OECD/NEA Report on Deep Disposal of Spent Fuel and High-level Waste - Current Status and Issues in Safety Case and Safety Regulation, and Implications for Safety Research by Regulators

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Abstract

The OECD/NEA has a broad spectrum of activities covering management and disposal of long-lived radioactive wastes, coordinated by its Radioactive Waste Management Committee. The Agency emphasises cooperation among all the actors involved in radioactive waste management, both institutional and non-institutional. An associated Forum reserved only to regulators is also very active. In this lecture we review the lessons to be learnt concerning the regulatory function in the specific field of disposal, with a view to identifying action lines for research. Extensive reference is made to the OECD/NEA literature.

The Regulatory Function and the Role of Research

Regulatory tasks in the field of radioactive waste management are carried out not only by technical regulatory authorities, but also involve, especially at the policy level, other bodies such as Parliament, Government, and regional authorities. There may be more than one technical authority issuing guidance, taking part in licensing, and carrying out control and supervision. The Regulators' Forum of the RWMC has captured the complexity and variety of delivery of the regulatory function in a table[1], and it has depicted the conventional regulatory system as a cycle embracing the principle of continuous improvement[2]. Regulatory authorities provide advice for the *elaboration of national policy and objectives*; they develop *rules and regulations* and the *associated practical guidance;* during the phases of *pre-licensing and licensing*, regulators define and develop operational criteria for such concepts as Best Available Techniques, and optimisation for geological repositories; finally, they supervise and control implementation. All of this takes places after due consultation and information of the interested parties, which include the implementers but also government departments and other regulators, e.g., those in charge of the civil works. The cycle starts again with feedback from performance evaluation influencing the next round of policy and implementation. An important issue in regulating disposal of long-lived radioactive waste, however, is that the effects of disposal are only apparent in the far future, which makes it impractical for today's regulators to evaluate performance for the purpose of continuous improvement of the regulatory cycle. Decisions have to be taken, therefore, on the basis of the best knowledge available at the point of commitment to closure and/or abandonment of retrievability, and with clear, societal understanding and agreement about the objectives and their ethical implications.

There is broad agreement that safety research is needed to support the drafting or updating of regulations, as well as for other parts of the regulatory cycle. The scope has to be carefully defined, however. The regulators themselves observe that, because implementers *must* carry out a broadly-scoped programme of technical R&D "*there should be no need for the regulatory body to undertake a full parallel R&D programme. Nevertheless, R&D work is essential for the regulator's scientific and technical ability, because it maintains or improves the regulator's competence, it contributes to the regulator's independence and it helps to achieve public confidence in the regulatory system*"[3]. A number of constraints on technical research by the regulator exist.

- Governments no longer necessarily support nuclear energy developments with large budgets, meaning that funds to regulators may have to come from industry's fees. Understandably, industry does not wish to see efforts "duplicated". In principle, technical research data can be shared across implementers and regulators and, to some extent, internationally. Typically, regulators are endowed with resources that allow them, e.g., to review licensing applications and to update regulations and guides, not to reproduce *in extenso* the research underlying the application.

- Traditionally, roles and duties are separated: the implementer prepares and proposes, the regulator reviews and responds, judging whether the implementer's proposal is compliant with standards and requirements. The functional separation between those generating knowledge and approaches and those checking knowledge and approaches is considered to be a guarantee of quality for both steps. If the regulator took on a research role, this functional separation could be blurred and quality reduced.
- The actual independence of personnel, the absence of a conflict of interest for the persons carrying out the different roles, is considered important. Additional technical studies by the regulator may reduce the pool of experts that are available to the implementer, as independence requires, in principle, separate pools of scientists. The issue is especially serious for smaller countries. Some of them, like Sweden and Switzerland, publish their safety cases in English so that they can access experts and reviewers from outside national borders.

