



Department  
of Energy &  
Climate Change

## **Call for Evidence**

# **Managing Radioactive Waste Safely: Review of the Siting Process for a Geological Disposal Facility**

## **Response form**

13 May 2013

# Call for Evidence

Please use this form to answer questions on the Call for Evidence on Managing Radioactive Waste Safely: Review of the Siting Process for a Geological Disposal Facility.

The closing date for the submission of responses is **10 June 2013**.

Responses can be returned by email (preferable) or post.

Email address: [radioactivewaste@decc.gsi.gov.uk](mailto:radioactivewaste@decc.gsi.gov.uk)

Or by post to: The Managing Radioactive Waste Safely team  
Department of Energy and Climate Change  
55 Whitehall  
London  
SW1A 2EY

In order to help us analyse responses, please provide details of your organisation.

When the call for evidence ends, we may publish or make public the evidence submitted. Also, members of the public may ask for a copy of responses under freedom of information legislation.

If you do not want your response - including your name, contact details and any other personal information – to be publicly available, please say so clearly in writing when you send your response to the call for evidence. Please note, if your computer automatically includes a confidentiality disclaimer, that will not count as a confidentiality request.

Please explain why you need to keep details confidential. We will take your reasons into account if someone asks for this information under freedom of information legislation. But, because of the law, we cannot promise that we will always be able to keep those details confidential.

The responses to this Call for Evidence will inform a public consultation that will follow in the autumn.

We would like to keep stakeholders who are interested in the MRWS process up to date on developments. If you would like to be kept up to date please sign up at the end of the form.

# Introduction

1. The UK Government's policy for the long-term management of higher-activity radioactive waste is geological disposal<sup>1</sup>. In 2008 the Managing Radioactive Waste Safely (MRWS) White Paper<sup>2</sup> was published which outlined a framework for implementing geological disposal based on the principles of voluntarism and partnership.
2. Three local authorities formally expressed an interest in the MRWS programme: Copeland and Allerdale Borough Councils, and Cumbria County Council. In January 2013, the three local authorities voted on whether to proceed to stage 4 of the process. The two boroughs voted in favour, but the county voted against. The Government had in 2011 given a specific undertaking that the existing site-selection process would only continue in west Cumbria if there was agreement at both borough and county level. The county's decision therefore ended the existing site selection process in west Cumbria.
3. Shepway District Council in Kent had also taken soundings from local residents, but subsequently decided against making a formal expression of interest in the current MRWS process.
4. The Government remains firmly committed to geological disposal as the right policy for the long-term safe and secure management of higher-activity radioactive waste. The Government also continues to hold the view that the best means of selecting a site for a geological disposal facility (GDF) is an approach based on voluntarism and partnership.
5. Evidence from abroad shows that this approach can work, with similar waste disposal programmes based on these key principles making good progress in countries like Canada, Finland, France and Sweden.
6. The fact that two local authorities in west Cumbria voted in favour of continuing the search for a potential site for a GDF demonstrates that communities recognise the substantial benefits that are associated with hosting such a facility – both in terms of job creation and the wider benefits associated with its development.

## Purpose of the call for evidence

7. In line with the Secretary of State's written Ministerial statement of 31 January 2013<sup>3</sup>, Government has been considering what lessons can be learned from the experiences of

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<sup>1</sup> Radioactive waste disposal is a devolved matter. The Scottish Government has a separate policy and supports long-term interim storage and an on-going programme of research and development. The Welsh Government has reserved its position on geological disposal of radioactive waste while continuing to play an active part in the MRWS process. The Department of the Environment in Northern Ireland supports the MRWS programme.

<sup>2</sup> Managing Radioactive Waste Safely: A Framework for Implementing Geological Disposal  
<https://www.gov.uk/government/publications/managing-radioactive-waste-safely-a-framework-for-implementing-geological-disposal>

<sup>3</sup> See <https://www.gov.uk/government/speeches/written-ministerial-statement-by-edward-davey-on-the-management-of-radioactive-waste>

the MRWS programme in west Cumbria and elsewhere. We are now inviting views on the site selection aspects of the ongoing MRWS programme in this call for evidence, particularly from those who have been engaged in (or have been interested observers of) the MRWS process to date. The responses to this call for evidence will inform a consultation that will follow later in the year.

