outline plans for producing an R&D programme for MRWS stage 5 for discussion will be produced by December 2011].**

## **6 Programme costs**

*Point 14. MRWS 146 stated that no estimations of costs have been made to undertake in the research work identified by the NDA. The reply provides no information, merely stating that the research program is driven by need. This provides no confidence whatsoever that any of these problems can be solved within the budgetary constraints which exist, in the relevant timescale. Implicit in this reply is the conviction that all problems of site selection can be solved by allocating relevant amounts of research money with an unrestricted Reply to the NDA response to MRWS paper 146 S Haszeldine 22 May 2011 Page 3 budget. The NDA must be unique on earth and having such confidence. A community would be unwise to host a repository with many significant outstanding technical issues remaining unsolved, with no timescale, budget or method for the resolution of issues.*

*Point 15. MRWS 146 stated that no timescales are given for individual research topics to be completed. This NDA reply appears to state that all work will be completed within 10 years. No evidence is provided to support this assertion. Indeed the NDA have failed to answer why their analysis of each research topic has failed to estimate of the cost and time for it to be completed.*

- 6.1 We procure our R&D through a competitive procurement process; we do not provide cost estimates for each activity in the R&D programme. However, **from this year we will publish the value of the contracts we award [Action 8, a list will be produced during October 2011 and updated regularly. Information will also be available via the Government "contracts finder"]**.
- 6.2 For business planning purposes, we do work to an overall budget. For 2011/12 our budget for external spend on R&D is about £5 million. This is sufficient for our current requirements, but we expect expenditure to be significantly greater in future phases of the programme (that is, from MRWS stage 5), when we would be carrying out site-specific R&D.

## **7 Funding for Communities to undertake independent research**

*Point 16. MRWS 146 pointed out the benefits of external scrutiny of the NDA research program, and the radioactive waste disposal program in general. MRWS 146 also called for significant additional funding to be allocated to communities, to enable communities to gain a full understanding of NDA proposals, even to the extent of commissioning some independent studies, to augment desk reviews. The NDA agree that external scrutiny is important, but completely fail to provide a*

*funding mechanism to support this. The implication is that communities will remain greatly under resourced and hostage to the views of the NDA as the Developer. That is un-democratic and unacceptable.*

*Point 25. MRWS 146 stated that communities involved as potential hosts for a repository site should be able to fund advisory work. This NDA points out that much of NDA research is externally peer reviewed, but does not concede any need for independent work. That peer review is, of course, to be welcomed. However that does not answer the point of the question, which is that all of this research work is highly technical and complex. Communities asked to receive these developments need to have the technical work synthesised, and interpreted, and explained, in terms which are understandable. In point (16) of this document, the NDA agreed that external scrutiny is valuable. However it seems that there is no commitment by NDA to fund such work, so that communities may be systematically disenfranchised. That is a power unbalance.*

- 7.1 These comments fall outside the remit of the NDA. Any desire from the community to source funds to support independent R&D or scrutiny would need to be agreed between the community and Government. The MRWS White Paper (para 6.52) identifies “commissioning specialist advice” as an activity that could be covered by a Community Engagement Package.
- 7.2 Although much of our work is technical in nature, we aim to produce executive summaries that are written in plain English. Another aspect of our approach to transparency is to develop some higher level documents, which aim to summarise the technical work in a more readily understandable way.

## **8 Specific technical issues**

*Point 17. MRWS 146 recognised the potential for leakage of radioactive gas as a critical safety performance factor, within a few years of a repository being closed. The NDA reply agrees with this problem and also states that the problem is long standing. This is contradictory to the statements made in item 15, where the implication is that all problems can be solved within 10 years, by spending small amounts of research money. There is no credible basis for the NDA to make this statement. Leakage of radioactive gas remains an intractable problem.*

*Point 18. MRWS 146 stated that computational models of the natural world do not have simple answers on which to build a safety case for a repository. This NDA reply agrees with that, but maintains the fiction that computer models with uncertain outcomes can be used to build and conclude range of numerical values for a safety assessment to be precise.*