For all these reasons, it has been suggested that regulators ought not to perform or commission basic research (elucidating basic physical processes), but rather confirmatory research[4]. This may consist for example of testing a subset of implementer data using alternative models and checking whether claimed results are replicated. Regulators are not tasked to do development work, as well. Research, when it is performed, may be called by a different terminology, e.g., obtaining *technical support*.

Regulatory bodies typically draw on a network of technical support organizations, which may be national laboratories, academies, or universities, whom they commission or whose own R&D programmes can provide answers to the questions regulators must ask. In bigger countries, regulators may select a research institution, contracting with it to remain fully independent of implementers (USA) or utilise nationally-funded ad-hoc organisations (France, Japan). In France, the advice by the technical support organisation is further reviewed and finalised, on behalf of the regulator, through a group of experts (the "GPD") from French and foreign institutions. Non-governmental organisations begin to be represented in the GPD. The nature of the research or review requests - and therefore the role of research - may differ considerably according to the level or phase of regulatory activity. Traditionally regulators have not a review role during the siting process; their role emerging when a siting decisions is to be made and thereafter implemented. During the siting period, the regulator may, however, want to build up the necessary competences that are needed for the coming decision and subsequent phases. Regulators who are developing upstream advice for policy makers will have different needs from project-oriented regulators who are judging compliance on technical aspects as well as other aspects of particular concern to stakeholders. The latter will need to keep a watching brief on the project-specific technical aspects, having access to data and analyses according to a calendar agreed to with the implementers. Regular reviews and subsequent dialogue with the implementers should also take place. In both activities the regulator may need technical support.

There may be a case for regulators initiating new areas of research. There have been occasions when the industry has been reluctant to undertake certain areas of research, either because they are just unwilling or don't want to expose uncomfortable issues. In these cases it may prove advantageous to initiate work in such areas as industry will soon want to get into it to avoid the regulator having the monopoly of knowledge. Similarly, if the technical regulator were to initiate research in policy-related fields, it is likely that policy makers will soon "wake up", grasp the political / policy implications and get involved. Finally, the field of disposal may open new fields of application for which the regulator may need to acquire new competence and technical support, e.g., when the nuclear regulator is given responsibilities for mining safety and/or for protection of the environment from the chemical hazards associated with the waste inventory.

To successfully identify priority areas for technical support implies a high degree of scientific or practical competence and perceptiveness. It may be observed that some regulatory bodies accomplish a relatively great volume of work because they do employ such uniquely talented personnel (possibly with backgrounds in academic, research or industrial settings) who have the ability to promote synergy between researchers and other experts. Typically, these regulatory bodies also make an important investment in training and nurturing such personnel, and then endeavour to keep them in the regulatory profession without continuous turnover. It is important to have an organisational culture that values stability and synergy, both when hiring and in day-to-day practice. As recognised in [Ref. 4] it would be beneficial for all countries to attain a better understanding and definition of what constitutes adequate research capability for the regulator.

Which technical areas of interest to regulators would benefit from research in the disposal area?

The safety case for disposal is a complex study relying on technical research but requiring (and relying upon) a large number of *tacit* and *explicit assumptions*. Models are themselves only a stylised representation of nature. The safety case is not a reproducible study in the same sense that an experiment is. While individual models may appear valid for application over short time periods, their underlying assumptions typically become less applicable as the system evolves. There is thus a duty on the part of the regulator to understand the nature of the safety case and to communicate its advantages and limitations. In formulating requirements on the safety assessment results, it ought to be made clear whether, in order to form a judgement, the regulator requires mostly conservative analyses, or analyses that emphasize a best estimate of what could happen. Today regulators tend not to promote a mostly conservative assessment, because this choice would essentially celebrate the lack of knowledge. Instead, a clear presentation of the knowledge-base on the different timescales is needed as a prerequisite for confidence, in general, and for the uncertainty analysis, in particular[5]. The trend is to present and evaluate scenarios thought to be as realistic as possible and to look separately at "altered" (plausible but not necessarily extreme) scenarios.

