

Editorial

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The Importance of Nuclear Waste as an Issue for E&E

We should declare a personal interest in the issue of radioactive waste management at the outset; our interest in the subject, as assessors and managers of risk, was stimulated in 2003 on learning of the intention of the British government to create an advisory group known as the Committee on Radioactive Waste Management (CoRWM). We applied to become members, drawn by the challenge of the problem, social as well as technical, and its obvious importance in a small country which had for decades failed to come up with a 'solution' to its burgeoning stockpile of waste. Both of us had extensive experience of advising on risk assessment and management in relation to a diversity of hazards. We were both appointed but, as it transpired, spent less than one and a half years as members of CoRWM and we will return to our experience later. We welcome, however, the invitation to be guest editors of E&E and to look back with the benefit of hindsight on how the issue of high level radioactive waste management in particular has developed more globally.

First though, it is worth noting why radioactive waste is a fitting topic for this journal. The short answer has to be that the unresolved issue of nuclear waste is regarded by many as the Achilles' heel of the nuclear fuel cycle, while at the same time nuclear power is gaining favour as, at the least, an interim measure in the global challenge to ensure continuing security of electricity supply during the C21st while also reducing greenhouse gas emissions. What might be unusual for E&E, however, is that in this issue we have invited a highly multidisciplinary group of authors to contribute. This is because, as mentioned above, the process of reaching a decision about what to do with nuclear waste entails both highly technical and complex socio-political issues.

The Papers in this Volume

The opening paper, by Gordon Thompson, sets the scene by providing an historical account of the US effort, so far unsuccessful, to dispose of high-level radioactive waste. As the author says, it is important to understand the reasons for this disappointing outcome, for on the one hand the process of deciding is consuming large amounts of human capital, and, of greater importance, the unresolved situation poses a continuing risk of a large release of radioactive material to the atmosphere. Because of the failure to find a more lasting solution, most high level waste is currently stored at reactor sites in high-density configurations in water-cooled pools. Loss of cooling water could result from accident or attack, leading to a pool fire and, potentially, a release of radioactivity large even by comparison with Chernobyl. Nonetheless, Thompson suspects that the Yucca Mountain project, to provide a deep underground repository, will lose momentum and eventually be cancelled, leading to continuing wet storage at commercial reactor sites along with dry storage in ISFIs (independent spent fuel storage installations). He concludes by noting the complex ethical issues to which this gives rise. For some, the storage and passing on of spent fuel to future generations would be burdensome and therefore immoral and counter to any notion of sustainability. For others, the fact that the stored waste contains plutonium could permit it to be seen as a valuable energy resource for future generations.

Thompson's final comment is that there is no systematic debate in the USA about the respective merits of opposing ethical perspectives on nuclear waste. The second paper, by Bill Leiss, describes what might be seen as Canada's path to providing just this platform. As Leiss describes it, 1998 was a pivotal point in the history of Canada's approach to dealing with its nuclear waste. In that year the Seaborn report was published amid great controversy. The conclusion which caused the furore was that whereas, from a technical perspective, the concept of geologic disposal had on balance been adequately demonstrated, *it had not been shown to have broad public support*. At the time report was denounced by industry partisans e.g. 'a social perspective is not relevant to safety as normally defined,' but the genie was unleashed. In 2002 the Canadian government required reactor owners and operators to

establish an arm's-length entity, the NWMO (Nuclear Waste Management Organization), to re-examine the disposal issue and recommend a preferred solution within three years. A crucial and controversial aspect of NWMO's remit was to examine the "acceptability" of disposal options, not just from the experts' perspective of the technical demonstration of compliance with safety criteria, but from the viewpoints of the wider public, a move which opened the door to far wider considerations of social legitimacy. Thus, NWMO sought to start afresh by considering and comparing all feasible disposal options, by blending technical and social dimensions into a unified evaluation, by subjecting decisions to ethical evaluation, and by inclusion of an exhaustive program of public and stakeholder consultation.¹ The Leiss paper describes perhaps the most difficult part of that process – the attempt to integrate social, ethical and technical issues within the same evaluation framework with equal priority.