*Point 19. MRWS 146 stated that radioactive waste dissolved in groundwater from the repository will eventually leak into the ocean. This NDA reply agrees with that, but appears to conclude this is not important because that will be potentially thousands of years into the future. The NDA are ignoring the fact that leakage into the ocean is against international law.*

*Point 21. MRWS 146 stated that the NDA appears to be undertaking no specific research on plutonium or MOX disposal. This NDA reply states that a desk study is underway, but agrees that no specific new research on MOX is being undertaken. It is clear that plutonium dissolution and criticality remain poorly understood at present. Consequently, the NDA may need to generate a research program on an entirely new, and globally poorly known, research area of plutonium disposal, which other nations have not undertaken. Such a programme could take many years, or*

even decades. The realism of this proposition cannot be assessed with the minimal information provided by NDA, and remains an area of very serious doubt.

*Point 22. MRWS 146 stated that the heat produced by MOX and plutonium, and particularly by future disposal of spent fuel will be important. This heat causes the rocks to expand, and will lift the land surface, with important implications that many new fractures will be generated and re-opened. This will enable groundwater flow to circulate much more freely than at present, with greatly increased potential for leakage of radioactivity above and around a Repository site. The NDA cites an unpublished report, but agree that even on their best assumptions, heat effects will be very noticeable. NDA completely miss the scientific point that it is not the heat itself that is important, but the physical consequences for the rocks enclosing the Repository. No good reply has been given to this critical problem.*

- 8.1 **We recognise the specific technical issues raised by Professor Haszeldine as what we call “potential issues”, which we will address using our issues management process [Action 9, issues have already been added and will be considered by March 2012].** We discussed our management process with the partnership in April 2011 [9] and a further meeting on this topic is scheduled for late June 2011. **As part of our issues management process, any potential issues will be evaluated to see whether there is an R&D need and then these will be prioritised and added to the R&D programme document as an addendum. We will formally consider the points raised by Professor Haszeldine within this process [Action 10, issues have already been added and will be considered by March 2012].**

## 9 International repository

*Point 20. MRWS 146 stated that European union regulations permit agreement between different states to enable disposal of waste in other countries. The NDA reply that they are not considering such options. That is remarkable, because it may be both cheaper and more secure to purchase storage in other countries rather than the geologically complex UK.*

- 9.1 The remit for NDA-RWMD is given by the MRWS White Paper, which plans for geological disposal of UK wastes in the UK. This states ‘*This White Paper sets out the UK Government’s framework for managing higher activity radioactive waste in the long-term through geological disposal, coupled with safe and secure interim storage and ongoing research and development to support implementation*’.

## 10 Underground Research Laboratory (URL)

*Point 23. MRWS 146 inquired if an underground research laboratory was to be explicitly planned. This NDA reply appears to concede that this very expensive facility may be required. If so, it is truly remarkable that no mention of this underground laboratory as a contingency is included in the NDA research planning strategy document.*

- 10.1 The R&D programme document refers to the period up to and including MRWS Stage 4 of the MRWS site selection process. As such, its scope does not cover underground research in the UK. Underground research will form part of Stage 6 of

the MRWS site selection process. **Therefore, during MRWS Stage 5, we will develop our plans for the underground research that will be required during Stage 6. These plans will include consideration of whether or not a stand alone URL is required [Action 11, action will be progressed during MRWS stage 5].** In the current phase, we are participating in a number of international collaborative projects in overseas URLs to build technical understanding and capability in this area [10].

## 11 Geological setting

*Point 24. MRWS 146 stated that legacy information from previous UK site investigations, particularly in West Cumbria, has not been explicitly taken into account. This NDA reply states that previous information is not appropriate. That is quite bizarre, and not a scientific approach appropriate to resolve any problem. At the time of the 1990s Nirex investigations, the west Cumbria site was very well characterized, and became a globally leading knowledge standard. The site remains well known to this day, with important information not just on the local Site, but also on the entire west Cumbria Region. This is a fundamental admission that science based evidence appears to be unimportant to the NDA, if the results are potentially inconvenient. How can the residents of West Cumbria have any confidence in the quality of the NDA work if the inconvenient information is being ignored, and by being unavailable on the NDA website, much of this information is suppressed?*