The field of scenario construction is one where different countries proceed differently. Distinct national efforts are needed to understand and review such distinct approaches in order to judge safety case completeness. A common feature is however arising: that of identifying different periods in the lifetime of a repository and evaluating and recognising the different levels of knowledge and understanding that are expected within those periods. Different safety functions dominate at different times, different levels of predictability and of plausibility apply, and different safety indicators may be invoked over the different timescales. This is an area in which regulators may want to do more research in order to formulate regulations that are better attuned with what it is feasible to demonstrate or not demonstrate in regard to the different timescales, and in order to force the implementers to be more cogent and clear. The use of safety functions and safety indicators is reviewed in the NEA Report 6251 of 2009 (INTESC).

Just as implementers need to nuance their statements of performance over time, there is a need for regulators to nuance their criteria: in particular, there is a need to de-emphasize "dose" and instead, to emphasize yardsticks that pertain to the quality of the analyses and to fulfilling the safety functions. In this perspective, the "dose" concept itself needs to be better understood, as shown at the international workshop recently held in Tokyo[6]. Overall, current regulatory practice in the goal of protecting the "health and safety" of the public is challenged by the fact that the radiation protection experts indicate that "effective dose" is not a measure of health detriment at times more than a few generations away[7]. Issues exist in the practical application of "effective dose" even in current radiation protection practice. The concepts of "effective dose" and "potential effective dose" need to be better grasped, presented and used by regulators, and the terminology used consistently. Important changes in concepts have been introduced by the ICRP-103 recommendations[7], notably in the concept of optimisation. Work is afoot to gauge their significance in the field of disposal.

A crucial aspect in structuring the disposal safety case will be the long timescales involved, which impact something of great importance to the regulator: the safety-relevant concepts. One cannot take everyday concepts – applicable to contemporaneous endeavours – and apply them uncritically to any timescale. The concept of "safety", for instance, implies control. In the long-term repository context, should not a different qualitative definition of safety be considered? Similarly, societal standards of "health" and "protection" have changed dramatically in past generations, and should be expected to vary across future times. To what extent can regulators – and by implication society – live with "fuzzy" concepts when dealing with the long term? Is it a shortcoming that the term "safety" is typically NOT defined in regulation?

The first 100-200 years, the ones during which the repository will be operated and there is access to the underground, seem particularly deserving of regulatory attention. This is the period during which the full regulatory cycle, including control and enforcement, can certainly be carried out in real time and the classical protection concepts apply unchanged. The process of regulatory review, in order to be credible, should be seen as capable of initiating a decision to reverse steps taken by the implementer. Typically, two motivations would be found to intervene: 1. The need for further conditioning and characterisation of containers or to undo work that was not up to specifications, e.g., due to a failure of the QA system; 2. The need to revise the design concept following a period of performance confirmation. Such reversals imply a need for reversibility of decisions and retrievability of the waste packages. Regulators tend to shy away from discussing retrievability, as the latter is not part of the long-term safety concept. Yet, retrievability may well be needed during operations in order for the long-term safety potential to be fully realized as well as for operational safety. Regulators may thus want to consider if some degree of retrievability is useful/necessary for reasons of operational safety and/or for assuring the initial, high-quality conditions to achieve long-term safety. If today's judgement is that "yes, retrievability is useful/necessary", this will imply regulation on how reversal/retrieval decisions would be made during operation and at each future review milestone. Would it also not be worthwhile for (future) regulators to be explicit in decision-making and to communicate first a decision that there was no reason to reverse back to previous steps and *only subsequently* that a decision can be made to move forward? The whole area of retrievability and reversibility seems to be ripe for regulatory reflection and research[8].