The third paper, by Tapio Litmanen, provides a Finnish perspective on the entrainment of socio-political considerations in what previously had been regarded as a technical decision making process. Finland's experience is central because of the year 2000 decision by Eurajoki Municipal Council to accept the island of Olkiluoto as the site of a final disposal facility for spent nuclear fuel. Key in Litmanen's analysis is the issue of independence. Independence is vital from the perspective of trust and trust is vital because where such highly technical issues are being addressed the lay audience (stakeholders and the public) cannot be expected to acquire sufficient expertise to make valid judgments on what they are being told. The role of social science is to ensure that the processes of decision making respect the needs of the stakeholders and lay public. In Finland the regulator, STUK, took on the role of protector of the public interest and it does command trust. In spite of this and the undoubted success of the Finnish process, Litmanen is not entirely satisfied. He attributes what shortcomings there were in part to the changing way social science is practiced and the potentially conflicting demands of the commissioners of the social science which could, in some cases, be seen as compromising the independence of the social scientists. Essentially he asks the question: if the overseers are not independent how can the process be judged independent?

Another important matter in understanding how decisions are made is how the various participants perceive the risks, and what motivates those perceptions. Since decisions also involve a complex interplay of actors, it is also pertinent to ask how the various actors perceive other people's perceptions, and whether these alternative perceptions in turn affect their own. Lennart Sjöberg and Britt-Marie Drotz-Sjöberg investigate these matters in the Swedish context² by addressing the issue of how politicians, who have to make and sell decisions to the public, view the risks of radioactive waste management compared to the public and experts. Of the many interesting strands to this paper, several stand out. For example, it is often presumed that politicians react to public demands rather than their own assessments of the risk or that of experts, resulting in irrational decision making. But is this true? Their paper suggests not, and that politicians in fact are guided by their own risk beliefs and not by the opportunistic gambit of merely accommodating themselves to what they think the public wants. Questions are also raised about the role of stakeholders in participatory decision making, the views of whom tend, one way or the other, to be more extreme than of others, and which could lead to a serious distortion of decision processes. The paper also explores the nature of 'trust,' finding that trust in science is a more important determinant of perceived risk than social trust, where social trust entails perceived honesty, objectivity, consistency, competence, and fairness. This finding is consistent with a Eurobarometer poll³ in 2005 which found that two out of three European citizens believe that decisions of a scientific and technical nature should be based primarily on the opinion of experts.

The fifth paper, by Deborah Oughton, examines from an ethical and philosophical perspective the modern trend to participatory decision making involving public and stakeholder inputs, as for example required by the Aarhus Convention. Often it is presumed that participation is of itself such an obviously good thing that even to question it is an act of heresy. Oughton's

¹ NWMO, Assessing the options: future management of used nuclear fuel in Canada, June 2004.

² As in Finland, there has been preliminary acceptance by some Swedish communities of a repository siting decision.

³ See http://ec.europa.eu/public_opinion/archives/ebs/ebs_225_report_en.pdf

paper provides a clear signal that, like everything else contributing to complex decisions, the mode and conduct of participatory processes also requires carefully scrutiny. She addresses the issue of how stakeholders and the public should be involved in such processes, starting by examining and confirming the validity of the view that they should, and then addressing how. She finds legitimacy to be the over-riding criterion for successful stakeholder and public participation rather than efficiency, that is, acceptability of the outcome. Here there is a common cause with Litmanen's concerns.

The next paper is about our understanding of the health effects of exposure to ionising radiation. It should not be overlooked that in parallel with the revolution in the approach to societal decision making, scientific knowledge also advances. As health risks are possibly the foremost concern of the wider public in considering nuclear waste, it is curious that health gets no special attention in the deliberative processes we have seen, especially that run in the UK by CoRWM which sacked and did not replace its only health expert. Keith Baverstock's paper sets out those new developments in understanding of the health consequences of ionising radiation, particularly in relation to low doses of the kind which might arise from far-future leakages from nuclear waste repositories. The issue is that there is new radiobiological evidence of harmful cellular processes, known as genomic instability and the bystander effect, which are induced by radiation, but which are not factored in to current risk estimates used by industry and regulators. At the least, this evidence widens the bounds of uncertainty.