## Background

8. Higher-activity radioactive wastes are produced as a result of the generation of electricity in nuclear power stations, from the associated production and processing of the nuclear fuel, from the use of radioactive materials in industry, medicine and research, and from military nuclear programmes.
9. As one of the pioneers of nuclear technology, the UK has accumulated a substantial legacy of higher activity radioactive materials. Some of it has already been processed and placed in safe and secure interim storage on nuclear sites. However, most will only become waste over the next century or so as existing facilities reach the end of their lifetime and are decommissioned and cleaned up safely and securely.
10. These higher-activity wastes can remain radioactive, and thus potentially harmful, for hundreds of thousands of years. Modern, safe and secure interim storage can contain all this material – but this method of storage requires on-going human intervention to monitor the material and to ensure that it does not pose any risk to human or environmental health. While the Government believes that safe and secure interim storage is an effective method of managing waste in the short to medium term, the Government is committed to delivering a permanent disposal solution.
11. In October 2006, following recommendations made by the independent Committee on Radioactive Waste Management, the Government announced its policy of geological disposal, preceded by safe and secure interim storage. The Government subsequently announced that it would pursue a policy of geological disposal with site selection on voluntarism and partnership. This remains Government policy.

## Geological disposal

12. Geological disposal involves isolating radioactive waste in an engineered facility deep inside a suitable rock formation to ensure that no harmful quantities of radioactivity ever reach the surface environment. It is a multi-barrier approach, based on placing packaged wastes in engineered tunnels at a depth of between 200 and 1000m underground, protected from disruption by man-made or natural events.
13. Geological disposal is internationally recognised as the preferred approach for the long-term management of higher-activity radioactive waste. It provides a long-term, safe solution to radioactive waste management that does not depend on on-going human intervention.

# Response form

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Email address: [radioactivewaste@decc.gsi.gov.uk](mailto:radioactivewaste@decc.gsi.gov.uk)

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Would you like to be kept informed of developments with the MRWS programme?	Yes
Would you like your response to be kept confidential? If yes please give a reason	No

The Government is interested in your views on the geological disposal facility site selection process outlined in the 2008 Managing Radioactive Waste Safely (MRWS) White Paper. To assist us you may wish to consider the following issues in your response:

- What aspects of the site selection process in the MRWS White Paper do you think could be improved and how?
- What do you think could be done to attract communities into the MRWS site selection process?
- What information do you think would help communities engage with the MRWS site selection process?

## 1. Introduction

1.1 I have been intermittently concerned with UK nuclear waste disposal since the mid 1970s, when as an officer of the British Geological Survey (BGS) I was asked to check out a list of low-lying islands west of Scotland as to their suitability for a geological disposal facility (GDF). I sat on a British Nuclear Fuels Ltd (BNFL) Geological Review Panel, carried out a major seismic project for Nirex at Longlands Farm in 1994, and was an expert witness for Friends of the Earth at the Nirex planning inquiry of 1995-96. I have since submitted responses to various consultations, including the West Cumbria MRWS Partnership consultation of 2012. My evidence about the unsuitability of West Cumbrian geology for hosting a GDF helped to persuade Cumbria County Council (CCC) not to proceed further in the MRWS process. In March 2013 I published a letter in *Nature* correcting an editorial, to point out that CCC's decision to withdraw was based both on *geological* and *democratic* arguments, and not, as the editorial suggested, a mere failure of marketing of the process.

1.2 The following response is of necessity a brief referenced summary of my views on the MRWS process, which can be supported by more detailed evidence. In summary, the MRWS process requires a fundamental change in both its basic assumptions and its organisation. A new White Paper is required.

## 2. The case for geological disposal

2.1 There is no *scientific* case for geological disposal. The concept of 'disposal' of radioactive wastes seems to have been first discussed publicly in 1954, some 5-10 years after the development of atomic weapons by the USA, UK, USSR and France [1]. In 1958 the Atomic Energy Research Establishment (AERE) had no answer as to how to deal with solid high-level waste than the following bland and complacent 'solution':

*“Highly radioactive materials can also be buried in the soil [sic] if the material is treated in such a way that no leaching of the material can occur” [2].*

2.2 By 1960 the emphasis was very much on marine disposal [3]. Although the UK signed the London Dumping Convention (LDC) on marine pollution and dumping of wastes in 1975, it continued both with dumping of nuclear waste and with research on marine disposal well into the 1980s [4-6]. The UK was one of a small minority which voted against the 1985 LDC resolution (adopted by a large majority) calling

for a moratorium on marine dumping of radioactive wastes [7]. Only in 1997 did the UK finally accept [8] the London Protocol (successor to the LDC) prohibition in 1993 of all nuclear waste dumping at sea. Even after that date the Royal Society and the Royal Academy of Engineering (RSRAE) [9] could still contemplate marine disposal, talking of possible future international research projects despite the fact that submarine disposal was “currently” prohibited.