There is much to be said for a flexible approach to disposal. In particular, it can be observed, with the NAS, that a "flexible approach has more in common with research and underground exploration than with conventional engineering practice"[9] and , more generally, that "Other things being equal, those technological projects or developments should be favored that leave maximum room for maneuver in the future. The reversibility of an action should thus be counted as a major benefit; its irreversibility, a major cost."[10] This first time period of project implementation is also one where the reference technology for disposal is to be developed and where large research and development budgets need to be deployed by the implementer: Can thick-walled containers be welded? Is the machinery for waste emplacement and/or retrieval ready for industrial application? Which excavation methodology would least affect the host rock? The common denominator questions are: Which technique works best? How does this translate into confidence/uncertainty in disposal safety?

Safety cases for disposal typically focus on the times beyond 1,000 years and before 1,000,000 years. Often this practice is mandated or condoned by regulation. The earlier period of time however – the first 1,000 years - is the period throughout which a regulatory presence may reasonably be thought to be available; it is the period within which the greatest modelling complexities are faced, but also the period when zero releases to the environment are expected; and it is the period in which the man in the street is most interested[11]. It is an important period for safety. Traditionally regulators have shown interest in the technical aspects (coupled thermal, hydraulic, mechanical and chemical processes) but less interest in how society should deal with a major event during this period: repository closure. Do national policy and safety rules imply that we will "walk away" when a closure decision is made? If *so*, what is the position of regulators on this issue? What advice should they give to policy makers? If *not*, how do they pass on responsibility to the subsequent generation of regulators? How do they involve the local public in the safety measures, including monitoring and memory keeping? What provisions can reasonably be made now for addressing such needs in the future? Clearly, the disposal issue is not closed with the closure of the repository. Some regulations (Sweden and Finland) do recognize that the first 1,000 years are a special time period, and have more stringent post-closure protection criteria during this period than afterwards – related to the presence of the society and regulators – but have yet to resolve all of the issues implied by closure.

The very long term, beyond a million years, is an important area in which regulators are likely to need research insight. The safety case specialists observe that some hazard from the disposed waste may remain for extremely long periods. They emphasise that there are, at the same time, practical limitations as to the farthest removed date for which anything meaningful can be said about the protection provided by any system against the hazard[12]. Uncertainty in prediction, however, does not make the hazard go away. Without radiation shielding, and if undiluted, the waste will remain radiologically (and, likely, chemically) hazardous basically indefinitely (0.2 mSv/yr dose-rate at 10 m distance from a glass waste form at 10^{+8} years; 10 times higher rate at 10^{+7} years). The need to protect humans and the environment from SF and HLW is not only a priority for present times but it is also an issue to be considered for the far future, beyond a million years. Perhaps the issue deserves more attention by regulators in order to answer sustainability and protection concerns. Namely, can "safety" be required for all timescales? Should the regulator allow for residual risks? What information should regulators give to policy makers regarding the residual risks? There is scope here for more precise work that may feed into regulation, e.g., after understanding when and if HLW (and/or SF) change waste category, and when the chemical toxicity upon ingestion may become dominating. The timing of both aspects needs to be verified.

Overall, the above observations would lead us to consider three main regulatory periods: the period of actual implementation and continued presence of the nuclear industry and its regulator; the period where the nuclear industry may not exist but civil society may still function[13]; and the period of no control[14]. The latter period may itself be divided into different sub-periods based on the level of knowledge that can be brought to bear at the time of authorizing the disposal operations, including knowledge on the type of hazards to be expected.

