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NUCLEAR ENERGY AGENCY
RADIOACTIVE WASTE MANAGEMENT COMMITTEE

Cancels & replaces the same document of 22 September 2010

Summarised responses to Retrievability and Reversibility (R&R) questionnaire issued to NEA member countries in May 2008

The second phase of the RWMC Reversibility and Retrievability project was a data gathering phase, through use of a questionnaire to elicit information on the current status of disposal programmes in member countries with respect to the role(s) of reversibility and retrievability in those programmes. The questionnaire was issued to NEA member countries in May 2008.

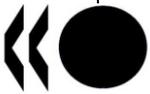
A working group was convened and a meeting was held in Toronto, Canada in October 2008 at which the responses were analysed. The responses to the questionnaire were found to be very helpful in illustrating areas of general agreement, areas where there are significant differences, and areas where further discussion and investigation could be useful among countries. The working group has held a number of subsequent meetings at which various topics arising from this analysis have been discussed and developed.

The responses to the questionnaire are summarised in the attached table. They were updated in 2010. A copy of the questionnaire is also attached following the table.

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	1. Definitions and Scope of Application	2. Historical Development	3.1 Current Policy - General	3.2 Communications with Stakeholders	3.3 Stepwise Decision-Making
Austria	N/A	The issue of final disposal of radioactive waste is still unresolved. Questions regarding reversibility and retrievability have not played a major role. Austria is very interested in common shared repositories for radioactive waste.	The concepts of reversibility and retrievability would influence our decision making because of the following reasons: <ul style="list-style-type: none"> • Appropriate new techniques could be developed in the future. • Technical problems of disposal could lead to unexpected hazards or risk. • The public acceptance for the disposal of radioactive waste is likely to be higher if retrievability of the waste is kept. 	N/A	N/A
Belgium	Terms: “phased or stepwise disposal process” “flexibility” - the possibility of reversing decisions already taken R&R both refer to taking back waste emplaced in a repository; by the same technique as used for the emplacement in the case of reversibility (before sealing) or by other techniques (more complicated, ...) after sealing or closure in case of retrievability.	The issue of retrievability will be dealt with specifically in the context of the first Safety and Feasibility Case (2013).	Retrievability is not considered to be a firm requirement. Retrievability must not adversely affect long-term safety. Care is taken not to make decisions that would rule out the possibility of a hypothetical retrieval.	A Waste Plan in which political and societal requirements will be taken into account via a process of a broad societal discussion and involvement is currently in progress.	The regulatory framework describing amongst others the licensing process is in development. The licensing process is based on a stepwise approach. The role of retrievability has not yet been determined.
Canada	“Retrievability” - the ability to remove waste from where it has been placed “adaptability” - the capacity to adapt to changing knowledge and conditions over time Stages of development include Preparing, Technology Demonstration and Long-Term Containment. Retrievability of packages of used nuclear fuel applies both during the preclosure phase and	The collaborative development of the management approach, Adaptive Phased Management, and in particular the need for retrievability of used fuel throughout all phases of implementation, was responsive to the needs expressed by citizens and specialists in radioactive waste management during the NWMO’s study process. Retrievability of used nuclear fuel is a fundamental feature of Adaptive Phased Management, the approach	Retrievability of used fuel during all phases of implementing Adaptive Phased Management is an important feature of the used fuel management approach in Canada. An extended period of monitoring before the access tunnels and shafts are backfilled and sealed is included in the plan.	It is expected that the NWMO would communicate with interested individuals and organizations all key decisions associated with implementing Adaptive Phased Management including a key decision associated with retrievability of used fuel. The NWMO is committed to providing meaningful opportunities for interested individuals and organizations in	Adaptive Phased Management has stepwise decision making and decisions about the form and extent of retrievability of used fuel at any phase would be considered during implementation of Adaptive Phased Management. Retrieval of used fuel would become increasingly more demanding and costly during the later stages of implementing Adaptive Phased Management. Keeping the deep geological

