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**NUCLEAR ENERGY AGENCY  
RADIOACTIVE WASTE MANAGEMENT COMMITTEE**

**Cancels & replaces the same document of 21 September 2010**

**Minutes of the RWMC Reversibility and Retrievability Project Meeting**

**June 21-23 2010, Paris**

Please send any queries regarding this document to [claudio.pescatore@oecd.org](mailto:claudio.pescatore@oecd.org)

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**SESSION I: INTRODUCTION**

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**1.1 Opening of the meeting; and 1.2 Explanation and adoption of the agenda**

In Claudio Pescatore's absence during Days 1 and 2, Brendan Breen chaired the meeting. The agenda was agreed to without changes.

**1.3 Review of project status, including feedback from RWMC-43**

After the opening of the meeting and the adoption of the agenda, Richard Ferch briefly described the current status of the Reversibility and Retrievability project.

Following the last Working Group meeting in Washington DC in December 2009, a substantially revised version of the project report had been prepared and was presented to the RWMC at its meeting in March 2010. Some comments were received at the meeting. In general, the RWMC was satisfied with progress made so far. It was noted that the report was primarily from the point of view of repository development rather than from the point of view of someone planning for actual retrieval, and that this needed to be made clearer. It was suggested that costs and feasibility needed to be dealt with further, and that it was important to ensure that the report gave a balanced point of view.

Further detailed comments were sent by the UK delegation after the meeting. As a result of these comments, a further fairly substantial rewrite was done, and this resulted in the version that was distributed to Working Group members for this meeting (NEA/RWM(2010)10/PROV Reversibility and Retrievability for the Deep Disposal of High-Level Radioactive Waste and Spent Fuel Findings of the Ad-hoc NEA Project, 09-Jun-2010). Further work will be needed on the draft following this meeting, and to take into account additional comments received from Canada.

It is expected that a revised version of the report should be produced by approximately August 10, and distributed to the Working Group for comments to be received by September 10, following which a final version would be prepared and posted to the Reims Conference web site as one of the background documents for the Conference.

The R-scale leaflet had also undergone revisions in February and March of this year, and has been used on a trial basis in the UK and France.

Finally, it would be important for this meeting to move preparations ahead for the Conference in Reims in December of this year.

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**SESSION II: RECENT DEVELOPMENTS IN  
R&R**

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**2.1 Swedish Nuclear Waste Council report**

Carl-Reinhold Bråkenhielm presented the major findings of the recently published document "*Nuclear Waste State of the Art Report 2010*", from a series of yearly reports to the Government and political community. The Swedish National Council for Nuclear Waste is an advisory committee to the

Government. A significant part of this report dealt with the question of retrievability. It was noted that the retrievability-related part of the report benefited from the work of the NEA R&R project.

The Council recommends that pre-closure retrievability should be given more explicit attention in the Swedish programme, particularly from the point of view of decision-making and regulation. Pre-closure retrievability is becoming a significant issue, and public attitudes towards retrievability in Sweden are more positive than they were a few years ago. It is likely that the more positive attitudes toward retrievability reflect a more positive view of technology, and of the possibility of future improvements in disposal or the potential future use of spent fuel, as well as the possibility of correction of problems. Retrievability is more of a preoccupation for decision-makers than for the general public. In general, the public does not differentiate between pre- and post-closure retrievability, and focuses on safety rather than on future resources.

Given that the primary objective of a repository is long-term safety, it was noted that safety must not be compromised by provisions for flexibility and reversibility, even though these may be crucial elements of the stepwise decision making model. The Council's view is that long term security and safeguards must take precedence over the principle of autonomy of future generations, and therefore effective closure without unnecessary delay is required. After final closure of repository, safety- and safeguards-related considerations must be given priority over the principle of freedom of choice of future generations. However, the Council also believes that provisions for pre-closure retrieval have the potential to strengthen the final repository's long-term safety.

There has been some recent discussion in Sweden of the option of deep borehole disposal, driven particularly by interest from some NGOs, and this has also contributed to the discussion on retrievability. It was noted that it is more difficult to verify claims about geological conditions for borehole disposal as compared with a conventional repository, and there is effectively no way to deal with operational incidents or to provide for retrievability either before or after closure. The difficulty of retrieval is considered a benefit by some groups.