*Point 26. MRWS 146 commented that the west Cumbria region does not appear to coincide with international norms for developing radioactive waste disposal sites, which are in flat lying topographic areas, of simple, un-faulted, geology. The NDA reply state that this novel complex and hard-to-predict UK geology, already known to be subject to large flows of groundwater, is not a problem. This does not inspire confidence for a community being asked to pioneer an entirely new type of radioactive waste storage site, with only a vague outline of research priorities, with an unspecified budget, and no timescale for completion.*

- 11.1 We have discussed this issue in a number of meetings with the West Cumbria MRWS Partnership specifically on geology and have summarised the outcome of these meetings in a technical note: 'Further information on geology for the West Cumbria Partnership [11]. The note concluded that at this early stage in the voluntarism process, before desk-based studies, site investigation or even site identification we cannot single out particular areas of west Cumbria and make strong claims for their suitability. To attempt to do so now would pre-empt the voluntarism and partnership aspects of the site selection process and would not recognise the degrees of technical uncertainty that must remain until further detailed work has been undertaken on specific sites.

## 12 Summary of actions

- 12.1 The MRWS Partnership asked for indications of 'if when and how' the points could be addressed. Here we summarise the actions we will take, all of which (except number 11) will be progressed over the next year:
- 12.2 We will take the following actions

1. We invite feedback from stakeholders on all our publications and we would welcome comments on our R&D programme document. (Ongoing action.)
2. If, through feedback, we find that there are areas where there is significant disagreement about the R&D needs or our assessment of the priority, we will discuss these with stakeholders through workshops or other mechanisms and explore the range of views and the reasons for them. This could lead to a reassessment of our R&D needs. An example of this approach is a recent workshop on colloids. We would publish the output of any such workshop and record any changes to our assessment of R&D needs. (Ongoing action.)
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6. In response to a number of comments received, we will improve access to our technical information by making more of our reports directly downloadable from the Bibliography. (This action will be progressed over the next year, but may take longer to complete in full.)
7. We are starting the process of development of the R&D programme for MRWS stage 5. We will consider ways in which we can engage stakeholders on the overall approach to identifying and prioritising R&D needs. This could take the form of a series of technical workshops. We envisage that we would involve the Learned Societies in this process, acting as an independent voice to ensure that our approach is based on sound scientific processes for document development and peer review and that this could be a useful way of balancing feedback from individuals against more formal interactions with Regulators, CoRWM, Government and the Partnership. We will include Professor Haszeldine's suggestions for alternative prioritisation within this process. (Outline plans for producing an R&D programme for MRWS stage 5 for discussion will be produced by December 2011.)
8. From this year, we will publish the values of the R&D contracts we award. (A list will be produced during October 2011 and updated regularly. Information will also be available via the Government "contracts finder").
9. We recognise the specific technical issues raised by Professor Haszeldine as what we call "potential issues", which we will address using our issues management process. (Issues have been already added and will be considered by March 2012.)
10. As part of our issues management process, any potential issues will be evaluated to see whether there is an R&D need and then these will be prioritised and added to the R&D programme document as an addendum. We will formally consider the points raised by Professor Haszeldine within

this process. (Issues have already been added and will be considered by March 2012.)

11. During MRWS Stage 5, we will develop our plans for the underground research that will be required during Stage 6. These plans will include consideration of whether or not a stand alone URL is required. (Action will be progressed during MRWS Stage 5).

### 13 Conclusion

In this document, we respond to a request from the West Cumbria MRWS Partnership to respond to points raised by Professor Haszeldine in his reply to the NDA response to MRWS paper no 146. We consider the points made by Professor Haszeldine and set out our response together with the actions that we propose to take. We are committed to transparency and to continuing to engage with others as our R&D programme develops. The actions that we propose recognise the need for continued interaction with stakeholders within a framework of review and scrutiny of our programme by Regulators and Government. We would like to thank the Partnership for their feedback and recognise that continued dialogue will lead to improvements in our processes.

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