	during the postclosure phase.	selected in June 2007 by the Government of Canada for long-term management of Canada's used nuclear fuel. During the NWMO's three-year study process from 2002 to 2005, Canadians indicated that retrievability was an important feature that they wanted in the approach for long-term management of Canada's used nuclear fuel.		Canada to participate with implementing Adaptive Phased Management including key decisions such as the retrieval of used fuel.	repository accessible for monitoring and retrievability for an extended period of time (e.g., several hundred years after used fuel container placement operations are completed) is not expected to become more difficult with time.
Czech Rep.	The terms reversibility and retrievability are not defined or used. Reversibility is a natural consequence of stepwise decision making, but retrievability is not part of the programme.	Discussions on retrievability and reversibility were held among representatives of the involved stakeholders during the Czech concept development. These discussions led to the decision not to include the reversibility and retrievability explicitly in the proposed concept.. The main reasons for non-incorporation of retrievability into a DGR development concept were the safety and economical aspects of the retrievability concept. Reversibility is implicitly incorporated in the concept as natural feature of the stepwise decision making process. Retrievability is considered mainly politically-driven.	The reversibility concept is implicitly included into the stepwise DGR development approach, during which at each decision making stage several options for follow up stages will be discussed. Involvement of stakeholders into the decision making process, in which they could influence the proposed solution (in the extreme also reverse the solution) makes the process transparent and acceptable to the broad public.	The main forum for opinion and policy discussion is during the particular stages of the environmental impact assessment when public hearings are part of the process. If the issue of retrievability is raised, stakeholders will take part also in that decision making process.	A stepwise decision making process is an essential part of the Czech concept. If the question of retrievability is raised for inclusion into the concept, it will affect and will make more difficult the following decision making process. This issue is still open.
Finland	The only term used is "to open" the repository, i.e. retrievability. The final disposal has been designed in such a way that it is technically feasible to retrieve the final disposal canisters from the repository to the surface in all phases of the project (including post-closure).	Retrievability entered the policy discussion at the time of the EIA in 1997-1999. Politicians, in particular, wished to have the possibility of doing things better in the future if new technology became available. Possible conflicts are seen between retrievability requirements, safeguards considerations and long-term safety aspects; retrievability must not compromise the long-term safety of disposal in any way. Retrievability is not considered a safety issue.	Spent fuel disposal shall be planned so that no monitoring of the disposal site is required for ensuring long-term safety and so that retrievability of the waste canisters is maintained to provide for any development of technology that would make it a preferred option. Retrievability applies only for spent fuel and HLW. Retrievability requirements do not vary between stages of repository development or with time.	Retrievability has not played an important role during public communication.	Key milestones and phases are: the site characterisation and selection phase; the site-specific research and design phase; the application for the construction licence; construction and non-radioactive pilot testing; the application for the operating licence; and disposal operation.
France	Reversibility - the possibility of	The 1991 French Radioactive Waste	The reversibility of deep	Andra will have a dialogue from	Stepwise decision making process

	<p>progressive, flexible management of the disposal process, leaving future generations free to make their own decisions in the matter. The staged approach is as follows: “Post package emplacement” stage; “Post cell-sealing” stage; “Post module-closing” stage; “Post repository zone-closing” stage; and “Post-closure” stage.</p> <p>For the time being, reversibility and retrievability are focused on the pre-closure phase, which does not exclude the recoverability of waste after closure. The 2006 Act states that reversibility duration may not be less than 100 years.</p> <p>By law, the wastes considered for deep reversible geological repository are those that cannot be disposed in above-ground or near surface repository for safety or radioprotection reasons.</p>	<p>Act requested the feasibility study of a deep geologic repository to include consideration of a reversible approach. During the siting phase of the URL (1992-1998) reversibility appeared to be a significant issue for public acceptance and decision makers.</p> <p>Here are listed reasons found by Andra to express the motivations for reversibility: prudent approach allowing progressive decision-making, precautionary principle, and attitude of modesty. These are obviously social issues. Note that politicians recently expressed that a reason for reversibility is the possible need for retrieving failing disposed wastes. This is a safety-related issue.</p>	<p>geological disposal is required by law for a period which cannot be less than 100 years. The historical development shows that this demand relates to social acceptance.</p> <p>Regarding variation between stages of repository development or with time, the answer to these questions will come from the work that Andra will have to carry out from now to 2014 in order to prepare proposals for the future law. Reversibility is not addressed in the law after final closure for the time being.</p>	<p>now to 2014 with various stakeholders to prepare socially acceptable options with respect to technical limits. In particular, the decision-making process will be an important issue.</p> <p>A reversibility - retrievability scale would provide a suitable framework to support dialogue with stakeholders.</p> <p>Stakeholders will take a strong part in establishing proposals for reversibility requirements. It is expected that this will address the motivations for reversibility, and the decision-making process.</p>	<p>is incorporated in French programme, technically and legally. The license for creating the disposal facility cannot be delivered unless the reversibility requirements defined by law are fulfilled.</p> <p>It is anticipated that the following features will be considered when assessing the difficulty of retrieval or recovery:</p> <ul style="list-style-type: none"> - Time of access to the disposed waste according to the available technology. - Availability of technology for retrieval of the package, considering its state: package integrity, mechanical environment (is it free of movement or not) - Estimated dose associated with retrieval.
Germany	<p>Retrievability - possibility to retrieve waste packages disposed of in deep geologic formations.</p> <p>Reversibility is not defined as part of the waste management concept.</p>	<p>Retrievability was part of the conceptual and safety related issues regarding the disposal of radioactive wastes raised in 2000. In 2005 a workshop was held organized by the Federal Office for Radiation Protection (BfS).</p> <p>Conflicting points still exist and discussion will continue. The following arguments were raised:</p> <ul style="list-style-type: none"> • Waste may not be stored in a geologic repository until evidence of long term safety is given. • Retrievability may not compromise disposal safety. • For common disposal concepts retrievability can be realized without particular measures. 	<p>Reversibility is not considered for geologic disposal in Germany. It is intended to implement safety requirements on waste containers which contribute to retrievability. The concept of retrievability itself is not an element to be licensed.</p> <p>The new Safety Requirements Governing the Final Disposal of Heat-Generating Radioactive Waste, Final version, July 2009 (still under discussion with federal lands, but mandatory for BfS) implements following requirements in context of R&R. Waste containers must fulfil the following safety functions, with</p>	<p>A discussion with a wide range of stakeholders on this issue was held from October 30 to November 1, 2008 in Berlin.</p> <p>After the former operator’s decommissioning concept of the ASSE II mine had come under public criticism, Federal and Lower Saxony Ministries (BMBF, BMU, MU) agreed in November 2007 upon examining other decommissioning options. For this purpose, the Comparison of Options working group (AGO) and a stakeholder group (Begleitgruppe) was established in March 2008. Member of so-</p>	<p>A stepwise decision-making process has not yet been incorporated within the relevant German administrative legislation.</p> <p>A proposal for a stepwise procedure is drafted by the federal ministry for the environment, nature conservation and reactor safety in new Safety Requirements Governing the Final Disposal of Heat-Generating Radioactive Waste, Final version, July 2009 (Chapter 5, Step-by-step procedure and optimisation).</p> <p>A stepwise decision-making process is used to optimize the repository design: “The concept and design of the</p>

