

**JOINT RESPONSE TO DEFRA CONSULTATION ON MANAGING
RADIOACTIVE WASTE SAFELY: A FRAMEWORK FOR IMPLEMENTING
GEOLOGICAL DISPOSAL**

The following submission to the Defra consultation on managing radioactive waste safely represents a consensus view by the following:

Energy Institute

CONTACT: Jocelyne Bia (jbias@energyinst.org.uk)

Geological Society

CONTACT: Edmund Nickless (edmund.nickless@geolsoc.org.uk)

Institute of Materials, Minerals and Mining

CONTACT: Professor Peter Flewitt (peter.e.flewitt@magnoxnorthsites.com)

Institute of Physics

CONTACT: Tajinder Panesar (tajinder.panesar@iop.org)

Loughborough University

CONTACT: Professor Peter Warwick (p.warwick@lboro.ac.uk)

Royal Society of Chemistry

CONTACT: Dr Jeff Hardy (hardyj@rsc.org)

University of Aberdeen

CONTACT: Professor David Read (d.read@abdn.ac.uk)

University of Manchester

CONTACT: Dr Nick Bryan (nick.bryan@manchester.ac.uk)

University of Sheffield

CONTACT: Dr John Roberts (j.w.roberts@sheffield.ac.uk)

Answers to specific questions

1. Do you agree with this approach to compiling and updating the radioactive waste inventory and using it as a basis for discussion with potential host communities? If not, what would you propose?

The approach to compiling and updating the radioactive waste inventory and using it as a basis for discussion with potential host communities is sensible. The objective must be to minimise uncertainty amongst communities by providing information that characterises legacy (and potential future) radioactive waste in terms of volume, radioactivity (including half-lives) and physical properties.

However, the publication of the inventory alone will not be sufficient to convince a community that a scientific case for radioactive waste management has been made. It is also important that the strategy through which the waste will be safely managed throughout the process, including packaging, interim storage, transportation, emplacement and repository closure, is explained.

We recommend that information on the radioactive waste inventory and the waste management strategy should be published in a document in a form that is readily understood and enables potential host communities to understand why certain repository strategies are preferred and safe. There is a lack of public understanding of risk in the UK that must be acknowledged and addressed in this document. A solution would be to employ familiar analogies, including natural and artificial analogues and comparisons that put the risk in context. Overall, this document must be clear, unambiguous and transparent with all technical terms explained in plain language so that communities can use the information with confidence in decision-making.

More information about the inventory is required to ensure that people will be well informed about the nature of the waste management problem. For example, the locations of the main components of the inventory are relevant to transport issues and the material state of wastes; i.e. whether or not they are already conditioned and packaged, is relevant to understanding the arrangements for temporary storage. The effect of continuation or cessation of reprocessing on the distribution of activities and volumes of wastes should also be explained.

2. Do you have any comments on the proposed technical approach for developing a geological disposal facility, as set out in Chapter 3?

We agree that current experience in tunnelling/mining and of research and development in packaging and underground emplacement gives confidence that geological disposal is technically achievable.

The rationale for preferring a single facility for higher activity wastes (paragraph 3.15 of the consultation - the Government 'sees no case for having separate facilities') needs to be clarified, i.e. is it economic or is it intended to ensure greater radiological safety? The potential interactions or interferences between co-located waste types, with potentially different engineered barrier systems, are a factor that has to be considered in terms of long-term performance and safety. It is premature to reach a conclusion about this before design options and safety factors are fully considered.

In relation to the issue of retrievability, we agree that early closure is the preferable course of action. The period of construction and operation of a repository provides time for strategic decisions at any time up to closure (paragraphs 3.13 to 3.20 of the consultation). We agree that the design of a repository should provide for flexibility of future options and capacity, whilst optimising safety.

We support the need for further research to optimise the design and delivery of a repository. Further research, development and demonstration on the engineered barrier system (EBS) are necessary for the different waste types and volumes that are specific to the UK, and on the geoscientific methods for investigating and interpreting the rock conditions that are specific to the UK (paragraph 3.21 of the consultation). Whilst progress in other national repository development projects and international research projects may not be directly relevant to the UK MRWS programme, there is much to be gained from international collaboration and sharing of best practice.

Research and development of science and assessment methods that underpin the short- and long-term safety of a geological repository should be subjected to intensive peer review and broad dissemination through publication in academic journals. The learned and professional societies will be able to play an important, independent role in achieving this.

Borehole disposal of certain wastes (e.g. plutonium, spent fuel, HLW and possibly long-lived ILW) is an alternative only for a volumetrically-small but radiometrically-significant proportion of the overall inventory. The viability of borehole disposal should be thoroughly researched before a decision is made on which wastes are suitable¹. Prolonged indecision about borehole disposal would needlessly leave an uncertainty in the inventory for disposal in the main repository (paragraph 3.21 of the consultation).