2.3 Onshore geological disposal is therefore more a matter of expediency than of scientific argument; it was an option resorted to once marine dumping, and proposals around offshore disposal for higher activity wastes (e.g. seabed emplacement) had become unacceptable. It has no more scientific basis than, say medical triage during an emergency when time and resources are limited. Triage *per se* is not justifiable in normal circumstances.

2.4 The scientific method relies fundamentally on making predictions which are then tested by experiment. The ‘experiment’ concerning the geological disposal of long-lived nuclear waste can never be tested, because of the quasi-geological timescales, and therefore a crucial element of the science is missing. Phrases like ‘*it is generally accepted that*’, or ‘*scientists are in accord that*’, quoted both by politicians and scientists, do not magically wave a wand over hopes and beliefs about the safety of nuclear waste burial - however sincerely held – to turn them into sound science. The phrases are also less than persuasive when uttered by the consulting geologists and engineers whose livelihood depends upon progressing geological waste disposal. Furthermore, these sorts of generalisations are circular and self-referencing; country A decides to go for this method of disposal because countries B and C recommend it, and *vice-versa*.

2.5 I am not advocating that deep geological disposal should necessarily be abandoned. But it needs to be approached with the utmost caution, with research and investigations spread over one or even two generations. There is no other man-made process which is overtly designed to be effective over 100,000 years. Whereas it may be considered irresponsible to leave the waste problem to the next generation, it is even more irresponsible to arrive at a hasty ‘solution’ which may affect 30,000 future generations. The only recourse, both logically and morally, is to stop producing more of the waste now while we consider what to do next. In parallel with that, a programme of secure surface storage for, say, 100 years will reduce the immediate threat of accidents.

2.6 The hubris of engineers is almost limitless. Much is made of their ‘engineered barrier systems’, and some take the view that the host geology is more or less irrelevant, because the man-made barriers will suffice. The safety case is a probabilistic estimate involving the compounding of individual probabilities for failure of components of the system. This method suffers from a number of flaws, including:

1. The upscaling of values from the laboratory to the field level.
2. The short timescale of measurement compared with the timescale of a GDF.
3. The fact that some crucial parameters are derived by ‘expert elicitation’ - a euphemism for making it up; an educated guess.

2.7 Two examples illustrate this hubris. The first is the KBS-3 method of encapsulation of waste in copper canisters, developed by the Swedes 37 years ago and adopted by the UK. From the confident prediction then that the copper will only corrode by a millimetre or two in a million years, we have recently had the discovery of a new mechanism of pitting of the surface of the copper even in the absence of oxygen. The copper canister may now corrode away in a few hundred years [10]. A second example is the 1986 Challenger space shuttle disaster. The official NASA view was that a catastrophic malfunction would occur once every 100,000 trips, on average. Privately, some engineers thought that the probability was more like 1 in a 100. In the event, the probability of disaster proved to be of the order of 1 in 10.

2.8 The only rational solution to the engineered barrier system problem is to ensure that the geology – the final barrier – is intrinsically safe. That means flat layers in an environment of stagnant groundwater flow, and absence of faulting and fracturing. In my view the only feasible rock types that fits the criterion for the UK are certain clays, putty-like, but much harder, always provided that the layer be of adequate thickness.

### 3. The onshore UK search process

3.1 In parallel with the marine dumping summarised above, the UK started to investigate onshore geological disposal at around the same time that the Flowers report on nuclear power and the environment was published in 1976 [11]. One key finding of Flowers has been consistently ignored for the last 35 years:

*“There should be no commitment to a large programme of nuclear fission power until it has been demonstrated beyond reasonable doubt that a method exists to ensure the safe containment of long-lived, highly radioactive waste for the indefinite future”* (Chapter XI, para. 27).

3.2 Flowers referred to contracts between the BGS (then known as the Institute of Geological Sciences, IGS) and the UK Atomic Energy Agency (UKAEA) of 1975 and before that to investigate onshore disposal sites and options, noting that high-level waste (HLW) continued to be dropped into a shaft at Dounreay. The results of the BGS investigations were made public in 1979 [12]. The UKAEA commissioned the IGS to drill the Loch Doon granite, but the local district council refused planning permission for the drilling. Following an appeal by the UKAEA, the public enquiry reporter rejected its appeal. The failure of the process here, as at various other sites where the UKAEA subsequently applied for permission to drill, was essentially due to deceit and lack of transparency [13], compounded by an attempt to limit the terms of the inquiry [14]. The national programme of test drilling was abandoned in December 1981, due to public protests, with only the region inland from Dounreay having been successfully drilled. The overall impression was that the Thatcher government had been rushing towards nuclear new build, without having first made the case that new reactors were justified; thirty years later the government is repeating this fundamental error.