		<p>• Flexibility of disposal concept will be improved.</p> <p>The main drivers for discussing retrievability are NGO's and the experiences by closing the Asse mine.</p> <p>At the beginning of 2009, the Federal Office for Radiation Protection (BfS) took over operatorship for the Asse II mine from Helmholtz Zentrum München. In 2009 BfS investigated three different options how Asse II can be safely decommissioned.</p> <p>One option was to retrieve the waste from the mine and to emplace it somewhere else.</p> <p>On January 2010 BfS presented as the result of the comparison of options, that according to the present state of knowledge retrieving the waste is the best variant of how to further deal with the radioactive waste emplaced in the Asse II mine. In a plan-approval procedure, the selected decommissioning option must be licensed by the competent authority, the Lower Saxony Ministry for the Environment and Climate Protection. In 2010 BfS intends to start drilling into the first waste-containing chamber in the Asse mine by the end of the year. This will be the first step of the test phase (finding of facts). In a second step the emplacement chambers will be opened, in a third step the waste will be recovered for test purposes (feasibility study).</p>	<p>due regard for the waste products packaged therein and the backfill surrounding them:</p> <ul style="list-style-type: none"> - For probable developments, handleability of the waste containers must still be guaranteed after 500 years in case of salvage (recovery) from the decommissioned and sealed final repository. Care should be taken to avoid the release of radioactive aerosols. - During the operating phase up until sealing of the shafts or ramps, salvage (recovery) of the waste must be possible with due regard for an assumed ingress of solutions into the emplacement zones 	<p>called "Begleitgruppe" are local and regional politicians, environmental and conservation organisations.</p> <p>BfS and external experts named by the Begleitgruppe were in charge of the AGO. In February 2009, the AGO published a report in which they evaluated what closing options the Asse mine should be investigated in more detail. BfS ordered out feasibility studies for each decommissioning option. These studies were introduced in a public workshop in October 2009. BfS had investigated three decommissioning options in a so-called comparison of options on the basis of previously established criteria.</p> <p>BfS takes the decision to retrieve (recover) all the waste from the mine with the participation of the general public in a comprehensible procedure.</p> <p>On January 2010 BfS presented the result of the comparison of options to the public. According to nuclear law, a plan-approval procedure has to be carried out for the decommissioning of the Asse mine. In this procedure the general public is given the possibility to read up on the issue and to articulate concerns or make suggestions in the licensing procedure. Objections raised in time by the citizens affected by the decommissioning and the statements of the involved authorities are jointly discussed</p>	<p>final repository shall be developed on a step-by-step basis, having weighed up the optimisation targets listed below. Additionally, while operational, the final repository shall be continuously optimised in accordance with the principles of radiation protection and from a safety management viewpoint".</p>
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Hungary	<p>Retrievability - the planned ability of retrieval of waste from the disposal facility which is planned to be final but not closed and not sealed (not back-filled) yet.</p> <p>No explicit reference to reversibility in the regulation.</p>	<p>No such discussions were held with a broader range of stakeholders. Arguments learnt at international fora were taken into account when the regulator and policy maker decided to incorporate the issue into the regulation and the national programme in order to facilitate the future communication with the public.</p>	<p>Retrievability might have helped to gain social acceptance during the Bataapáti LILW repository project.</p> <p>Retrievability is required only under the operation period and not required after the closure of the repository.</p>	<p>Some experience has been collected in the communication on a new LILW repository (which is expected to be put into operation this year in Bataapati). We believe that R&R has not been a key issue regarding the communication with the stakeholders.</p>	<p>Stepwise decision making process exists in the sense that it has to be started with the Parliament's approval in principle that is required by the Atomic Act (see previous bullets). In the case of the Bataapati repository prior to the Parliament's decision a local referendum was held, too.</p>
Japan	<p>Retrievability - considered the same as given in the 2001 NEA report.</p> <p>Reversibility - not defined..</p> <p>Although retrievability is not legislated, official reports point out necessity of pre-closure retrievability from a perspective of safety regulation.</p> <p>At present, retrievability of high-level radioactive waste (vitrified waste) and TRU waste for deep geological disposal is explicitly referred to in the official reports.</p>	<p>To date, discussion on retrievability has been carried out only from a perspective of safety regulation, as found in the official reports. From a perspective of safety regulation, maintaining waste retrievability at pre-closure stage is thought necessary to cope appropriately with contingencies which could have a harmful influence on human environment.</p> <p>The discussions were made focusing on the period of maintaining retrievability until repository closure from a perspective of safety regulation. There were no significant conflicts.</p>	<p>Although regulatory requirements are now considered to be less influential to make a disposal choice, it may contribute to political decision making, considering that stepwise process could go backward. Though such matters on social acceptance have not been fully discussed yet, reversibility may contribute to improvement of social acceptance.</p>	<p>The siting process stipulated by the law requires respecting views of mayors of municipalities and prefectures where candidate sites locate. However, qualification factors specified by the law do not include reversibility and retrievability. They are not topics in communications with stakeholders at this moment.</p>	<p>A repository is regulated in a stepwise manner from license application/permission, through subsequent detailed regulation, to programme termination.</p> <p>According to an official report for safety regulation, it is stated: "safety regulation has no rational reason to require maintaining retrievability after confirming post-closure long term safety because it is inconsistent with disposal concept, and because development and long-term maintaining of retrieval method create cost and technical problems".</p>
Korea	<p>Retrievability – as defined in the 2001 NEA Report.</p> <p>Reversibility is foreseen for all stages of repository development after establishing the national programme. At this moment we consider that reversibility can be possible during the emplacement of the disposal canister in the deposition hole only before backfilling of the disposal tunnel according to the current design.</p>	<p>Discussions between researchers affected the applicable technology in developing the repository, and the design of the repository.</p> <p>We think the retrievability and/or reversibility can be possible in all stages. But it might be difficult to ensure the retrievability after the backfilling of the tunnels.</p> <p>The main drivers are the safety of the repository and the long term management of the HLW waste in the case that some innovative techniques appear.</p> <p>R&R are considered a combination of the safety issues and the social issues. The safety is the impact</p>	<p>There is no administrative basis for the incorporation of the reversibility and/or retrievability in Korea.</p> <p>They can improve the social acceptance because they will enhance the reliability of the safety in the disposal system. That is, we can retrieve the wastes in the case of failure of the disposal system.</p> <p>We think that the requirements for the reversibility have to vary between stages or with time. Whether the backfilling of the disposal tunnels is carried out or not is the main reason. Also,</p>	<p>We don't have any program for stakeholders to take part in decision making related to the incorporation of reversibility and/or retrievability yet.</p> <p>Stakeholders-that is the government, utilities, regulatory body, implementers and publics-could take part in the workshops or hearings on decision making of the reversal or retrieval.</p>	<p>We expect a stepwise decision making process in the national programme.</p> <p>It is expected that reversibility and/or retrievability is one of main elements to contribute to the decision making process. For example, it will contribute to determine the disposal option in our country.</p> <p>As the progressive steps in the repository development are taken, the technical complexity and cost of retrieval will tend to increase because of the backfilling of disposal tunnel and access tunnel and the placing of seals. Retrieval</p>