The technical literature makes constant reference to uncertainty. Uncertainty will exist in any human endeavour. Decision-making has always to take uncertainty into account. Uncertainty analysis is a technical endeavour whose results become themselves more and more uncertain as longer time periods are considered. The regulators have to be aware of its potentials and pitfalls. Monte Carlo analysis is known, for instance, to introduce "risk dilution". The regulator should be in dialogue with the implementer and define to what extent uncertainties should be reduced. By experience, the regulator may not fully rely on his experts and consultants in this respect because they will naturally find motives for more research. Decision-making is hardly ever based on numerical values for uncertainty. The real issue for decision making is that of confidence, concerning when – in fact – it is reasonable to end the uncertainty analysis. Confidence-building implies awareness, which in turn must rely on a deliberate set of actions/procedures meant to achieve confidence for taking a specific decision under a specified set of constraints or context. A frame needs to be articulated, including by the regulator, whereby confidence is sought first and during which confidence is evaluated, communicated, and enhanced. A 2005 paper[15] reviews the concept of confidence for disposal safety cases and identifies a number of actions for confidence building and criteria for reviewing and establishing one's own level of confidence. The NEA review criteria can certainly be appropriated and augmented by the regulator. Research into regulatory review and confidence criteria would be helpful for preparing regulators to review safety cases, for verifying the regulator's level of confidence, and for preparing statements directed to the implementers, public, and politicians. The formulation of these criteria would be a good basis also for interaction with the latter constituencies

Social research in disposal: an area where regulators can and should innovate

One important area where industry and regulatory research would overlap to a (much) lesser extent concerns the role of the regulator and the expectations on the regulatory system in modern society. The manner in which regulators fulfil each of the activities within the regulatory cycle, while informed by science, is very much culture-specific. Evidence for this is found (a) in the multitude of ways in which the regulatory function is delivered[1]; (b) in the variation seen in the safety standards across countries: they are different numerically (up to 2 orders of magnitude, if the risk-dose conversion factors are considered), they are applied differently, and their bases may differ too[16]; (c) in the observation that regulatory decisions are rarely unconstrained and must have regard to the responsibilities and authorities of other (Government) bodies[2]. Regulation can thus rest on different values and viewpoints. There is however a mounting societal requirement worldwide that, through transparency and accountability to the public, regulators must be champions of democracy. Increasingly, modern regulators tend to be seen as "the peoples' expert", needing to become more and more visible and open to stakeholder requests for information, advice, and actual presence[17]. This trend, captured in the table below taken from the recent NEA Collective Statement on Geological Disposal[18], is at the heart of progress in waste disposal in the Nordic countries. One result of regulatory research has resulted, in Sweden, in the regulator suggesting to the Government that Waste Fund money be also given to non-governmental organisations for their own review of the disposal project and for their participation in consultation meetings.

Traditional expectations for roles and responsibilities of regulators	**Evolving expectations for roles and responsibilities of regulators**
• Defining regulatory options, investigating their consequences under different assumptions, making choices regarding regulatory options. • Communicating the bases of regulatory decisions.	• Maintaining open and impartial regulatory processes. • Providing stakeholders with understandable explanations of the mechanisms of regulatory oversight and decision making, including explanations of the opportunities available for stakeholder participation therein. • Serving as a source of information and expert views for local communities.

In this context, it is well for regulators to develop their awareness, foresight and competence in the societal areas. It is justified for regulators to seek to clarify, through tailored research, at least the following major issues:

1. The role played by regulators, including new behaviours, new duties, and new organisation of their regulatory activity; and in relation to this, the perceptions, values, and needs of societal stakeholders, who are calling on regulators to evolve. Stakeholders – particularly from local civil society – call strongly upon regulators to share their expertise and assist in multi-dimensional, prospective safety assessment long before licensing commences. Regulators increasingly need to coordinate views from a broad range of actors and stakeholders, to formulate judgments, to explain and communicate, and to act as a safety resource centre regarding both technical and non-technical aspects of disposal[17]. In response to these demands, regulators in several nations can already be seen to adopt a more active and visible role, without compromising their independence and credibility. In each case, this role evolution has been supported by R&D in the social sciences, ranging from studies of ethical values that underlie stakeholder requests, to cycles of mock-hearings designed to test and improve the transparency of safety statements.