3.3 New, broader principles, involving search for suitable geological environments rather than just rock types [15] were employed in the late 1980s search of the UK landmass. A secret list of 537 potential sites, mostly on accessible land such as MOD property, was compiled by the BGS and Pidea [16, 17]. The list was sifted progressively using scientific and sociological criteria, but eventually reduced to a shortlist of about a dozen (the number depends upon how they are counted). A ‘Sellafield-B’ site had been added in at this late stage, and this became, after another location shift and political interference, the Longlands Farm site selected for a Rock Characterisation Facility (RCF). Had the Nirex appeal into refusal of planning permission been successful, the RCF would undoubtedly have become the UK’s intermediate level waste (ILW) GDF.

3.4 The Inspector of the 1995-96 planning inquiry [18] found a series of objections:

1. No formal involvement of any regulator for the overall GDF project.
2. Connection between RCF and GDF “*direct and obvious*”.
3. Legal issues vis-à-vis Irish Government not resolved.
4. Alternative sites need to be examined.
5. Short-listed alternative sites must be subject to public consultation process.
6. Exceptional justification is required for any GDF near the sea.
7. Various adverse environmental impacts.



8. Site is not a true Basement Under Sedimentary Cover (BUSC) site.
9. National site selection process flawed.
10. Selection of Longlands Farm based irrationally on nearness to Sellafield.
11. UK sites elsewhere have greater potential to meet legal and regulatory requirements.
12. No sites under investigation internationally resemble Longlands Farm.
13. Nirex did not understand groundwater conditions sufficiently.
14. Poor understanding of fault behaviour.
15. Nirex too optimistic due to lack of appreciation of limitations of the site.
16. No model for gas migration ready for testing by an RCF.
17. Safety assessment predicts zones of discharge to biosphere, but present-day discharge not understood.
18. Site concept vulnerable to rapid upward transport of radionuclides.
19. No further investigations of the site are justified.

3.5 The Secretary of State for the Environment followed the Inspector's recommendation that Nirex's appeal be dismissed, in March 1997. His successor, after the national elections, stated that Nirex had "*no plans to investigate any other sites*". Nirex published a series of science volumes collectively termed *Nirex 97* in 1997 and 1998, updating *Nirex 95*. Although CCC refused Nirex permission to keep the Longlands Farm boreholes open in 1999, we see here the start of a predetermined plan to return to Sellafield eventually.

3.6 The RSRAE report of 1998 [9] called for "*an organisation, independent both of government and of the nuclear industry, tasked with identifying possible sites, and with the resources to commission relevant research.*" The House of Lords Science and Technology Committee Third Report of 1999 [8] recommended that:

*"the first phase of site selection ... would consist of establishing qualitative criteria and using them with desk studies to identify a "long list" of, say, 15-20 potentially suitable sites. The criteria at this stage would be primarily, but not exclusively, geological and hydrogeological ... The final list of sites for field investigation would be derived by consultation or by using a volunteering approach"*

3.7 The MRWS consultation document of September 2001 made no reference either to systematic site selection, as recommended by the two learned societies and by the House of Lords, or to site search, but concentrated purely on voluntarism. It is surprising that the consultation document does not cite a Nirex technical note on voluntarism, dated September 2000 [19], but which doubtless helped formulate the voluntarist process.

3.8 The committee that was subsequently set up, CoRWM (in retrospect termed CoRWM-1), comprised social scientists and their ilk, but no earth scientists. Given that a government will never embark upon a policy for which it has no idea of the outcome, and given that the local council for Sellafield would be bound to volunteer, it can be argued that this new strategy was one of predetermination, i.e. of returning to Sellafield via a 'voluntarist' process, and thus sidestepping the fundamental scientific problems raised at the Nirex inquiry. Part of that predetermination process was to exclude earth scientists from the committee.

3.9 CoRWM-1 started work in November 2003. Nirex presented its voluntarist report [19] to the committee, in a marginally updated form, in February 2004. However, another interim report by Nirex [20], dated July 2003, sank without trace. This excellent report discussed how to identify regions and districts, then move to the assessment of potentially suitable sites; it even supplied costs and timescales. A systematic national survey, followed by a desk-based evaluation of 15 sites, then by surface-based

evaluation of three sites, would cost £491M (£678M in 2013, allowing for inflation). The national survey would cost £5M, and desk-based evaluation of 15 sites £40M, at today's prices. This suppressed or forgotten report is the only governmental mention since the 1980s of systematic piecewise geological searches.