		factor in designing of the repository and the social issues are the important factors in public acceptance.	with time, the degradation of the repository makes the requirements vary. Finally, the reversibility itself is possible as soon as the money for the reversibility remains.		after repository closure, although technically possible, will require additional resources to re-establish surface and underground facilities and access to the waste. To keep the repository at a given stage, the aspects of maintaining security and safety, including radiological protection and nuclear safeguards should be considered. Because of these aspects, the difficulties will increase with time.
Spain	<p>Retrievability is used in the English versions of some Spanish public documents. However, the term mainly used till now is “recoverability” Both terms are used with the same meaning, being considered as the potentiality for retrieving the waste packages, thus closer to the definition of retrievability used in this R&R project.</p> <p>The definitions as given in 2001 NEA Report are not formally used.</p> <p>The concept (and term) of reversibility is not officially considered.</p>	<p>The retrievability issue emerged in the late 80’s with the development of the El Cabril LILW near surface disposal facility, which design was modified in order to facilitate the retrieval of waste packaged, trough the use of a robust cubic concrete container for the emplacement of the waste drums into the disposal cells, adding an additional engineering safety barrier.</p> <p>With regard to the HLW, the report emitted in 1998 by an Inquiry Committee created by the Senate, aiming at the study of the situation concerning radioactive waste, recommended to take legislation initiatives which establish the need to continue the R&D activities in order to guaranty the feasibility of safe final disposal of spent fuel considering its potential retrieval. This report was not binding for the Parliament or for the Government. Nevertheless, some of these recommended actions were included in the subsequent fifth (1999) and sixth (2006) General Radioactive Waste Plans. It was specified that the concept of retrievability for a defined period of time should be considered in the further</p>	<p>Retrievability and reversibility are neither official options nor regulatory requirements for the final disposal of HLW in Spain and thus, they are not considered in the strategy adopted by ENRESA for HLW and SF final disposal.</p> <p>Nevertheless, the potential implications of an eventual implementation of retrievability in the HLW final repository design has been studied by ENRESA following the governmental recommendation of the past 5th General Plan for Radioactive Waste (July 1999), also specified in the 6th Plan (July 2006) currently in force.</p>	<p>Public and stakeholders involvement in decision making is increasing in recent years in Spain and thus, it undoubtedly will be present in the HLW final repository programme.</p> <p>Nevertheless, nothing can be said at this moment regarding this particular retrievability/reversibility issue relating to the stakeholders involvement, accounting for the current stage of the Spanish programme</p>	<p>From the practical point of view, the Spanish repository development comprises three stages: 1) Feasibility, 2) Demonstration and 3) Execution. The third stage would be performed in four phases: 1st) Design and building (including site characterization, 2nd) Operation, 3rd) Closure and 4th) Post-closure.</p> <p>According to the current regulations governing the licensing of nuclear facilities, the licensing of a HLW final disposal facility should be submitted to the following authorizations: prior or site authorization, construction authorization operating permit, authorizations for modifications (to the design or to the operating conditions), dismantling authorization, and closure declaration</p>