During the discussion it was noted that regulators will view retrieval in operations as a given, in order to ensure that safety in operations can be achieved. That is, in order to operate safely and recover from problems (e.g. in handling), the waste packages need to be retrievable during the operational phase of the repository. Post-closure, it is considered that controls, including regulatory controls, institutional controls and possibly retrievability, should be unnecessary, but not impossible.

From the legal point of view, the Council recognizes that many open points remain, especially regarding the ownership of waste. Although it is generally accepted by the public that the State is the only clear candidate to own the waste in the long term, the Swedish government has not stated a clear position on this subject.

From the technical point of view, retrievability during the operational phase is considered a consequence of safety and quality control requirements. Although it is not considered necessary to provide for post-closure retrievability in design and construction, there has been a successful test of the retrieval of a copper canister.

## **2.2 Belgian Citizens Panel**

Hughes van Humbeeck made a presentation on the Belgian Citizens Panel initiative and its report on long-term management of radioactive waste. Jean-Pierre Wouters then described the FANC/AFCN approach to retrievability and reversibility. This presentation was delayed until Day 3 of the meeting.

In addition to a legally-required public consultation that will take place later in the process, the Belgian process also includes a pre-consultation stage involving a 32-member citizens' panel facilitated by an independent organisation (the King Baudouin Foundation). There has been 30 years of research in Belgium and it is accepted that deep disposal in clay is a valid option provided that reversibility, i.e. the possibility to choose a different option, is possible for a reasonable time of at least 100 years. The waste plan is to be accompanied by a strategic environmental assessment, including consideration of the alternatives, and public consultation. In November 2010 the final waste plan, the SEA, the citizens' forum report and a decision document will be presented to the Federal Government. The intention is that the site specific safety and feasibility case will be presented in 2020 and a licence application made in 2025.

The Belgian regulator considers that 'flexibility' is required in the process (broadly equivalent to the term 'reversibility' as used by the Working Group). 'Reversibility' is used for retrieval of waste before closure, while 'retrievability' is considered to apply after sealing and closure of the repository.

The main motivation for reversibility appears to be the ability to choose a different option in light of new information. From ONDRAF/NIRAS' point of view, operational safety, long-term safety and robustness lead automatically to favouring reversibility. The reference design has also taken reversibility into account, for example by already including a supercontainer for HLW and spent fuel with high durability containers having lifetimes well in excess of 1000 years.

From the regulator's point of view, retrievability cannot be an integral part of the long-term safety case, i.e. long-term safety must not depend on retrievability. On the other hand, reversibility of emplacement during operation is a required element of operational safety. During the discussion it was suggested that retrievability during operation is actually a consequence of the need for operational safety, regardless of whether retrievability is formally required or not.

During the discussion, it was emphasized that post-closure retrievability and pre-closure retrievability are two different things. Pre-closure, retrievability does not necessarily drive the design, it's just part of operational safety. Post-closure is politically, legally and technically quite different. Once emplacement is completed, retrievability is no longer an element of operational safety, and maintaining a repository open after this point is separate, although it may still be considered a part of the quality assurance programme to ensure that assumptions underlying long-term safety assessment are met.

It was also pointed out that allowing for reversibility to allow for different options in the future does not mean that the initial concept is no longer considered valid, assuming it still meets basic safety requirements. Closure represents a point in the project where we declare that the disposal is complete and reversibility is no longer required, regardless of whether or not there are other options now available.

Regarding decision making for retrieval, the decision on whether to retrieve, for example in the case of an operational defect, may require a safety assessment. There are accepted margins between the design provision and the safety case assumptions, and it may be important to avoid overselling retrievability as a panacea, or essential, for every incident that might occur during operations.

### **2.3 ANDRA's intermediary report to Government on Reversibility (Dec. 2009)**

Jean-Noël Dumont made a presentation on Andra's intermediary report to French Government on Reversibility. The document was issued to the French Government in December 2009, and revised in February 2010. A new edition for extended distribution is in preparation. This final printing is anticipated in October 2010.

The first chapter of the document is about the approach for defining reversibility requirements. The concept of reversibility has progressively emerged in French regulation. The parliament has adopted in 2006 deep geological disposal as the reference solution, but reversibility is also required for a period of at least 100 years. According to the definition adopted by Andra in 2002, reversibility is a “progressive and evolutionary management of the disposal process, giving freedom of decision for future generations”.