The final paper presented here is a viewpoint by Max Wallis, describing his experience of the work of the UK's CoRWM which, like the Canadian NWMO, sought to reach a decision on the future of the UK's nuclear waste legacy which was anchored both in science and social acceptability. Max Wallace had a strong interest in the UK process, attending a fair number of the public meetings and, where permitted, contributing. By coincidence, both Canada's NWMO and the UK's CoRWM started their processes in the same year, with a similar time frame, and reasonably similar objectives, but by very different routes. Also, judging by events and including the perspective related in this paper, with very different outcomes in terms of procedural validity. Thus, Wallace finds, as have others including eminent bodies such as the House of Lords Science and Technology Committee,⁴ the CoRWM process to have been marked by a panoply of shortcomings, several of which alone would have holed the enterprise below the waterline had not the sponsoring departments sought repeatedly to casually dismiss and deny the deficiencies. Thus, Wallace identifies major shortcomings in the quality and use of science, the deliberative procedure employed, the means of short-listing options and procedural matters relating to the independence of the Committee from its lead sponsor (DEFRA) as well as commercial nuclear interests.

Personal Reminiscences on CoRWM and its Legacy

We intend to take this opportunity, with the benefit of our personal experience, to evaluate what went wrong with the CoRWM process. The management of HLRW is not a trivial issue for the UK; the present "management strategy" both creates unnecessary risk (e.g. Thompson, *ibid*) and costs to the tax payer. Radioactive waste management is equally an issue in many other countries. The urgent need for a solution was identified in the UK in 1976⁵. The UK has a distinguished record of technical expertise in nuclear issues and in our experience all the necessary tools to make decisions on how to manage this hazardous material safely. It is thus a matter of national importance to understand why the CoRWM process was so inferior to the Canadian and Finnish processes described in this volume. One way of deciphering this is to take a step back, and to consider the nature of knowledge itself.

Radioactive waste management is first and foremost a complex technical issue involving many aspects of natural and applied science, health and engineering, that is, one involving considerable technical expertise. 2007 saw the publication of a very relevant and timely book

⁴ House of Lords Science and Technology Committee (2004) 5th Report of Session 2003-4, Radioactive waste management, HL Paper 200: TSO: London.

⁵ Royal Commission on Environmental Pollution Sixth Report, *Nuclear Power and the Environment*, HMSO 1976.

by Harry Collins and his co-worker Hugh Evans, from Cardiff University, entitled "*Rethinking Expertise*."⁶ They identify five levels of expertise from what they term "beer mat"⁷ expertise (at the lowest level) to contributory expertise (highest level), i.e., the expertise developed by those skilled in a subject, including for example gravitational wave physics, but also more mundane skills such as car driving. Their thesis is that this high level of expertise is only acquired by being part of the community that practices that expertise and "speaks the language." Thus, for there to be effective communication between different expert communities an intermediate fourth level of expertise, "interactional expertise," is required. This level of expertise allows its holders to communicate effectively with the contributory expertise community. It follows that a committee that has to provide advice on a multidisciplinary subject must devote a significant proportion of its effort to sharing expertise at the interactional level and this is precisely what the Canadian project, under NWMO, did with an extensive series of papers prepared by international experts and made widely available on the INTERNET. In contrast CoRWM, which arguably produced a much greater volume of paper, relied on papers prepared largely by its own membership, very few of which would survive external peer review.

In December 2004, when the House of Lords Science and Technology Committee (HofL) reviewed CoRWM's progress one year into their process it remarked as follows⁸: "*We judge the composition of CoRWM to be inappropriate for offering advice to the Government on the technical aspects of their remit*" and "*we have no confidence in the technical ability within CoRWM itself sufficiently to understand the science of some of the disposal options. Whilst CoRWM will receive advice from a number of sources, we do not believe it can even be considered an "intelligent customer" for technical advice without additional expertise.*" and "*We urge the Government to consider, without delay, either the appointment of additional members to CoRWM with expertise in earth science, materials or civil engineering, or the establishment of a technical sub-committee to CoRWM.....*".