2. The open, hybrid socio-technical character of regulatory objects, which may require new clarification of concepts and a new range of assessment criteria. As an example, it may become no longer usual to judge on purely technical grounds the adequacy of a potential repository site. Elements of a very different nature will come into play, for instance the quality of the technical and/or political decision-making processes that have led to site identification and characterisation; the fit between a regional socio-economic development plan and the waste-management activity; etc. These are concepts broadly associated with the modern concept of "optimisation" or "Best Available Techniques". The upcoming SKB's application (safety case, in fact) for spent fuel disposal at Osthammar will contain a volume entirely dedicated to the site-selection process, including the social aspects, which will be reviewed by the regulators as part of the decision-making process for authorisation. While the regulatory function may not always include direct assessments of such elements, it is important for the regulatory authorities at the least to develop understanding of these

elements' status in each context and to clarify the regulatory position in such a complex environment. The broad reach of today's concept of "optimisation" is a subject that deserves research and reflection[19].

It must be realized as well that, ultimately, radioactive waste has a profound, symbolic dimension[20], which calls into question the feelings of security and survival. The way criteria are formulated or presented can be seen as challenging survival[21]; the way technical safety is applied to a facility may raise issues of dread. To the extent possible, regulators should facilitate the installation of the waste facility in a manner that makes it part of a community. It will be good for safety in many ways if safety is seen to be bordering more with friendly controls than with threatening paraphernalia[21]. The FSC is suggesting that a "safety by integration" attitude (namely, a safety concept that allows for, and contemplates, the involvement of the local community) would be more conducive to public confidence and, ultimately, to safety itself than the more traditional approach of "safety by exclusion" (namely, total separation of the safety concept from the local community)[21, 22].

Finally, the regulators have to be aware of additional symbolic values that the waste may have and position themselves[21]. If waste disposal represents "no esteemed deed", if a repository is "not a place of honour"[21, 23] how could the body mandated to protect our safety not refuse outright the production and disposal of nuclear waste? How is it possible for a regulator to claim integrity when licensing RWM activities and installations? Research would undoubtedly help respond to this question of symbolic values.

Concluding Remarks

Confidence in regulatory decisions requires competent and trusted staff to keep track and review project developments, and to communicate the regulator's own confidence in the project results. The regulators do need technical support to fulfil their mission. There may be a case for regulators initiating new areas of research in order to have industry and/or policy-bodies to be more concrete and informative concerning the identified topics of regulatory interest. More broadly, regulation is a means to impose a degree of both control and certainty into a process, and regulators perform an important role in helping fulfil society's expectations of how radioactive waste should be managed. Regulators also help shape society's expectations. As a practice, regulation has to integrate both scientific and social (including ethical) knowledge. Ethical knowledge is important to help formulate a clear and deliverable objective for protecting the interests of future generations. Just like the implementers, regulators will need to devote more research efforts in understanding the expectations of society on their role and deliverables, and to establish transparent and accountable processes that respond to those expectations.

Reference

[1] NEA (2009) *The Regulatory Infrastructure in NEA Member Countries, online at* http://www.nea.fr/html/rwm/regulator-forum.html

[2] NEA (2005) *The Regulatory Function and Radioactive Waste Management. International Overview*; NEA n° 6041; Paris: OECD. See also the Regulators' Forum *Flyer* online at http://www.nea.fr/html/rwm/regulator-forum.html

[3] NEA (2010) *Regulatory Research for Waste Disposal – Objectives and International Approaches* (Draft) NEA/RWMCRF(2010)1.

[4] NEA (2004) *Collective Statement Concerning Nuclear Safety Research Capabilities and Expertise in Support of Efficient and Effective Regulation of Nuclear Power Plants*;; Paris: OECD.

[5] An interesting debate on this aspect took place between the NRC and the EPA at the time of releasing the final rule for Yucca Mountain (reasonable assurance - a reactor safety standard of proof – vs. reasonable expectation - an environmental protection approach taking the long term into account). See Section 2 in EPA 402-R-01-009, *Public Health and Environmental Radiation Protection Standards for Yucca Mountain, Nevada (40 CRF Part 197) – Final Rule - Response to Comments Document*, June 2001 ; also it may be observed that, as uncertainty increases in time, a conservative approach would force to consider increasingly detrimental scenarios, whose occurrence is even more uncertain.