3.10 An anonymous, annotated Nirex report dated October 2004 [21] is available at the Cabinet Office website. It anticipated possible outcomes to the CoRWM-1 deliberations, by recommending action a good 18 months in advance of the CoRWM final report. The aim was to push for geological disposal. It contains recommendations on how to target MPs, and includes a detailed compilation of parliamentary questions. The overall flavour of the document can be summarised by the following:

- *“The purpose and aim is to enable our target groups to realise that ... **'our' way is the best way forward**, otherwise there can be no future development of the nuclear industry.”*
- *“We have to be sure that **'opinion leaders are carefully recruited and groomed'**”*
- *“**isolate** or convince those **MPs who are against**”*
- *“Investigate ways of **using other organisations** e.g. BGS, Geological Society ...”*

[my emboldening]

3.11 This document reveals how the Nirex thinking of the time was more about PR manipulation than transparent science. For example, Nirex hoped that the nuclear waste inventory - a fundamental parameter in any disposal options – should “*hopefully*” be kept secret. The BGS and the Geological Society of London were indeed ‘used’, as Nirex put it, in later phases of the MRWS process.

3.12 The December 2004 report by the House of Lords Science and Technology Committee [22] was highly critical of CoRWM. Failures included its unreasonably broad remit, and lack of physical scientists or engineers on the committee. The Science and Technology committee was chaired by Lord Oxburgh, an eminent geologist. It said that too much reliance was placed on the advice of its contractors – in practice this meant Nirex.

3.13 In 2005 Nirex published a review of the site selection process [23] that led to the selection of Longlands Farm. At the same time the previously secret list of 537 potential sites was released – but only in an online searchable form, county by county. Despite this review purportedly being in the interests of transparency, it misleads in various ways, for example, in trying to disguise the fact that the final site was never in the original list. I have discussed the evasions and manipulations of this so-called ‘transparent’ report in more detail elsewhere [24].

3.14 In late 2005 Nirex claimed [25] that the *Nirex 97* set of science documents, issued after the end of the 1995-96 Planning Inquiry, had solved many of the problems discovered by the Objectors at the Inquiry itself, and that the outcome of the Inquiry might have been different, had *Nirex 97* been available in time. This assertion, which implies that the Longlands Farm locality is indeed suitable, is not true. On the contrary, detailed examination [24] of the hydrogeological modelling in *Nirex 97* shows that the hydrogeological parameters assigned to fault zones, in particular, have been manipulated so as to remove the preferential fluid-conducting property of the major faults. The modelling is essentially dishonest. Empirical evidence that the faults in the Sellafield – Longlands Farm area act as good conduits for water includes the fact that the local water utility targets its drilling on these faults to get the highest flow rates [24].

3.15 In March 2006 the BGS, commissioned by Nirex, was said to be finalising a report into the suitability of UK rock formations for hosting nuclear wastes. A joint BGS/Nirex statement, amounting to one page of text, asserted that “*it can be concluded that rather more than the previously determined 30% proportion of*

*the UK land mass would provide a potentially suitable geological setting for a repository*" [26]. This statement became the sole geological justification for deep disposal quoted in the 2008 MRWS White Paper. The anticipated research report, due to be finalised by late 2006, was never published. That such a fundamental conclusion underpinning a White Paper could be based on an unsupported assertion is unacceptable. It is difficult to avoid the suspicion that the survey revision had led to West Cumbrian rocks being omitted from the report, and that the report was therefore suppressed.

3.16 Once the CoRWM-1 report [27] was published it was cherry-picked by government for the 2008 White Paper. The report recommended geological disposal, but only for existing wastes - it was not a 'green light' for new build. It also recommended a robust programme of interim storage. Both these recommendations have been ignored.

3.17 CoRWM-1 was reconstituted in 2007 as CoRWM-2, with new membership including two geologists. Its remit included scrutiny of plans for geological disposal. But as a scrutineer of this aspect it failed dismally, taking the 'three wise monkeys' approach to geology - 'we don't yet know enough'. CoRWM-2 can be added to the list of nefarious doubters such as the tobacco lobby and climate change deniers, in their practice of agnotology. One example, indicating either an astonishing misunderstanding, or else a blatant disregard for the truth, is given by the CoRWM-2 chair in a letter to a Cumbrian constituent, in which he alleges "*It could be argued that the British process has also screened out unsuitable geology before asking communities to volunteer.*" [28].