Publicly the sponsors of CoRWM, DEFRA and the devolved administrations, either ignored or dismissed this advice and indeed a senior DEFRA civil servant, when asked under oath⁹ if he was concerned about the HofL criticism, claimed he was not. In his paper, Wallace, from the perspective of a stakeholder, identifies important failures in the CoRWM process in aspects of its public consultation, accusing it of concealing information relevant to the public discussion and essentially of being economical with the truth.

Our disenchantment with the CoRWM process started at the earliest meetings in January 2004 when it seemed that some members (hereinafter the "caucus"), nearly half the committee, were well-acquainted with one another and already had a clear idea of the direction in which they were determined to go; weak chairmanship allowed them their way. By the time of our departures in April and May 2005 the committee still had no strategy to address the technical aspects of the problem. Indeed, it appeared that an atmosphere of antagonism to expertise of any kind, whether natural or engineering, health or social science, prevailed. By this time the caucus had fully taken over the direction of the committee which displayed all the attributes of "groupthink"¹⁰.

Whereas Canada now has a clear audit trail from the deliberations of the NWMO and a clearly marked path ahead, CoRWM started experimenting with volunteerism, as noted by Wallace, an approach rejected by Sweden and not part of the successful Finnish process. CoRWM's own audit trail is a second-rate web site with a dysfunctional search facility¹¹ and some 2,250 documents, many of the most important of which are not accessible over the web and the

⁶ H. Collins and R. Evans (2007) *Rethinking expertise*, University of Chicago Press: Chicago and London.

⁷ From a brewery which produced beer mats with very basic explanations such as how lasers, radars, x-ray generators etc., work.

⁸ house of Lords Science and Technology Committee, 5th Report, See: <http://www.publications.parliament.uk/pa/ld200304/ldselect/ldsctech/200/20003.htm>

⁹ Dr Robert Jackson in February 2006

¹⁰ See: <http://en.wikipedia.org/wiki/Groupthink>

most important one (the scientific evaluation of the CoRWM process carried out in 2006) 'unavailable' even after a freedom of information application (Wallace, *ibid*).

Committees such as CoRWM are but a part of a much larger system, some elements of which the committee is designed to serve, others designed to serve the committee, and still others to exercise oversight. As Litmanen's paper has described, Finnish law on environmental impact assessment requires the involvement of social sciences in the making of technical decisions such those pertaining to radioactive waste. This is a relatively recent development and Litmanen's account provides a valuable and detailed evaluation of the role of social scientists in the successful Finnish process of selecting the municipality of Eurojoki as the repository site for Finland's spent fuel, with special emphasis on how this served the public interest. What this analysis most clearly reveals is the complexity that is entailed in such a process when properly followed. From the perspective of most European countries, what is most impressive is the political continuity that has supported the process from the decision in principle to use geological disposal taken by parliament in 1983, to site selection on schedule in 2000, and projected opening of the repository in 2012. One might contrast this with the UK's performance, essentially acknowledging that the issue was urgent in 1976, followed by the rejection on scientific grounds of a planning application by NIREX in 1997, and barely perceptible progress represented by CoRWM's final report in 2006, and the anticipated availability of a high level waste repository in 2075.¹²

Litmanen emphasizes the importance of "independence". CoRWM presented itself as an "independent" committee but that seems to be a claim based on a novel definition of the word independent. The OED defines independent as: "*Not depending upon the authority of another, not in a position of subordination or subjection; not subject to external control or rule; self-governing, autonomous, free*". We would, particularly in the context of nuclear issues, add to that the phrase "*free of vested interests*." DEFRA seems to have tried to meet the definition of independent by appointing both sides of a highly polarised dispute (over the role of nuclear power) to the Committee, the caucus and chairman anti-nuclear and other members and the project manager (who had a degree of autonomy) from the pro-nuclear camp. That left only four of the 12 initially appointed members, including ourselves, as neutral, or as we would claim, "independent."