From the technical point of view, reversibility relies on design features supporting retrievability of waste packages before closure, extensive monitoring and interim storage. There are many open questions related to monitoring that have yet to be resolved. It is still an open question whether monitoring will be required post-closure. It was noted in discussion that if monitoring is a legal requirement, this implies the ability to make use of the results. The quality of monitoring results must be adequate to support decisions on retrieval. Raw data as well as interpreted results will be stored, to allow re-interpretation.

It was pointed out that the European Commission’s MoDeRn project is addressing a range of questions on monitoring of geological disposal, including how to address unexpected results. There are many important questions still to be answered. It was pointed out that monitoring without criteria can be confidence-lowering rather than confidence-raising.

Regarding interim storage, since retrievability of waste is not the first design option, the construction of a separate interim storage facility to cover the contingency of retrieval is not considered justifiable. A multipurpose staged interim storage facility is foreseen, which can be used to store waste before disposal as part of the operational programme, as well as interim storage in the case of retrieval of some waste packages. The licensing and acceptance of such a multi-purpose facility may be controversial.

The decision-making process is based on implementation by steps, leading to the introduction of the concept of partial closure. This concept does not make retrieval impossible, but progressively more complex. In this stepwise approach, some hold points are expected that will facilitate considering all previous stages and making appropriate decisions for subsequent stages, with the participation of stakeholders. It is realized that decision-making for retrieval would be a major, time-consuming decision process, and the cost of retrieval would likely be similar to or greater than the cost of disposal.

## **2.4 ANDRA’s publication on Reversibility as a Governance device for geological disposal**

Luis Aparicio presented Andra’s recent publication on reversibility and described the aims and supporting work for the document. The work is actually the result of a major collaborative effort between Andra and outside experts in the social sciences and humanities initiated in 2008. Andra is the book’s editor and is responsible for one of its chapters, which was written collectively by more than ten representatives of different teams of the Agency. It was noted that the experience of integrating scientific and social points of view has been highly enriching.

Reversibility as a governance principle follows from the 28<sup>th</sup> June 2006 Planning Act on radioactive waste management. This principle blurs the frontiers between experts, public, and decision-makers. In order to prepare the public debate and the application required in that document, Andra is committed to gather the different views on the topic, technical as well as social. The robustness of Andra’s project will be measured according to its capacity to contain these different views. Defining a reversible geological repository, i.e. a definitive solution that provides flexibility over time, is both a technical and political complex issue which demands strong expertise in both areas and requires mediation skills. The role played by social sciences and humanities will be crucial for the achievement of the required objectives, since continuing dialogue with all interested parties, international partners, researchers and, particularly, local actors is necessary.

The book stresses that different decisional and safety models are embedded in the proposed solutions to manage radioactive waste. In Andra's approach, reversibility represents an ability of society to intervene in the actual disposal process. Available options are assessed at different stages, on the bases of previous decisions, and reversibility is defined recursively. But the discussion on reversibility is mainly a technical one, while the social acceptability issue of the deep geological disposal is pervasive in the public space. Reversibility is not a specific and unmovable argument for promoters or detractors of deep repositories.

In the discussion, it was noted that the ability to retrieve may be seen either as positive, as it promotes autonomy, or as a burden that imposes a requirement on following generations to take decisions and actions. It was noted too that long-term safety is rooted in the safety culture of the original implementer. This depends on organizational issues, which represents yet another branch of social science input. This is not only a matter of "public relations" (building trust); it is also a place where social values impact directly on safety. Reversibility implies confidence in the ability of future generations to exercise freedom of choice, but on the other hand it is frequently considered that the human aspect is usually the weakest link in technical projects.

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### **SESSION III: REGULATORY POLICY VIS-À-VIS REVERSIBILITY AND RETRIEVABILITY**

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Two closely related discussion sessions were led by Richard Ferch. Brittain Hill of the USNRC participated by telephone.

As general comments, it was noted that terminology continues to be an issue; for example, the Belgian use of the terms reversibility and retrievability is different from the NEA's. It is important in the Working Group's work, including the final report, to distinguish carefully between the two concepts, as well as between retrievability both before and after closure.

The question of reversibility and retrievability and how they affect regulatory policy will be brought to the Regulators Forum for follow-up discussions.

#### **3.1 Reversibility: how challenging for regulators?**

In France, the regulator is considering the question of the logic to be followed for reversibility. If a single licence is given for the whole operational period, it is expected that the first part will be defined in detail. Later parts will be less well-defined, but basic safety principles must be assured.