		consolidation of the ENRESA 's repository generic designs.			
Switzerland	<p>Retrievability - "the possibility to remove waste from an open, partly or completely closed facility with more or less large technical or financial investment"</p> <p>Retrieval - "the desired removal of radioactive waste from a facility with the aim of further disposal, processing or re-use."</p> <p>The disposal concept developed by EKRA involves "facilitated waste retrieval" as part of "reversibility", a key element of sustainable development.</p> <p>The disposal of radioactive wastes is envisaged in a facility where, after emplacement, a period of monitoring is foreseen before closure, during which emplaced waste can be retrieved without great effort. A representative fraction of the waste is placed in a pilot facility to test predictive models and to facilitate the early detection of any undesirable behaviour of the system, if this should occur. This concept applies to all categories of waste.</p>	<p>The option of indefinite monitored retrievable storage was discussed with a minor fraction of opponents as early as the eighties (concept of "Nuclear Guardianship").</p> <p>In 1994, the possibility of monitoring and retrievability was included in the general license application for a LLW repository at Wellenberg, Canton Nidwalden. After the cantonal veto, the analysis of the reasons for the negative outcome of the vote showed that the public was afraid of taking decisions that were felt to be irreversible.</p> <p>As reasons for implementing the concept of retrievability, EKRA lists a series of ethical considerations:</p> <ul style="list-style-type: none"> • A waste management concept should leave open to every generation the possibility of either shaping it or rejecting as an expression of the right of self-determination as part of democratic decision-making. Each generation should, in principle, have the possibility to make use of new knowledge regarding disposal and disposal requirements. • In the sense that we feel entitled today to make a decision which may involve irreversible consequences or considerable burdens for future generations, we are contravening the principle of fair treatment. <p>The EKRA report also points out that "A higher level of social acceptance is to be expected for [a geological disposal concept where the repository will remain open for a period of 100 years] than for a</p>	<p>Retrievability is prescribed by the Swiss legislation. Waste retrieval should be possible "without great effort" until repository closure, which will be preceded by an extended monitoring period.</p> <p>It appears clearly that the public expects that the issues of monitoring and retrievability should be considered in any waste disposal concept. Retrievability requirements are the same for all categories of waste.</p> <p>The government will decide on the closure of the facility, thus ending the period during which the waste should be retrievable.</p>	<p>Retrievability is part of the current Nagra communication concept.</p> <p>As no repositories exist as yet, no concrete steps have been taken to involve stakeholders in decision making in this respect.</p> <p>Communication measures are expected to follow the legislation established for other nuclear facilities, i.e. the relevant authorities shall regularly inform the public of the state of nuclear installations and of the situation relating to nuclear articles and radioactive waste. They shall also inform the public of any particular occurrences.</p>	<p>A staged decision making process is included in the Swiss programme.</p> <p>Retrievability must be demonstrated prior to the operating licence application.</p> <p>After waste emplacement, tunnels and caverns are successively backfilled for safety reasons, which has an impact on waste accessibility. Conditions created by the presence of waste itself (temperature, radioactivity) will also be taken into account in the retrieval concept.</p> <p>According to the legislation, retrievability should only be ensured up until closure and final sealing of the repository.</p>