The first and most important problem with the whole CoRWM enterprise was that there was a strong constituency for whom no solution was a good outcome. For example, the strongest card in the anti-nuclear lobby's opposition to new build is the unsolved waste problem. So long as there is no solution they would maintain, correctly in our view, that it would be unethical to generate more waste. The Secretary of State who initiated CoRWM (Meacher) and the incumbent at the time of appointment of members (Beckett) and the responsible Minister (Morley) in DEFRA have all expressed their opposition to nuclear power. Appointments to CoRWM were delayed several weeks due apparently to getting approval from the then Secretary of State (Beckett). From the HofL report it is clear that the Chief Scientific Advisor to DEFRA, the late Professor Sir Howard Dalton, was not consulted on the membership before appointment. It seems plausible then that the "appointments process" was politicised from the outset.

We speculate that this might well have been the reason why the originally appointed Chair of CoRWM, Kathryn Bryan, who was involved in the interview process for the membership, resigned in January 2004, barely a month after the first meeting of the Committee. She was replaced "on the spot" by an existing member, Gordon MacKerron, an economist, also with a track record of opposition to nuclear power. The National Academy of Sciences in the USA, which prides itself on offering independent advice to government for more than 140 years,¹³

¹¹ For example, a document, No 2248, randomly selected from the document list, was "not found" on 22 February 2008.

¹² <http://royalsociety.org/displaypagedoc.asp?id=27169>

¹³ <http://www.nationalacademies.org/studycommitteeprocess.pdf>

identifies among many other factors that ensure independence and objectivity, the pivotal role of the Chair. MacKerron would have been well advised to read the briefing that the NAS provides to the Chairs of its committees.

Thus we have to conclude that the very foundations of CoRWM were deeply problematic from the outset and it is interesting that as far as we are aware NWMO, in spite of being a commercial enterprise, managed to maintain its independence and integrity.

When it comes to the role of expertise there is a very basic issue which is addressed by Collins and Evans. It is interesting to consider their account of the history of social science's involvement in technical decision making. Up to around 1970 and a bit beyond, technical decisions were the sole province of experts in the appropriate disciplines. From then onwards until 2002/3 this supremacy was increasingly questioned to the point that anyone's opinion was as good as anyone else's; folk knowledge was in the ascendant and technical expertise was no more and no less important. More recently there has been a developing consensus that expertise may after all be important and that it has a different role to play compared to stakeholder and public input.

In our view all the most sophisticated deliberative process can do is inform about the opinion of a very small sample of the population and it is a very legitimate question what the meaning of that result is. If a sample of say 60 individuals were brought together to assess whether public funding of opera was appropriate because it is a minority interest, the consensus might well be that it is not. In terms of the Collins and Evans model those with the contributory expertise to judge what public good derives from opera performances would be such a small proportion of the sample that their weight would be swamped by those with only beer mat knowledge of the benefits of opera.

In Finland never more than 40% of the general population have been in favour of geological disposal, but the Eurajoki decision at the local level was strongly in favour. One might argue that because of the potential close involvement with radioactive waste management policy the Eurajoki inhabitants had acquired more expertise than the average member of the public and were better informed to make the judgements necessary; their opinions carried greater legitimacy. As Oughton (*ibid*) says, "*superficial public participation efforts usually serve the decision makers much more than they serve the stakeholders.*" We conclude and have always maintained that education of the public and stakeholders is the key to robust decision making that serves the public interest; to CoRWM, which produced no independent documentation of any worth aimed at educating the public and stakeholders, education was an irrelevance, indeed counter to their philosophy which saw the public as already having the necessary wisdom.

CoRWM's public and stakeholder engagement (PSE) process, particularly in the early stages, was both superficial and ill thought through. It seemed to us, from the comments made by members attending PSE events, that the criterion of success was that "*a good time was had by all.*" Certainly as observers of that part of the process we were not aware of any thinking in depth about how the results from these events reflected public opinion in general and most of our questions were brushed aside. We have observed this behavioural pattern, which goes starry-eyed at the mere thought of public engagement, and pays no heed to issues of validity and legitimacy, in other contemporary settings.

The issue of how to manage the highly toxic waste products of nuclear power generation affects almost every country with a nuclear power programme and every country that plans to go nuclear. In the first case it is a matter of dealing with a legacy of waste, and in the second it is an issue that ought to be resolved before new build commences. The outlook is not all bleak; Finland and Sweden are well advanced, Canada is on the way, all three having had successful decision making processes.