3.18 The concept of a 'volunteer community' is nebulous; in the MRWS process the definition of 'volunteer' has been perverted during stages 2 and 3 of the West Cumbria process, and the word 'community' is in many instances meaningless. I shall not delve further into the flawed West Cumbrian 'volunteer' process here, as it has been discussed at length in other consultation responses (for example, those of John Wilson, NFLA and SPAND). Regarding 'community'; this word has also been distorted in the West Cumbrian process. Considering the UK as a whole I have already pointed out [24] that there were several potentially suitable sites considered in the 1989 national search, comprising terrain of dozens of square kilometres, in which there are no inhabitants, and, furthermore, some of these sites were owned by the Ministry of Defence (MOD). So who is supposed to 'volunteer' sites such as these?

#### **4. Other countries**

4.1 The DECC call for evidence (paras. 4-5) asserts that programmes of waste disposal site selection in other countries are making "*good progress*", using "*an approach based on voluntarism and partnership*". Firstly; civil nuclear power has been in existence for 60 years, and not a single one of the 32 countries with nuclear reactors has yet opened a GDF for intermediate or high-level waste. This can in no way be termed "*good progress*"; on the contrary it is lamentable and irresponsible – and by the latter, I mean that it is irresponsible to continue producing such waste without any clear means of what to do with it. Secondly, three of the four countries cited as examples (Finland, Sweden and France) all carried out systematic geological surveys of their entire country, before homing in on potential sites by a process of sifting and elimination. Only after that were 'communities' involved, with the power to approve of or veto the project within their boundaries.

4.2 Canada, the fourth country cited, is in the special position of having an area of 60 times that of England and Wales, but only half the population. Most of Canada comprises hard rock terrain at the surface, with very low relief. Such rock is intrinsically fairly promising as a GDF host rock. It is therefore reasonable for Canada to reverse the internationally agreed process of geology first, followed by voluntarism, especially when the Canadians apply a stringent test of whether the geology is likely to be suitable once a community has volunteered [29]. Canada is currently at the stage of having evaluated 27

volunteered localities for geological suitability (equivalent to MRWS stage 4). Seven localities were rejected (as would any UK site such as Longlands Farm, had it been subject to the same preliminary tests as the Canadian sites).

4.3 France is at the stage of constructing an underground laboratory in clay at Bure. French law only permits retrievable storage for 100 years, so it has not yet come to grips with the problem of irreversibility of disposal. France's solution is therefore one of extended robust underground storage, not of final disposal.

4.4 Sweden's preferred GDF site, at Forsmark, is currently under consideration by the regulators. It is likely to run into severe difficulty because the copper encapsulation method (termed KBS-3) has been found to have a fundamental weakness [10]. KBS-3 is the technique being put forward in the UK.

4.5 Finland submitted a construction application for its proposed GDF at Olkiluotu in December 2012. It may run into the same problems as the Swedes, because it also uses the KBS-3 encapsulation method; however, Finnish regulation does not appear to be as independent or as robust as its French or Swedish counterparts.

## 5. Independence of the nuclear waste disposal agency

5.1 European Union Council Directive 2011/70/EURATOM states (Article 6.2) "*Member States shall ensure that the competent regulatory authority is functionally separate from any other body or organisation concerned with the promotion or utilisation of nuclear energy or radioactive material, including electricity production and radioisotope applications, or with the management of spent fuel and radioactive waste, in order to ensure effective independence from undue influence on its regulatory function.*" [30].

5.2 Given that the directive applies to all stages of spent fuel and radioactive waste management, from generation to disposal (Art. 2.1) it cannot be argued that site selection is exempt from regulation. As shown above, the 'scrutiny' by CoRWM-2 was completely inadequate. Nor is it satisfactory to wait until a site or sites have been selected, because then any regulatory agency will be constrained by what is 'on offer'. Independent regulation has to include the process by which site selection is made.

5.3 The Nuclear Decommissioning Authority (NDA), into which Nirex was absorbed in April 2006, is very far from being independent. NuclearSpin obtained documents [32] under Freedom of Information showing that in 2008 the NDA was seriously considering switching to an overtly pro-nuclear stance. Although this policy was not adopted, for fear of a backlash, the suspicion is left that the NDA remains pro-nuclear, but covertly so. This conflict of interest within DECC can only be resolved by removing the nuclear waste disposal responsibility from the NDA, and taking nuclear waste policy off the Office of Nuclear Development within DECC itself, and placing it in another department to allow for critical challenge.

5.4 Sweden and Canada each provide funding for genuinely independent review and scrutiny of nuclear waste disposal plans. In the UK concerted and thoughtful opposition (which is distinct from mere nimbyism) is being provided *pro bono* by independent specialists (as is the case with my own work), or by the NGOs. Instead, some £3M of public money has gone to PR agencies in an (unsuccessful) attempt to soften up the population of West Cumbria. If the UK government has nothing to fear then it should set up an independent review agency, following the example of the Swedish NGO Office for Nuclear Waste Review (MKG).