There are formal licensing actions at siting, construction, operation, and closure, but not necessarily at various other points such as partial emplacements, backfillings, etc. Nevertheless, these actions might be considered to be key points that would be submitted in any case to regulatory review, either through the terms and conditions of the authorization or being considered as "significant modifications" requiring a licensing decision. If as a consequence of stepwise decision-making there is a significant change, e.g. backfilling that makes retrieval more difficult, the regulator would need to be involved, i.e. a staged process would also involve staged authorizations even if the licensing process was not explicitly staged. In the US, any condition that would substantially affect the retrievability of waste prior to closure would require a license amendment.

In general, the consensus appeared to be that existing licensing processes for dealing with significant changes, together with requirements for periodic reviews, provide an adequate regulatory framework for dealing with reversible and stepwise decision-making processes during the pre-closure phase.

### **3.2 Policy of retrievability and retrieval of waste: how challenging for regulators?**

In Spain for el Cabril LILW disposal facility, the regulator established requirements related to retrievability which resulted in an increase in the robustness of the disposal system. No decision has been taken on the issue of retrievability for high-level waste.

From the Swedish point of view, for operational safety the regulator demands that there is always a safe position to restore to in case of problems. For practical purposes, this means that retrievability of packages is an operational requirement during the emplacement phase. On the other hand, the law says that a final repository must not require societal control, including retrievability. Therefore it is expected that the regulators will require retrievability pre-closure, but post-closure they will not, although it is not necessary to rule it out completely – it is not required, but need not be prevented. Closure cannot be approved until the regulator is certain that disposal is the right option and safety is assured. After closure, the logic of retrievability suggests that the design should not make it unnecessarily difficult to retrieve, but this is outside the original regulatory remit.

One point of interest relates to delayed closure. If decision making and retrievability requirements led to a delay in sealing or backfilling galleries, there might be an impact on safety. Therefore the regulator needs to be involved in any such decisions, preferably from an early stage when such delays may be considered or planned as part of the development process (e.g. in a “flexible” or “adaptive” staged process).

After closure, it is generally agreed that retrieval would be a new nuclear operation requiring a new licence. One question that may need to be resolved in some countries is ownership of the material after closure. A related issue is the possible distinction between physical closure (sealing of the last access shaft) and regulatory closure, which may be some time later in order to accommodate a post-closure surveillance period during which the operator may continue to be responsible. If the time period foreseen for such a surveillance period is very long, it may be necessary to have some method to transfer responsibility to the state, since the organization originally responsible for the production of the waste may not continue to exist, especially beyond the end of nuclear energy production in a country.

This led to a discussion about maintaining competencies for very long time periods. If institutional oversight of some kind is foreseen for an extended period, the transfer of both knowledge and the ability to act on it may be key points. The RWMC’s memory project was to start the week after the Working Group meeting, and it was suggested that this project needs to consider the impact of post-closure retrievability on memory requirements.

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## **SESSION IV: ETHICS AND VALUES**

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### **4.1 Balancing safety vs. freedom of choice vs. fairness vs. acceptability**

Richard Ferch made a presentation on behalf of Claudio Pescatore in which he presented the Swiss “Monitored long-term geological disposal” concept, and the process which led to its adoption, as an illustration of the interplay among the ethical obligations to protect future generations, to reduce the

burdens of both hazard and decision making, to preserve freedom of choice and action, and to ensure public acceptance.

There was some discussion on whether public acceptance was really an ethical principle on the same level as the others. It was pointed out that we cannot achieve safety without a willing voluntary host community. Without the ability to achieve safety (poor geology) we don't even discuss acceptance, but nevertheless acceptance is a *sine qua non*.

There was also discussion about the hierarchy of the principles. There are situations (e.g. in medicine) where fairness (informed consent) may take precedence over safety, so "safety first" should not be considered an *a priori* principle, but rather as the outcome of a considered judgment. There was also a discussion about imposed risks vs. personally accepted risks, and about balancing the needs of society vs. the individual. There is also a time dimension, which may involve seeking intergenerational equity without disadvantaging present society (e.g. balancing worker safety vs. future public safety). Since implementation itself can last several generations, the time dimension may apply even during operation.

The presentation included a table comparing degrees of retrievability vs. disposal/storage concepts. While it was agreed that the table had stimulated discussion, it was not considered suitable for inclusion in the report, as there was little consensus on where individual programmes would fit within the table.