At the other end of the scale comes the UK. For the UK a model was, so to speak, on the doorstep. It was with the strong "encouragement" of one of us (KB) that CoRWM visited both Finland and Sweden and indeed ultimately CoRWM adopted many of the features that were presented to them during that visit but most notably they must have rejected the Finnish site selection process, which set out to first identify the optimum locations from a geological perspective and then to engage with the communities. Instead CoRWM opted for experimenting with volunteerism. We say "must have" because these events took place after we left the committee; volunteerism was not discussed in the first 15 months of the committee's life.

We judge that the CoRWM made three seminal mistakes in its first months:

1. was led headlong by the caucus into a 6 month long trial of a controversial PSE technique known as "deliberative mapping." This depleted funds, wasted nearly 20% of the allotted duration of the committee, and caused considerable internal friction. This expensive fiasco was embarked upon without even defining beforehand what would be a successful trial outcome.
2. was to expend so much time on eliminating unlikely options. We disagree with the HofL, which implied that starting with a clean slate, all options on the table, was unnecessary. What was unnecessary was the time taken, 16 months, to eliminate even the most bizarre, namely projecting the waste into the sun with rockets. At this stage the committee was gripped by a zealotry and fervour, with associated blindness and deafness, akin to those with a belief that they would "save the world."
3. was that the committee was refractory to developing a strategy for dealing with the scientific and engineering aspects of the problem. Up to the time we left the committee's activities had focussed purely on public and stakeholder relations.

These three errors were fully apparent less than one year into the committee's life. We simply could not believe that a government committee sponsored at the highest level, in a highly technically developed European country, could be so reckless. This was the origin of the disaffection that eventually led to our departure from CoRWM. As a result of the work of Collins and Evans we now see that we were experiencing what they call the "second wave" in which social scientists (those at least of a particular schism) regard all participants as being equally knowledgeable. Even on matters of science, where we held contributory knowledge, the opinion of a public relations person carried as much, if not more, weight. At the time we described the situation as "Alice in Wonderland." Now thanks to Collins and Evans,¹⁴ we at least can appreciate what was going on: it was not imagined.

In October 2004 one of us (KB) was asked by a senior civil servant from the Scottish Office, Elizabeth Gray, who had been on the recruitment panel, "how things were going with CoRWM" and as a consequence was invited for further discussions immediately prior to the plenary meeting of the committee in October. It was suggested by Gray that an independent review of CoRWM's progress would be appropriate. As from March 2004 our numerous approaches to the Chair had failed to rectify what we saw as a serious perversion of a decision making process and it was agreed with Gray that if the hoped for improvements did not materialise at the October 2004 meeting, a letter to the Chair detailing all the concerns would be copied to her. It was the copying of this letter, and its further transmission by Gray, which led through a kangaroo court convened by the Chair and an "investigation" by a so-described¹⁵ independent representative of the Office of the Commissioner for Public Appointments, to the sacking of one of us and the resignation of the other. His report, the Roberts Review, upon which Morley leaned to justify the dismissal, is unavailable even through the freedom of information route. This is possibly because it contains criticism of the Chair, as was expressed to us by Roberts.

¹⁴ And others e.g. F. Furedi (2004) *Where have all the intellectuals gone? Confronting 21st C Philistinism*, Continuum Press: London.

¹⁵ He was in fact a DEFRA-nominated business man with OCPA training.

The primary concern expressed in that letter to Gray was the frank and open contempt in which some of the Committee held science; to quote one member, Lynda Warren, "the laws of science are as mutable as the laws of Parliament" or another, Fred Barker, "science on tap not on top." Fine maybe if he or any of the other members of the committee were competent to turn the tap.