## 6. The ambiguous role of the BGS

6.1 In 1971 Baron Rothschild introduced the customer-contractor principle to British civil science funding. A large tranche of research money was taken away from research councils, and given instead to government departments, which then ‘commissioned’ the research they needed (or thought they needed) from government research agencies. Any single department (say, Energy) as the ‘customer’ usually had only one place to go to for (say) its North Sea research (in this case, the British Geological Survey, as the ‘contractor’ in the new parlance). This crude attempt to apply a free-market price mechanism to science R&D has no more sophistication than a child’s game of shop. It was intended to give the taxpayer better value for money, but it depends entirely on the acumen (or otherwise) of the departmental civil servant advising his or her Minister how and where money should be spent.

6.2 In the site search process there appears to be no alternative but for government to contract the BGS, as the nation’s archivist of geological information. BGS national searches took place in the 1970s and again in the 1980s - the latter leading by political manipulation, not by good science, to the choice of a ‘Sellafield’ site.

6.3 In 2006 the BGS co-authored a one-page assertion [26], jointly with Nirex, but never published the scientific evidence underpinning it, as discussed above. The role of the BGS has thus been compromised by its willingness to put its *imprimatur* to such a joint statement, while withholding the evidence upon which it is based. This crude approval by rubber-stamping is what the customer-contractor relationship has been reduced to. The BGS has been further compromised by a recent statement from its head of nuclear waste research that West Cumbria “*offers potential to find a good site*” [33], whereas all the published evidence, and the previous BGS site searches, say that it does not. The BGS subsequently refused to release any geological information to support this claim.

6.4 The BGS was commissioned by the NDA to undertake a geological screening exercise of West Cumbria [34]. Comparison of the confidential draft BGS 2010 screening report (sent to me anonymously) with the final published version, together with the published peer reviews, shows that severe alterations were made to the draft, at the behest of the NDA. The final BGS screening report did not remove aquifer rock volumes from consideration; this fundamental screening criterion was to be postponed until site surveys were started. The BGS should not allow itself to be compromised in this way.

6.5 In 2012 the Geological Society of London offered its support for the West Cumbria MRWS partnership process. However, the technical experts of the so-called ‘contact group’ assembled for this purpose comprised an academic who sits on the board of the BGS, plus two employees of the BGS. West Cumbria MRWS alleged that the two BGS officers had attended this meeting in their own time, but according to the BGS they were there in an official capacity. In short, this was a piece of subterfuge by the BGS to influence the outcome of the consultation. It would have been more honest to admit that it was the BGS offering its opinion, not the learned society. The BGS has become untrustworthy.

6.6 Flowers [11] noted 35 years ago that “*We have no doubt that the IGS [now the BGS] must do the work, but in such a way that they retain their independence of judgement.*” It is precisely this “*independence of judgment*” that has demonstrably been lost by the BGS in recent years. While it is difficult to avoid using the BGS in future, it is clear that the BGS’s findings in any future national or regional site search must be subject to transparent and outside scrutiny, preferably from overseas. In addition, the terms of reference for the BGS work must not be unduly constrained.

## 7. Has the UK learned any lessons to date?

7.1 DECC's first tangible reactions to CCC's decision to opt out of the West Cumbria MRWS Partnership process have been to acknowledge that the "current" process has come to an end, but then to talk to the two borough councils alone. There is thus widespread suspicion that DECC may try to restart a new process in West Cumbria, but without the county council.

7.2 On 30 April 2013 DECC replied to queries by a Cumbrian resident [31]. The official wrote:

*"It is also not correct that the Public Inquiry into the Nirex Rock Characterisation Facility (RCF) found that the Borrowdale Volcanic Group of rock near Sellafield is unsuitable for a repository."*

7.3 This is untrue. The Inspector stated:

*"The project in this instance is the investigation & characterisation of the BVG & overlying sediments in this particular PRZ: and an RCF anywhere else would not achieve this."*

7.4 The Inspector was explicit that the application to construct an RCF could not be decoupled from the Potential Repository Zone (PRZ) surrounding it, and therefore of a GDF. The BVG was the target host rock, found at an accessible depth (but also sufficiently deeply covered by sediments) below Longlands Farm. In recommending dismissal of the Nirex appeal, the Inspector did indeed conclude that the BVG, forming part of a so-called 'modified BUSC' environment, was unsuitable. DECC refuses to accept this, and indeed appears to smear the reputation of the Inspector and his Assessor, insinuating that they were:

*"not qualified to assess fully the safety case for a geological disposal facility via a planning application, and such a case was not put by Nirex in what was an application only for a Rock Characterisation Facility." [31]*

7.5 This seems to imply that the Inspector had exceeded his powers at the planning inquiry. It is smear, by association with the phrase 'not qualified'. One might have equally stated, and be as equally factually correct, that the Inspector and his Assessor "were not qualified to judge the Eurovision Song Contest, and they were not asked to do so". If such a specious argument is the basis for DECC trying to return to the Sellafield area, DECC will fail yet again.