		geological repository which is sealed immediately after the operating period” and adds that for the term "final disposal" may be disturbing, in the sense that “‘Final’ relates solely to the giving up of responsibility by those previously responsible under law and not to the transition of the waste to a permanently safe state.”			
UK, excluding Scotland	<p>Reversibility - a form of retrievability in which the waste could be removed by reversing the original emplacement process.</p> <p>Retrievability - the building into a repository concept of a methodology that would allow access to the waste even after vaults had been backfilled.</p> <p>Recoverability - a “third category” of retrievability in which waste is recovered from a repository by mining or similar intrusive methods.</p> <p>“phased geological disposal” - the identification of sequential phases of development that lead eventually to the sealing and closure of the filled geological disposal facility.</p> <p>No decisions on reversibility, retrievability and recoverability have been made at this stage.</p> <p>In the UK this description refers to all ILW (short- and long-lived), vitrified HLW, long-lived LLW unsuitable for near-surface disposal, and radioactive materials such as spent fuel or separated plutonium or uranium that may be declared as wastes in the future.</p>	<p>Following the failure of the repository siting programme in 1997, discussions with stakeholders, and the findings of a parliamentary committee and of a citizens’ panel, showed that retrievability was an important issue for acceptance of geological disposal. This led to the proposal of the phased disposal approach.</p> <p>The principal conflicting points of view can be summarized as follows:</p> <ul style="list-style-type: none"> • whether or not enhancing retrievability by design and construction measures will increase environmental, security and safety risks; and • whether or not enhancing retrievability provides additional reassurance that justifies the additional detriments such as increased radiation exposures of workers or increased costs. <p>The main driver for consideration of retrievability has been stakeholder desire for an ability to respond to future technological advance or new information about risks and opportunities.</p> <p>Safety, economics and social issues are of course all relevant to consideration of retrievability. All will need to be considered in evaluating and deciding the way forward. The main driver for</p>	<p>Government acknowledges that there is a divergence of views on the issue of waste retrievability, but on balance considers that CoRWM’s conclusion was correct, i.e. that “leaving a facility open, for centuries after waste has been emplaced, increases the risks disproportionately to any gains”. Closure at the earliest opportunity once facility operations cease provides greater safety, greater security from terrorist attack, and minimizes the burdens of cost, effort and worker radiation dose transferred to future generations. CoRWM noted that it is likely to be at least a century from publication of their recommendations in July 2006 until final closure of an entire facility is possible. Hence Government’s view is that the decision about whether or not to keep a geological disposal facility (or vaults within it) open once facility waste operations cease can be made at a later date in discussion with the independent regulators and local communities.</p>	<p>NDA-RWMD has recently published a consultation document on its proposals for public and stakeholder engagement (PSE), which would be expected to cover, inter alia, the topic of retrievability. Stakeholders have not taken part in the actual decision-making process but, as noted in responses to previous questions, have strongly influenced the process.</p> <p>It is envisaged in NDA-RWMD’s proposals for PSE that major decisions would not be made without prior consultation and engagement, and that an important aspect of the overall process is the reporting back of information to stakeholder groups and more general dissemination, for example by means of the NDA website.</p>	<p>The UK has specifically chosen not to refer to “stepwise decision making” in stating its policy. Rather it has said that:</p> <p>“Implementation will be undertaken on a staged basis, with clear decision points allowing progress to be reviewed and costs, affordability, and value for money, safety and environmental and sustainability impacts to be assessed before decisions are taken on how to move to the next stage.”</p> <p>It is almost inevitable that there will be evolutionary processes that make retrievability more difficult with time. The main processes that have been considered in the UK programme are maintaining stability of underground openings (which can be overcome by refurbishment), deterioration of in-vault waste package handling equipment, e.g. the rails on which overhead cranes run (which again can be overcome by refurbishment) and corrosion of metallic waste packages (which can be limited by control of the vault environment).</p>

		consideration of this issue has been societal. No benefits are perceived in respect of safety and economics, rather there is the potential for detriments in these respects.			
UK - Scotland	N/A	In June 2007 the Scottish Government announced that it did not endorse deep geological disposal and has a policy for managing higher activity radioactive wastes (the Waste) arising in Scotland in near surface, near site facilities so that the Waste is monitorable and retrievable and the need for transporting it over long distances is minimal.	The policy will require a developer to consider retrievability when planning a near surface disposal facility.	Following the announcement in June 2007, there has been considerable interaction between the Scottish Government, waste producers, regulators and stakeholders including a workshop in June 2009 to discuss the content of a consultation document. The Scottish Government then consulted between January – April 2010 on a Detailed Statement of Policy for its Higher Activity Radioactive Waste. Monitoring and the concept of retrievability have been important issues for stakeholders during discussions. The Scottish Government expects to publish its final Policy later in 2010.	N/A
USA	“Retrieval” - the act of permanently removing radioactive waste from the underground location at which the waste had been previously emplaced for disposal. The term “reversibility” is not explicitly used or defined in the United States HLW program. “Performance confirmation” - the program of tests, experiments, and analyses that is conducted to evaluate the adequacy of the information used to demonstrate compliance with the performance objectives for the repository. The performance confirmation program is conducted up to the	Retrieval of waste was considered and specified in legislation in 1982. Consideration is based on economic and safety reasons. At the time this legislation was considered, stakeholders were involved through their elected members of Congress. As part of its rulemaking process, NRC proposed its geologic disposal regulations for public comment. Stakeholders commented on the practicality aspects of retrievability requirements. NRC received no comments with respect to the social and ethical issues As a result of public comment on its generic regulation, the NRC provided more flexibility in the application of the retrievability	The Nuclear Waste Policy Act of 1982 [NWPA], as amended, specifies that retrieval of spent nuclear fuel be maintained for any reason pertaining to public health and safety, or the environment, or to permit recovery of the economically valuable contents of spent fuel. This legislation also provides that DOE specify the appropriate period of retrievability, subject to NRC approval, as part of the construction authorization process. The ability to retrieve waste and conduct a performance confirmation program up until	The NRC has a communication plan in place for its repository oversight program which outlines approaches for communication with stakeholders. As development of the repository proceeds, any decisions about retrievability will be made through the licensing process or legislative processes with the benefit of stakeholder involvement. EPA has similar communications materials describing its requirements for the WIPP, including provisions related to retrievability.	The U.S. program incorporates a staged or stepwise decision making process. Maintaining a capability to retrieve waste, prior to closure of the facility, provides the necessary flexibility for decision making for either safety or economic reasons. NRC regulations provide for making decisions at four key steps, namely construction authorization, license to receive and emplace waste, a decision to permanently close the repository, and a decision to terminate the license. There are no explicit regulatory requirements addressing the potential increase in difficulty of retrieval at these stages, however, it could be