Other topics raised during the discussion included terminological topics such as the need to avoid "hot button" phrases, and differences between phrases such as "producer pays" vs. "polluter pays".

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## SESSION V: DECISION MAKING PROCESSES

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### 5.1 Reversibility and Stepwise decision making

This session was a discussion led by Carl-Reinhold Bråkenhielm on the relationship between reversibility and stepwise decision making processes. Reversibility is one aspect of stepwise decision making, but not the only one.

There was discussion about the relationship between regulatory decision making and societal and implementation decision making. The basis for the regulatory process is not necessarily the same as for a flexible stepwise decision making process. The steps in typical licensing processes are very broad, and may limit the steps that are possible during implementation. For example, a proposal to dispose of a small fraction of the wastes and wait for several decades before proceeding with the rest of the wastes might not fit within the normal series of licensing decisions. On the other hand, it was also pointed out that there is more to regulatory oversight than licensing, and that the day-to-day regulatory oversight process could be compatible with a flexible process involving many small steps.

The existence of multiple regulators or decision making bodies also complicates the decision making process. It was agreed that it is important to keep dialogue and negotiation open among all parties, and not to become too tied down to a fixed framework for decision making. However, this must be done in a way that respects the need for independence of the regulators. This led to some discussion about the dangers of "group think" within specialized communities of practice. It is important to ensure that the overall goal of public safety is always kept in mind, and that third party interests are accommodated in the process.



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**SESSION VI: MONITORING AND INSTITUTIONAL CONTROL**

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**6.1 Monitoring and Institutional Control**

Jean-Michel Hoorelbeke gave a presentation on the topics of monitoring and institutional control and their relationship to reversibility of decisions and decision-making for retrieval. In France it has been emphasised that closure involving backfilling and sealing does not mean 'walking away', but that there will be continued monitoring and institutional oversight post-closure. This is the justification for considering human intrusion scenarios in safety assessments only after a period of 500 years.

Monitoring is therefore important not only before closure, in support of stepwise decision-making during repository development, but also after closure. Before closure, monitoring is a normal and expected part of the engineered development process, regardless of whether a programme incorporates reversibility and retrievability or not. Since post-closure safety cases must provide assurance of safety even in the absence of institutional control, monitoring after closure is not part of post-closure safety assessments, but the provision of post-closure monitoring may still be an important component of building confidence and trust. Public concerns about monitoring are more likely to be related to the post-closure stage, as monitoring prior to closure is expected and routine. It is important to communicate the distinction between the ability of the safety case to demonstrate safety in the absence of monitoring and institutional control vs. the intention whether to terminate monitoring and institutional control or to continue them after closure, either for a specified period or indefinitely.

There is a significant variety of data that can be made available during pre-closure monitoring, and technical work on monitoring techniques continues. Research and development into monitoring techniques can improve the robustness and lifetime of instruments and improve the capability to measure important parameters. Such work can be expected to take place in all programmes, independently of whether reversibility is required or not.

If retrievability after closure is considered a requirement, there are significant questions that must be answered about the ability of monitoring to supply the information that would be required to support decisions on whether or not to retrieve. While environmental monitoring will likely be required for acceptance and confidence in safety, it is unlikely that remote environmental monitoring during the timeframes envisaged for monitoring will provide useful information about the evolution of a deep geological repository.

In addition to monitoring, there is also research being carried out into memory keeping over very long time scales. An important issue with respect to preservation of records is whether the records will be usable (understandable, language, data, diagrams, etc.) over long time scales.

It was noted during the discussion that there was information on monitoring from the responses to the questionnaire on reversibility and retrievability that was not reflected in the current draft of the report. It was agreed that the report needs to deal with monitoring issues.

There was also discussion on the relationship between institutional oversight and monitoring. While passive controls such as land-use records, archives and markers may not depend on monitoring, the possibility of more active controls that may be implied by requirements for extended periods of retrievability may also require the availability of ongoing current information about the repository. This leads to the difficult question of how to provide such information without the risk of compromising the

safety case. There may be a need to support continued development of remote monitoring techniques to support post-closure retrievability in those programmes that incorporate it.

There was also some discussion on passive controls such as knowledge management and memory keeping. It was pointed out that the range of situations in which memory can be lost is quite broad. There are recent examples of disruptions in institutional continuity that could lead to failure of institutional controls (e.g. the breakup of the former Soviet Union).