7.6 In conclusion, DECC appears to have learned little or nothing from the MRWS process of the last decade. In particular, DECC refuses to engage with the detailed geological objections put forward by myself and others. This merely reinforces my view that Sellafield has been the predetermined destination for the UK's GDF ever since the late 1980s, and that DECC is even now contemplating a way round the setbacks of unsuitable geology and lack of local support. Further evidence for predetermination has been given elsewhere [24].

## 8. Conclusions and recommendations

8.1 The government is caught between a rock of unsuitable geology (West Cumbria) and a hard place populated by understandably suspicious citizens (that is, much of the rest of England, where potentially good clay geology lies underfoot). The history of search processes during the last half-century shows that citizens of the UK are correct; whenever the subject concerns civil nuclear power generation, nuclear weapons, nuclear accidents, or nuclear waste storage and disposal, successive governments have been proven to be consistently untrustworthy. DECC, the currently responsible department for civil nuclear matters, has a built-in pro-nuclear bias, and is congenitally incapable of hosting an MRWS-type process.

8.2 Responsibility for site search should be removed from the NDA. The new organisation should be truly independent. Responsibility could be given to the Environment Agency, and, just as this agency funds itself partly through licensing of and permits to the industries that it regulates, the new site search organisation could be funded by the nuclear industry. This should include legacy wastes, except that from nuclear weapons production, which should naturally be funded by the MOD. The organisation should report directly to government in the manner of a royal commission.

8.3 A new White Paper is required. MRWS in its present form should be scrapped. This would also be an opportunity to replace the current rather puerile name, with its present participle and redundant adverb.

8.4 Geological screening must take place *before* volunteer communities (if there are any to be consulted) are asked to come forward. By 'screening' I do not mean the relatively trivial tests as carried out by the BGS in West Cumbria in 2010; I mean desk-top studies to check whether regions, areas and rock volumes have any potential to host a GDF. The claimed excuse that this would cost too much is untrue, as the Nirex costings from 2003 showed. Voluntarism must not, however, be abandoned; it can follow on logically, as other countries have done, once long lists and then short lists have been drawn up based on geology and hydrogeology.

8.5 As recommended by CORWM-1, processes for legacy waste must be separated from those for new build waste. This would, at least, provide a predictable quantity of waste arising within a known timeframe for consideration by any community or local authority; public trust in the process might then begin to return.

8.6 Whereas the BGS may in practice be the only national organisation capable of surveying the UK in the progressive levels of detail required, its work nevertheless has to be scrutinised by a truly independent expert committee. Its role in the last forty years has become diluted and distorted to that of being merely another commercial contractor, albeit with privileged access to data archives. The wishes of the 'customer' (in the first instance government, but ultimately the public) have been allowed to override impartial science.

8.7 The BGS maps and ancillary research, justifying the 2006 assertion that 'rather more than' 30% of the UK landmass is potentially suitable for a GDF, must be published immediately.

8.8 The government should, if it wishes to re-start an MRWS-type of process, search for a clay site in England, following international experience. There are no hard rocks in low-relief terrain to enable the examples of Finland and Sweden to be followed; therefore it should search for clay host rocks similar in properties to those being investigated in Belgium, France and Switzerland. There are several clay formations of adequate thickness and hydrogeological properties in eastern and southern England. But until it earns the trust of the public it will continue to encounter problems of nimbyism even if the geology can be shown to be sound.

8.9 The government should give serious consideration to long-term (100-year) secure surface storage, as recommended by CoRWM-1. This is in effect a requirement of current and proposed reactor sites, although current anti-terrorism measures are feeble or non-existent. The highest priority here should be the Sellafield storage facilities.

8.10 The timescale is long – the UK is back at the stage that Finland, Sweden and France were at thirty or more years ago. It should be recognised next quarter of a century, at least, must be devoted to thorough research into waste encapsulation and secure surface storage, together with honest and transparent search for a satisfactory repository site elsewhere than in West Cumbria.

8.11 A process for independent and critical scrutiny of site search and subsequent site characterisation should be put in place.

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