[6] *Main Findings from the 1st Regulators' Forum Workshop, Tokyo, 20-22 January 2009*, downloadable from *http://www.nea.fr/html/rwm/regulator-forum.html* ; the full proceedings are about to become available.

[7] ICRP 81 : Radiation Protection Recommendations as Applied to the Disposal of Long-lived Solid Radioactive Waste, Ann. ICRP 28(4), 1998.; ICRP 103 *:*The 2007 Recommendations of the International Commission on Radiological Protection, Ann. ICRP 37(2-4), 2007.

[8] Attention is called to the ongoing NEA project on Retrievability and Reversibility, and to the international conference to be organised 15-17 December 2010 in Reims, France.

[9] US National Research Council (1990) *Rethinking High-level Waste Disposal*. Washington, D.C.: National Academy Press.

[10] US National Academy of Sciences, *Technology: Processes of Assessment and Choice*, published by the U.S. House of Representatives, July 1969.

[11] See for instance *http://www.cefos.gu.se/digitalAssets/1292/1292435_Drottz_Sj__berg.pdf*

[12] NEA (2009) *Considering Timescales in the Post-closure Safety of Geological Disposal of Radioactive Waste*; see p. 8.

[13] Social scientists have also evoked the timescale of societal stability and endeavour, equivalent to only a few hundred years. See for instance A. Blowers in NEA (2008) *Regulating the Long-Term Safety of Geological Disposal of Radioactive Waste: Practical Issues and Challenges*, Workshop Proceedings, NEA Report No. 6423.

[14] This is not unlike early proposals in the regulatory arena. See NUREG-0300 of 1978.

[15] C. Pescatore (2005) *Confidence and Confidence Building – Two Technical and Managerial Concepts for Both the Provider and the Reviewer of a Modern Long-term Safety Case*, IAEA International Conference on the Safety of Radioactive Waste Disposal, 3-7 October, 2005, Tokyo, Japan.; see also the application of the "confidence" questions in the NEA report of the review of Nagra's Entsorgungsnachweis www.nea.fr/html/rwm/reports/2004/nea5568-nagra.pdf ; The NEA review questions are documented in *International Peer Reviews in the Field of Radioactive Waste Management. Questionnaire on principles and good practice for safety cases,* NEA/RWM/PEER(2005)2 *available at* http://www.nea.fr/html/rwm/docs/2005/rwm-peer2005-2.pdf

[16] NEA (2007) *Regulating the Long-term Safety of Geological Disposal: Towards a Common Understanding of the Main Objectives and the Bases of Safety Criteria,* NEA Report No. 6182

[17] NEA (2003) *The Regulator's Evolving Role and Image in Radioactive Waste Management. Lessons Learnt within the NEA Forum on Stakeholder Confidence.* Paris: OECD.

[18] NEA (2008) *Moving Forward with Geological Disposal of Radioactive Waste. A Collective Statement by the NEA Radioactive Waste Management Committee.* Paris: OECD.

[19] NEA (2009) *Optimisation of Geological Disposal of Radioactive Waste: National and International Guidance and Questions for Further Discussion* (forthcoming). Paris: OECD.

[20] NEA (2009) *More Than Just Concrete Realities: The Symbolic Dimension of Radioactive Waste Management.* Paris: OECD (forthcoming). Paris: OECD.

[21] NEA (2007) *Fostering a durable relationship between a waste management facility and its host community*

[22] Pescatore, C. & Mays, C. (2008) "Geological Disposal of Radioactive Waste: Records, Markers and People; An Integration Challenge to be Met Over Millennia". *NEA News*, Vol. 26; see also [Refs. 20 and 21]

[23] See the trailer of a movie, sponsored by the National Geographic, about the Finnish spent fuel repository: www.intoeternitythemovie.com