Passive institutional controls are most often counted upon to reduce the likelihood of inadvertent intrusion, as well as in support of non-proliferation safeguards. Because of the likelihood of eventual loss of memory, inadvertent intrusion is one of the scenarios that are usually addressed in safety cases. Should this be considered part of normal evolution, or an abnormal accident scenario? Does the answer to this question depend upon the time scale in question?

There was some discussion on the cost of monitoring and institutional control. It was pointed out that a balance should be considered in the decisions dealing with both issues, taking into account both the technical value and the societal value of these actions. The questions to be answered are what is to be monitored, how is the monitoring to be conducted and for how long?

Post closure monitoring and institutional oversight were also linked to responsibilities. Who is responsible for post-closure oversight? In this respect, it was noted that normally the regulator's responsibility terminates with the closure authorization. In some countries responsibilities after the repository closure are formally or legally defined (e.g. in Spain, the responsibility of the repository once closed falls on the government, by law) whereas in others this issue remains open.

It was generally agreed that monitoring and institutional oversight are subjects that will undergo continued development. There is a significant societal dimension to these topics.

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## **SESSION VII: RESEARCH, DEVELOPMENT AND DEMONSTRATION**

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### **7.1 R&D for Retrievability**

Kenichi Kaku gave a presentation on the current Japanese research and development programme related to retrievability and reversibility, followed by a short presentation to provoke discussion on the role of research and development for retrievability.

In Japan, where there is a voluntary approach to finding a site, it is considered that data must be gathered during the construction and operational period for a repository for the purpose of confirming the reliability of the safety assessment. The regulatory position is that retrievability should be retained until performance confirmation is completed. In practice this is likely to be until authorization for closure is granted. NUMO have performed design studies for retrieval from conceptual repositories involving both vertical and horizontal emplacement of waste packages.

With respect to the role of research and development for retrievability, the issues of the motivation for R&D, relative importance of retrievability and resource allocation, the interaction between repository design and retrievability, and the level of demonstration of feasibility of retrievability were discussed.

An important question to be resolved in each programme relates to the level of resources to be allocated to R&D on reversibility and retrievability at various stages of development. Programmes in which retrievability is a requirement will have different needs from programmes in which it is optional.

The motivation for research programmes was also discussed. Is the research carried out to improve acceptability, to support repository operation, or to allow for flexibility? It was suggested that research should always support safety, and not be done purely in order to improve stakeholder acceptance. Research and development that is triggered by stakeholder requests should be integrated into the developer's overall programme and not seen as simply an add-on.

It was also pointed out that retrievability is only one small part of the overall design and development process. A strategic decision is needed during the repository development process as to whether efforts should be focused on retrieval methodologies from an unmodified repository design, or on modifications to the design in order to facilitate later retrievability.

Decisions on the type and extent of research may also correlate with a stepwise decision making process. Depending on the stage currently under consideration, the research and development needs will differ.

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## SESSION VIII: COSTS AND FEASIBILITY

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### 8.1 Costs of retrievability and retrieval

Gloria Kwong gave a presentation on issues for consideration in the costs of retrieval. This was a preliminary study only. Little work has been done in this area since a Swedish study in 1998 had looked at 9 scenarios.

The fundamental principles were seen as managing waste so as not to impose undue burdens on future generations, using a financial system funded during the period of waste production and by the producer of the waste. Costs of retrievability would be dependant on repository design and its stage of operation, the volume of waste emplaced, and the timescale over which retrievability was to be planned for. This latter factor would influence the need to upgrade components and extend operations.

The costs associated with retrieval operations would include those related to secondary waste management and additional processing and storage facilities. An ongoing Canadian study is looking at only equipment costs in relation to used fuel container retrieval and demonstration of the technology, and is expected to report around end 2010. Retrievability is considered feasible during all stages, but retrieval without specific provisions will be more difficult and costly. Detailed cost estimates would be needed in order to make a fair comparison.

Discussions noted that 'bundling' of costs associated with both development of a repository and ensuring retrievability could make it difficult to identify separately the costs of a requirement for retrievability. There are many factors influencing the cost of retrievability, including repository design, the volume of waste, and the timescale during which retrievability is required. It was seen as important to recognise not just costs of retrieval of waste but also those of new nuclear installations to process retrieved waste and its packaging, and those of alternative repositories for the waste. It was noted that costs of retrieval are likely to be comparable in magnitude with those of repository construction and operation.