	<p>time of the decision to permanently close the repository. . Retrievability is considered during the operational or pre-closure period of repository development during which the performance confirmation program is conducted. There are no plans to provide for retrievability after permanent closure of the repository. The same terminology applies for all stages of repository development.</p>	<p>requirement (e.g., definition of retrieval does not imply ready or easy access to emplaced wastes at all times prior to permanent closure – DOE may elect to backfill parts of the repository with the intent that the wastes emplaced there will never again be disturbed; this is acceptable so long as the waste retrieval option is preserved). There is no record of significantly conflicting views on the subject of retrievability during the legislative process and since that time. The main driver was legislative direction that retrieval of spent nuclear fuel is to be maintained during an appropriate period of operation of the facility, for any reason pertaining to public health and safety, or the environment, or for the purpose of permitting the recovery of the economically valuable contents of such spent fuel. A regulatory decision by the NRC to retrieve waste would be for protection of public health and safety and the environment. Any decision to retrieve waste based on economic reasons would be the result of a change in national policy.</p>	<p>the time of the decision to permanently close the repository might contribute to social acceptance, however, no information is available on the extent to which reversibility and retrievability has increased social acceptance. At the WIPP, the fact that DOE has successfully removed waste containers after emplacement, and that EPA has exercised its oversight authority to ensure that it does so, has likely increased public confidence.</p>		<p>expected that increasing information obtained during repository development would be used to inform retrieval plans.</p>
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	4.1 Regulatory Issues	4.2 Monitoring, Demonstration, Performance Measures	4.3a Decision Making Process	4.3b Financial Aspects	4.3c Technical Aspects
Austria	N/A	N/A	N/A	N/A	N/A
Belgium	Regulatory framework under development: royal decree (licensing procedure, safety reference levels) and guidances. No specific regulatory requirements on R&R.	Not yet determined.	Decision making processes for retrieval not yet determined.	No separate cost estimation for the retrieval of LILW-LL or HLW has so far been made. It should be noted that a cost estimation of a waste retrieval case has been made for the LILW-SL surface repository.	The ease with which a hypothetical retrieval could be achieved was taken credit for in the selection of the current reference disposal concept for HLW.
Canada	Currently, there are no explicit Canadian regulatory requirements pertaining to reversal of steps in repository development or retrieval of used fuel.	Adaptive Phased Management includes monitoring of used fuel throughout all phases of implementation. Monitoring of the deep geological repository will provide necessary information regarding the performance and safety of the facility and will likely be a precondition regarding any decision to retrieve used fuel from the repository.	The decision-making process for retrievability has not been defined for each stage of implementing Adaptive Phased Management in Canada. It is expected that accessibility (to the used fuel container which has been placed in a deep repository), repository performance, safety, new technological developments, cost, unforeseen events and the next steps (e.g., transportation, reprocessing, high-level waste management, etc.) associated with long-term management of used fuel would be the main factors expected to influence a decision on retrieval.	Detailed cost estimates to retrieve used fuel from a deep geological repository have not been prepared in Canada. However, preliminary estimates would suggest that it is reasonable to expect that the costs to retrieve used fuel from a deep geological repository would be of the same order of magnitude as the costs to place used fuel in a deep geological repository. It is expected that the decision to place used fuel in a deep geological repository would not be made if there is a strong likelihood that the used fuel would be retrieved from the repository. Consequently, it is expected that allocating funds for a very low probability event such as retrieval would not be fair or appropriate.	No technical limitations have been identified for retrieving used nuclear fuel during implementation of Adaptive Phased Management in Canada. The ability to monitor and retrieve used fuel containers from a deep geological repository at a particular site with particular host geology features will be incorporated into the final design, development and demonstration of the deep geological repository system. A key aspect in the design would be the ease of retrieval prior to backfilling, sealing and closure of the repository. However, the repository system with features associated with monitoring and retrievability must be designed to be safe from an operational perspective and it must be designed to be passively safe over the long term.
Czech Rep.	There are not any explicitly defined requirements on reversibility in the Czech regulations.	The stepwise process with detailed evaluation of received results of each DGR development stage with proposal of justified follow up options is an essential part of the Czech concept. We consider that this approach is the only way which will make the decision making process and the DGR development progress effective.	N/A	N/A	N/A