Excavation of preliminary shaft(s) and tunnels should be regarded as a stage of site characterisation and assessment, i.e. prior to full authorisation for repository construction. This would be an important part of confirmatory testing for authorisation. Its role in performance confirmation should be made clear to avoid future misunderstandings (paragraphs 3.22 and 3.23 of the consultation).

¹ The technical issues are mainly concerned with safe and successful emplacement in deep boreholes as well as drilling feasibility.

3. Do you agree with the approach to public and stakeholder engagement set out here? If not, how do you believe your input could be better managed or your concerns addressed?

Raising awareness and producing briefing materials are vital for effective public and stakeholder engagement. It is important that communities are engaged at all levels including primary and secondary schools. Learned and professional societies and academic institutions are highly experienced in preparing and peer reviewing such materials and should be involved in this process, to provide additional assurance of the quality and objectivity of the material. Additionally, these bodies are widely experienced in scientific engagement with schools and the public through events such as the National Science and Engineering week and through organising educational workshops for communities.

Technical peer review of strategies and methods of scientific interpretations would help to engage stakeholders in the wider professional communities and would also ensure that state-of-the-art methods are used.

It is vital that there is open and unbiased dialogue with all forms of the media throughout the process so that information arising from their activities is as scientifically sound as possible. In particular, the basics of radioactivity, such as sources of background radiation and radioactive half-lives, need to be better understood so that the radioactive waste inventory can be discussed in context. We recommend that key MRWS implementers work together with learned and professional societies and with the Science Media Centre, or equivalent organisations, in order to host regular, unbiased scientific briefings for journalists and other interested organisations or individuals on the MRWS programme. This must take place across the whole country.

4. Government believes the system of regulation outlined in paragraphs 4.2 to 4.14 is strong and robust in relation to a geological disposal facility. Do you agree? If not, what other regulation do you feel is necessary?

A strong and well-resourced environmental regulator is a key aspect of achieving successful implementation and acceptance of a geological disposal facility². The regulator must test the robustness of the implementer's plans and safety assessment at every stage of a development programme (as is being done in the Swedish and Finnish repository development programmes). The public must have confidence in the regulator's abilities and objectivity.

Currently it is recognised that there is a skills shortage within regulatory bodies – partly caused by specialists being diverted to other projects, such as new nuclear build and tasks outside the nuclear field. This shortage must be

² A range of opinions were expressed by the working group on the subject of the current regulatory framework in the UK but no clear consensus was reached.

addressed immediately and a Government review on current and future skills for regulatory bodies should be carried out.

5. Do you think the proposed planning reforms in England outlined in Chapter 4 should apply to the development of a geological disposal facility, and if so how could this be integrated with the voluntarism and partnership approach outlined in Chapter 5?

It is essential that any changes to the planning regime are implemented in a way that is compatible with the MRWS voluntarism and partnership approach. It is important to note that the proposed planning reforms relate to England rather than the UK.

6. Do you agree with this approach to defining 'community' for the purposes of the site selection process? If not, what alternative approach would you propose and why?

No response.

7. Do you agree with the proposals for providing information to communities and the way Government proposes to issue invitations?

Chapter 5, paragraph 5.18 of the consultation states that the Government proposes to undertake a programme of awareness-raising and information dissemination, beginning with this consultation. This is absolutely critical and must comprise a long-term and well-funded commitment to an effective communications and engagement strategy that is based on objective and independent science and technology.

The campaign must focus on both the public and the media, as discussed previously in our answer to question 3. It is vital that the public can see that rigorous, state-of-the-art science is being applied by objective and independent experts and institutions. It is not sufficient to simply make a public announcement about the MRWS programme and then to direct interested communities towards a website where further information can be found. There must be a sustained and high profile media campaign prior to this that raises awareness and also a series of national workshops and events, throughout the UK, that allow communities to speak with unbiased technical experts. Learned and professional societies are experienced in public and media engagement and can offer independent and unbiased advice on an engagement campaign.

It is unclear who will be responsible for preparing the information for communities and who will provide independent scrutiny. The assumption is that the NDA will prepare the material and that CoRWM 2 will provide peer review. The learned and professional societies could play an important,

independent role in objectively reviewing this information and helping to ensure that it is of the highest possible standard, accuracy and clarity and that it is appropriate for the audience. A deadline of February 2008 for this information preparation appears very short, especially if the material is to be fully subjected to independent scrutiny to ensure that it is unbiased and accurate. It is important that long-term funding commitments should be made available for the preparation of these materials.

Communities should be aware that repository design is flexible and can be adapted on the basis of site investigation assuming that the initial screening criteria are met.