The astonishing and indeed, for the future of technological risk assessment in the UK, alarming, thing is that there were scientifically qualified civil servants both in DEFRA (Dalton, the Chief Scientist, and Robert Jackson, who had a longstanding interest in radioactive waste management through the committee that preceded CoRWM), in the Scottish Executive (Gray), a Scientific Advisory Council in DEFRA (chaired from April 2005 by Professor John Beddington, now the Government's Chief Scientist), and in the Cabinet Office a Chief Scientist (Sir David King). The only visible response to the excoriating report by the HofL and the publicity surrounding our departure from CoRWM was the appointment of a four person advisory committee to CoRWM around April 2005 with less than clear terms of reference. One can only assume that it was never the intention of DEFRA and the devolved administrations that CoRWM would produce scientifically sound recommendations; perhaps the Committee's real purpose, as suggested to one of us by Sir Bernard Ingham, was "*quite simply to cause delay*" in the interests of the anti-nuclear lobby.

In the event, and with the assistance of the Royal Society who appointed Professor Geoffrey Boulton, a geologist, to liaise with CoRWM, final recommendations were provided on time and as might have been expected, proposing geological disposal as the preferred option¹⁶. Professor Ian Fells is quoted at the time by the Royal Chemical Society¹⁷ as saying; '*and engineers have known for 50 years that deep geological disposal must be the way ahead.*' No analysis of the relative merits of the possible geologies, i.e., rock, clay or salt, no requirements for packaging; in short not anything at all about the difficult bits. So a proportion of membership of CoRWM have been persuaded that deep geological disposal is the best option but Wallace and his colleagues have not and we wonder what proportion of the UK population are so persuaded¹⁸; is there as a result of the CoRWM dispersal of some £7 million of the Treasuries beneficence any difference in public opinion? If not, and as it has failed to solve the science and engineering issues, that £7 million is wasted along with the 5 years it has taken to get here.

Only 6 weeks after the infamous letter was sent on 24 October 2004 the HofL published their excoriating judgement on CoRWM. It was a vindication of the battle that we had fought since January 2004. However, in 2007 the HofL said of CoRWM's final report¹⁹: "*In practice, much of CoRWM's time was devoted to "public and stakeholder engagement", to the exclusion of scientific analysis of the available options, and we were roundly critical of this preoccupation in our 2004 report Radioactive Waste Management. Nevertheless, when CoRWM reported, on schedule, in July 2006, it produced a well balanced report, around which it should be possible to build long-term consensus.*"

Would it be unduly cynical to wonder if this "welcoming" tone would have prevailed had CoRWM recommended some other solution, such as long term storage? Were their Lordships not a bit disappointed that more technical progress had not been made and might they not have pointed out that this could have been achieved had their 2004 recommendations²⁰ been acted upon? Apparently, if the result is "what you want"²¹ it matters little how it is obtained.

¹⁶ Indeed, given the inexpert nature of the Committee they could hardly have sustained a scientific argument in favour of an option that went against the perceived wisdom.

¹⁷ <http://www.rsc.org/chemistryworld/Issues/2006/September/BuryRadioactiveWaste.asp>

¹⁸ As a siting process based on volunteerism is integral to the Government's strategy public opinion in the UK matters much more than it did in Finland

¹⁹ House of Lords Science and Technology Committee, 4th Report of Session 2006/7, Radioactive Waste Management: an Update, 3 June 2007. See: <http://www.publications.parliament.uk/pa/ld200607/ldselect/ldsctech/109/109.pdf>

²⁰ See footnote 4

²¹ HofL reached the view in 1999 that deep geological disposal was the way ahead.

This brings us right back to Deborah Oughton's point about efficiency and legitimacy; it could be surmised that CoRWM were *efficient* as far as HofL (and probably the Royal Society) were concerned, but in no way can their process be described as *legitimate*, at least from a scientific and technical perspective, and we should remember that the HofL's Science and Technology Committee is one of two at the highest level of UK government.

In 2007 a new CoRWM was appointed with a new Chairman and a more tightly defined remit. Whether it can build on the insubstantial and fractured foundation laid by its predecessor remains to be seen. Copious ammunition has been provided to those who do not favour deep disposal and despite the 32 years that have elapsed since the urgency of the problem was recognised the UK still has the "hill to climb"; it does not have a technically viable strategy to deal with radioactive waste, whether legacy or from new build. Furthermore, there is mounting evidence that so far as openness, transparency and communication are concerned, and despite all the protestations of the importance of these attributes by government agencies, when it comes to the crux, the name of the game is still 'stonewalling.'