The question of responsibility for costs was also discussed. It is important to distinguish between costs that are the responsibility of the original owner, and those that are the responsibility of the eventual retriever of the wastes. Generally speaking, those costs that support the safety case are the responsibility of the original owner, but costs for provisions that do not support safety, but are only there to support retrievability, are more contentious. It is difficult to determine where to draw the line between good engineering practice that would have been followed even without retrievability, vs. costs that are incurred solely to support possible retrieval.

It was also pointed out that persons calling for retrievability need to be aware of the costs, not only of retrieval, but also of the costs of establishing and operating new facilities to deal with the recovered material, possibly including re-disposal. Retrieval is not the end-point. One way or another, the public will end up paying the costs.

## **8.2 Discussion on Decision-making for retrieval**

Peter-Jurgen Larue gave a presentation on evaluation criteria and results of comparison of options for the decommissioning of Asse. The options considered were retrieval of emplaced waste, relocation within the mine of emplaced waste, and backfilling of the mine with waste left in place. The current unstable state of the Asse mine and lack of detailed knowledge of the inventory and packages was described.

Evaluation of options had been carried out against criteria developed with the involvement of stakeholders and published on the internet. These criteria relate to operational safety, environmental consequences of brine inflow, long-term safety, feasibility, and time requirement. Systematic evaluation had been carried out and the ranking and weighting had resulted in an evaluation of retrieval > complete backfilling > relocation, though no one variant was optimal. Weighting played a key role in the ranking. Re-evaluation would be necessary in the case of instability increasing brine inflow considerably, which could lead to unacceptable worker doses for the retrieval option. The dominant factor favouring retrieval had been difficulty in demonstrating long-term safety for future generations.

A detailed action plan is being followed which involves elaboration of plans for retrieval, further evaluation of uncertainties, stabilisation of the mine, and taking emergency measures to limit the effects of uncontrolled rock fall. Preliminary estimates of cost for retrieval are 1 billion euros, and of subsequent disposal are 3 billion euros. Retrieval is expected to take around 15 years.

There was discussion of the uncertainties involved in the project. Much would not be known until exploratory work had been carried out. There was danger of collapse of chambers on opening them and that waste might not meet current acceptance criteria when assayed. There are significant licensing and waste acceptance issues involved with the eventual site for re-disposal of the retrieved wastes. It is likely that a new interim storage facility will be needed. There are many technical difficulties that remain to be resolved.

A significant contributor to the original problem is the very long time period during which the mine chambers were kept open. Keeping the chambers open has led to instability and brine intrusion. Stabilization of the open chambers is one of the key technical points that must be addressed.

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**SESSION IX: DRAFT R & R REPORT**

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**9.1 The current draft report**

There had been many comments on the draft report and not all had been addressed yet. It was noted that detailed comments had been received from the Environment Agency for England and Wales, most of which had been dealt with. It was noted that participants would get a further opportunity to comment on the next draft in August. If comments were sent on the present draft by 16 July these would also be considered in the redraft.

There was discussion of several points in the current draft.

Care must be taken to preserve neutrality and not to present retrievability or reversibility as unavoidable requirements.

It was suggested that in line with adding the words 'In this context' to the R-Scale leaflet for clarity similar words could usefully be added to 'terminology' section of the draft report at the end of the definition of 'storage'. This would also avoid confusion as the definition of storage includes the word 'retrieve' and 'retrieval' is also defined in the terminology section. The proposed addition in the case of the draft report was 'In the context of this report waste storage is not an alternative to disposal; rather it is a step in the management strategy leading to final disposal'.

It was requested that more attention be paid to constraints on decisions about retrieval (doses, licensing, new facility, management of recovered waste). It was pointed out that Asse gives us an example of the complexity of retrieval decision-making.

**9.2 Way forward**

Of particular urgency and importance was the point that members should update the table/summary of national positions sent out on 7 May. Once updated, these are to be placed on the conference web site. Updates were requested by 16 July.

The questions in the agenda for Session III will be sent to Regulators Forum members in order to get a more representative and complete set of responses, since there were not many regulators represented in the Working Group.

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**SESSION X: R-SCALE LEAFLET**

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**10.1 Development of the R-Scale Leaflet**

Jean-Noël Dumont described the evolution of the leaflet since the Washington meeting. A discussion followed on the experience with the leaflet and additional comments on its text. The leaflet is considered to be near completion and some relatively minor amendments were proposed, such as amendment of 'waste' to 'waste packages' in one section and the addition of 'In this context' before 'waste storage is not an alternative to disposal; rather it is a step in the management strategy leading to final disposal'. Several minor changes to Figure 1 were discussed.