8. Do you believe that the initial sub-surface screening criteria proposed by the expert panel are correct? Do you believe that the way in which Government proposes to apply these criteria in the process is correct? If not, how could this be done differently?

We are in overall agreement with the concept of utilising sub-surface screening criteria for excluding clearly unsuitable areas that may have been proposed by communities wishing to express an interest in hosting a geological disposal facility. However, we have some reservations about the brief definitions of proposed exclusion criteria and the qualifying comments regarding their application that are provided in Annex B. The joint CPG/CRP report³ explains the derivations and qualifications of the criteria in more detail and we recommend that Defra should ensure that the full report be used in any screening exercise especially by communities and their geological advisers.

Expert judgement will be required during the application of the exclusion criteria in order to avoid excluding potentially suitable areas from the list of candidate communities during the initial screening process. The involvement of the BGS is welcomed. We recommend that desk-based studies be used to evaluating sites remaining after the initial screening process. In this way a wider-ranging process could be applied by the NDA to evaluating the areas proposed by the communities expressing interest as the basis for Government to select the candidate site (or sites) that would then be investigated.

9. Has Government identified the relevant assessment criteria? If not, what other criteria should be used? Do you have any comments on how the criteria should be applied at different stages?

The assessment criteria are relevant and appropriate and should be applauded. It must be recognised that constructing a repository and storing

³ <http://www.defra.gov.uk/environment/radioactivity/waste/hilw/documents/cpg-crp-jointreport-may2007.pdf>

radioactive waste is a long and complex process. We note that little is said regarding how the criteria should be applied at different stages in the context of the information that will likely be available for decision-making at each stage.

There are several aspects of the site selection process that are vague and unclear. It is apparent in the consultation that there will only be one preferred site where underground investigations will be carried out prior to constructions. It is unclear what happens if these investigations uncover significant geological problems. It is assumed that unless such problems are insurmountable that engineering solutions will be found to overcome them. If the problems are insurmountable it is unclear what the process will be for choosing an alternative site.

It is unclear at which point a community can no longer back out of the volunteering process. It is assumed that it is at end of stage 4 of the site selection process.

10. Do you have any comments on whether and how a partnership arrangement could be used to support a voluntarism approach?

Learned and professional societies have regionally based local branches comprised of active members. These local branches could play an important role in partnership arrangements in activities such as accurately translating technical information into relevant and usable information for communities.

11. Do you agree that the work of communities and/or partnerships should be funded by Government through an engagement package? If so, what activities do you think it would be reasonable to expect Government to fund?

It is absolutely critical that the decision of a community to volunteer is based on sound information and proper appreciation of the implications of hosting the repository. Resources should be made available to allow communities to develop their understanding of the process including seeking independent and unbiased expert advice.

The work of communities and/or partnerships should be funded by the Government through an engagement package. In addition to an effective communications and engagement strategy outlined in question 7, there must be sufficient funding to ensure that communities fully understand all aspects of the commitment to hosting a geological repository. This will require that scientific and technological subjects are presented in an appropriate, clear, objective and independent manner. Learned and professional societies have significant experience in this and should be involved, in an independent capacity, in either the preparation or scrutiny of this material.

12. How best can Government and the NDA ensure that the development of a geological disposal facility delivers lasting benefits to the host community? Should this involve the use of benefits packages and if so how might this best be achieved, taking into account the need to make the best use of public funds?

No response.

13. Do you have any other comments?

Interim waste storage

Interim storage has not been discussed sufficiently in the consultation document. Technologies will be required to condition or immobilise wastes and sites required for storage. Monitoring, recovery and possibly reworking of stored wastes will be needed. The behaviour of the waste form in storage also needs investigation. There needs to be appropriate R&D funding to address these issues, regardless of the progress on the actual repository.

Future of CoRWM

It is agreed that CoRWM will need additional expert advice, and the formation of expert sub-groups CoRWM is one mechanism through which this could be achieved. To give added confidence, learned and professional societies and academic institutions will be instrumental in nominating expert representation for expert sub-groups with specialised skills. Additionally, these bodies can perform a critical role in objectively and independently reviewing materials and processes for stakeholder engagement and technical proposals.

The UK skills base

The recent report “UK long-term nuclear waste management: Next steps” stated the following in relation to nuclear skills⁴. The report identified that *...“there has been a significant decline in R&D funding in nuclear fission, and equally a decline in the nuclear skills base. There is a need for a nuclear skills renaissance to address this trend in order to support the implementation of the repository and to provide the scientists and engineers of the future”.*

The creation of the Dalton Nuclear Institute, the BNFL University Research Alliances, the Nuclear Technology Education Consortium (NTEC), the Nuclear Engineering PhD and the National Skills Academy for Nuclear are the first steps toward this renaissance. Also, encouraging participation in collaborative international programmes, research and development is a vital part of ensuring that best practice is learned and building a vibrant skills force.