The R-Scale has been used at an “open doors” session in Bure and in the Andra presentation to government. It has been used in a number of consultation processes in the UK. The final diagram of the leaflet (Figure 4) was identified as being particularly useful.

All agreed that the leaflet, and in particular the final diagram, had been a useful explanatory tool and particularly the final diagram. Once the 4-page leaflet is complete it is intended to attempt to produce a simplified 2-page leaflet based on the final diagram.

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## **SESSION XI: NEXT STEPS**

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### **11.1 Planning for NEA international conference on R&R, Reims, France, 15-17 December 2010**

Claudio Pescatore gave a presentation of the vision for the Reims conference, based on the presentation that had been given to the RWMC in March. The plans were updated during the discussion. Several changes to the lists of proposed chairs, speakers and panellists for the various sessions were made. These were to be followed up on by making contacts from Working Group members and the Secretariat to the prospective participants.

### **11.2 Near-term way forward for the Reims conference and R&R project**

Conference preparations will continue, according to the plans developed in the previous discussion. Working group members and the secretariat will contact potential speakers.

There was a discussion on follow-up actions following the conference. It was tentatively concluded that a meeting of the Working Group would be required to follow up on the conference and finalize the report, probably in the early February 2011 time frame.

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## **SESSION XII: CLOSURE OF THE MEETING**

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### **12.1 Other business**

No new items were identified.

### **12.2 Recap of the discussions and of the decisions made**

The meeting was adjourned at 5:00 pm

A list of actions follows:

Richard to send to members a short list of remaining outstanding questions for the report ASAP (members to respond with comments on draft report by July 16 - see below).

Secretariat to distribute this list of actions ASAP.

Rapporteurs to send notes on their sessions to Richard by July 2.

Secretariat to distribute questions for Session III to Regulators Forum members by July 2 (for responses by July 30 - see below).

WG members, Secretariat to contact possible presenters/chairs/participants for Reims conference by July 9.

R-scale task group to update leaflet by July 9, for posting on web site.

Richard to prepare minutes of the meeting for distribution by July 9 (for responses by July 30 - see below).

WG members to send updates to table of national positions on R&R by July 16, for posting on web site.

WG members to send references to additional candidate documents for list of references on R&R by July 16, for posting on web site.

WG members to supply references on decision making processes (e.g. FANC slide, UK EA guidance figures) by July 16, to contribute to report and/or list of references.

WG members to send comments on currently distributed draft of report by July 16, for next draft.

WG members to comment on meeting minutes by July 30, for posting.

RF members to comment on/respond to questions on regulatory policy re R&R by July 30, for next draft.

Secretariat (writing team) to distribute next draft of report by August 13 (for response by September 10 - see below).

WG members to respond with comments on the draft by September 10, for preparation and posting of final draft.

Draft report to be posted to conference web site by September 30.

ANNEX: LIST OF PARTICIPANTS

Belgium	Walter BLOMMAERT Federal Agentschap voor Nucleaire Controle (FANC)
	Jean-Pierre WOUTERS Federal Agentschap voor Nucleaire Controle (FANC)
	Hughes VAN HUMBEECK ONDRAF/NIRAS
Canada	Richard L. FERCH Consultant to NEA
	Gloria KWONG Nuclear Waste Management Organization (NWMO)
Czech Republic	Miroslav KUCERKA Radioactive Waste Repository Authority
France	Luis APARICIO Andra
	Jean-Noël DUMONT Andra
	Jean-Michel HOORELBEKE Andra
Germany	Peter-Jürgen LARUE Gesellschaft für Anlagen- und Reaktorsicherheit(GRS) mbH
Japan	Kenichi KAKU Nuclear Waste Management Organization of Japan (NUMO)
Spain	María del Carmen RUIZ LOPEZ Conseil de Sécurité Nucléaire
	Miguel CUNADO ENRESA
Sweden	Carl Reinhold BRAKENHIELM Uppsala University
	Saida ENGSTRÖM Swedish Nuclear Fuel and Waste Management Co. (SKB)



United Kingdom

Brendan BREEN  
Nuclear Decommissioning Authority (NDA)

George HUNTER

OECD Nuclear Energy  
Agency

Claudio PESCATORE