Support from the research councils and other funding bodies for university initiatives such as the Dalton Nuclear Institute and other academic groups and centres is vital to train the nuclear scientists and engineers of the future. Much

⁴ <http://www.rsc.org/Membership/Networking/InterestGroups/ESEF/Nuclear.asp>

more needs to be done to expand and assist these academic centres of excellence.

In addition, the recent announcement of the creation of a national nuclear laboratory (NNL) may provide additional momentum for this process. A properly funded, government owned, NDA supported, independent NNL would ensure the maintenance and development of the key skills that industry needs to underpin repository development (and also any future nuclear new build and legacy clean up). It would also be an independent source of specialist advice for government and other stakeholders. The NNL should be the central hub for the application of world class scientific research that in addition to the role of learned and professional societies will help bridge gaps between industry/NDA and stakeholder groups. It is worth noting that US national laboratories frequently act in this manner, for instance in the clean up at the Rocky Flats site⁵.

Learned and professional societies can contribute in many ways alongside the nuclear industry. For example, the Energy Institute, which has several hundred members involved in the nuclear industry, contributes to the promotion and development of skills in a number of ways including accreditation of academic courses such as those provided by NTEC, through regular liaison with Cogent, the Sector Skills Council for the nuclear industry, and through early contact with the new National Skills Academy for Nuclear (NSAN), which will go live at the end of 2007.

The soon to be launched National Skills Academy for Nuclear (NSAN) has a critical role to play in developing a standardised and coordinated approach to education, training and skills development in the nuclear sector. NSAN has estimated that 1500 skilled people need to be replaced each year, with an additional 11,500 over the next 20 years to complete the task of decommissioning, and 6500 in other civil/defence sectors, which includes new nuclear build.

Failure to address this skills shortage means the UK will be forced to compete for skilled overseas workers at a premium cost, and with a reduced likelihood of finding people with relevant UK expertise.

Nuclear new build

It will be desirable to dispose of both new and legacy radioactive waste in the same radioactive waste repository and that this should be explored through the Managing Radioactive Waste Safely process, as the necessary storage times and protection mechanisms will be no different. Repositories will need to house current legacy, any additional increment which might arise from the lifetime extension of the current AGR and PWR power stations (much less than any new nuclear build wastes), plus an allowance for a credible programme of new nuclear build, i.e. 10 power stations.

⁵ Los Alamos Research Quarterly, 2006, www.lanl.gov

New nuclear stations will generate significantly less volume of waste per unit of power generated, although the radioactivity of the waste would not be significantly different. A fleet of 10 new reactors would add approximately 10% to the volume of higher activity radioactive waste which already exists (a further 14,000 tonnes of spent fuel). The waste would be produced between 2018-2100, providing adequate time to make necessary plans and decisions.

Spent fuel management

If consigned to a one repository, UK stocks of non-reprocessed spent fuel will have a major impact on the size, cost, complexity and public acceptability of the project. This has already become evident in the USA with Yucca Mountain, where the once-through fuel cycle policy is now being questioned due to the burden it is placing on the repository. There is a need for a soundly based UK spent fuel strategy that considers all options, i.e. storage, conditioning and disposal, reprocessing and recycling and partitioning and transmutation. The NDA is currently carrying out a programme of work on this topic and learned and professional societies are looking forward to scrutinising the results. The UK should maintain sufficient skills to keep options open in the long interim period before the repository is built.

Plutonium

Plutonium is currently safely stored pending long-term management policy decisions. It is currently designated as a zero-value asset. There is a civil plutonium stock of 100 tonnes and also a stock of military plutonium. Currently there is no UK waste form for plutonium and its possible disposal, if declared a waste, has implications upon the design of the final repository because of criticality issues.

It is worth noting irrespective of the final decision regarding the status of plutonium there will remain a requirement for interim storage.

If treated as a resource, plutonium would be burned as Mixed Oxide (MOX) fuel. The UK does have experience of operating a prototype fast reactor. However, some (ca 5% of the stock) of the plutonium is contaminated or in a form that cannot be used for fuel without costly treatment and a strategy is more likely to be required for the disposal of this material.

The NDA has commissioned research to examine glass, ceramics and MOX pellets as plutonium waste forms. In all cases nuclear criticality safety is an important consideration.

The Royal Society in its latest report, *Strategy options for the UK's separated plutonium*, has made a careful assessment of the options for dealing with stockpiled plutonium oxide powder from earlier reprocessing and has recommended that it should be converted into MOX pellets which not only greatly reduces the possibilities for subversion but also allows the plutonium to be burned to generate power in modern thermal or fast-breeder power reactors.

It is important that any implications of the final decision on plutonium management are communicated to communities.