Finland	There are no specific regulatory requirements related to retrievability or retrieval.	A range of characterization and monitoring activities are and will be performed to support development and operation of disposal facility. Baseline monitoring is and will be carried out from the surface and underground. During construction, operation, and possibly part of the post-closure period, monitoring would continue. Plans for monitoring, data recording and safeguards measures are needed in all stages of the project.	There are no specific decision making processes in place related to retrievability or retrieval.	During the Decision in Principle discussion the position was approved by the majority that the responsibility for costs of retrieval should be with those who want to retrieve the canisters. During construction licensing, the proponent shall provide specified, sufficiently detailed reports on and plans for the re-opening of the repository and factors affecting it, as well as the opening technology and the safety of opening. An up-to-date estimate of the costs of opening shall also be submitted.	The KBS3-concept itself is considered to be retrievable enough and this is advantageous for acceptance. Moreover no extra technical features are needed for retrievability purposes.
France	Reversibility is imposed by the French law. The output of the research programme to be carried out from now to 2014 will support the definition of reversibility requirements. These requirements will be the object of a new law to be voted prior to the completion of the licensing procedure.	The main reasons mentioned in Andra's dossier 2005 for conducting observation and surveillance monitoring are to assist in reversible repository management and to contribute to the mastering of operational and long-term safety. Repository surveillance is aimed at detecting changes that might affect operational safety or long-term functions. Under no circumstances is it intended to base the assessment of a repository's safety on its monitoring. Nor can the existence of a monitoring programme during repository operation be used to compensate for a lack of any data concerning the safety assessments that would precede any disposal authorisation. Tests are planned in the next years to demonstrate the retrievability. This includes in particular full scale waste handling tests.	The reversibility is imposed by law. The stepwise approach of the disposal process contributes to reversibility as envisaged in France. The decision making process to go from one stage to the next will be part of the reversibility requirements. The retrievability of the waste packages in the next stage will probably constitute a facilitating factor of the decision process.	The cost estimate for the repository includes design features enhancing the reversibility as presented in the Dossier 2005. This cost estimate is based on a centennial operating period. This cost estimate is used as a basis to determine financial provisions for long term waste management. The cost of waste retrieval has not been estimated at the present stage.	The repository architecture presented in the Dossier 2005 incorporates a number of design factors enhancing reversibility without jeopardizing safety. They include the modularity of the repository, the durability of the structures, and various features facilitating waste package retrieval. Reversibility was one of the criteria used in the multi-criteria analysis carried out to select design options, along with safety relating criteria, cost and demonstration capability. No compromises with regard to safety are allowed while taking into account reversibility. Technical and scientific limits were identified and discussed in Dossier 2005. These limits relate in particular to the long term behaviour of materials and underground structures. This analysis led Andra to conclude to the technical possibility of a 200-300 years reversibility period. Some reviewers stated that such a duration is not consistent with state of the art and still needs to

					be demonstrated. A duration of hundred years seems today reasonably reachable towards the state of the art. In the French programme, the host rock is argillite, which creeps over time. This limits the possible duration of reversibility.
Germany	Up to now there have not been regulations for incorporation of retrievability in Germany. It is intended to implement safety requirements with respect to retrievability and other safety related aspects within the framework of the current update of the legal regulation: "Safety Requirements on Heat-generating Radioactive Waste" (GSR). Reversibility is not considered.	There are monitoring programs envisaged for the operational phase devoted to ensure compliance with the long term safety assessment. In principle they could also be used as a basis for a decision on retrievability.	Not applicable	As R&R have not been part of the German radioactive waste programme so far, no detailed cost estimations are available. Concerning retrievability rough estimations were made by considering the required increased host rock volume.	Results of R&D work show significant differences in limitations depending on the way of retrievability incorporation (e.g. open storage without backfill/sealing vs. open storage with backfill). Especially for salt rock there are serious difficulties expected for retrieving waste during the first 100 years because of the temperature effect on the salt rheology.
Hungary	In lack of discussions, decisions and/or common Hungarian standpoints on these practical issues we cannot answer these specific questions.	In lack of discussions, decisions and/or common Hungarian standpoints on these practical issues we cannot answer these specific questions.	In lack of discussions, decisions and/or common Hungarian standpoints on these practical issues we cannot answer these specific questions.	In lack of discussions, decisions and/or common Hungarian standpoints on these practical issues we cannot answer these specific questions.	In lack of discussions, decisions and/or common Hungarian standpoints on these practical issues we cannot answer these specific questions.
Japan	Any regulatory provisions and processes are not specified to deal with reversibility and/or retrievability at the present time. Safety standards will be established at an appropriate time, considering retrievability until repository closure.	At present, monitoring, demonstration and performance measures are not linked to reversibility and/or retrievability. However monitoring is expected to be capable of affording data necessary for safety assessment and confirmation of operational safety, during the period of maintaining reversibility until repository closure. In addition, it seems irrational to require maintaining retrievability as safety regulation after post-closure long term safety is confirmed by carrying out safety analysis for repository closure with using data obtained from monitoring.	Decision making processes and criteria are not defined at present and will be discussed in the future.	Costs resulting from reversibility and/or retrievability haven't been estimated or provided yet.	An official report for safety regulation states: "For implementing retrieval safely and effectively, it is important to study repository design incorporating retrievability and retrieving measures. Details such as scope and period of sustaining retrievability; design and implementation method of retrieval; and others should be studied, considering domestic/overseas technological findings in the future. It is important for the responsible organization to be considerate to prevent adverse effect on the safety performance of repository."

Korea	<p>In Korea, we don't have any regulatory provisions or processes on reversal of steps in repository development yet. So there is no regulatory requirement related to this decision making.</p>	<p>There are two monitoring stages in the stages of the repository development. The first one is when the disposal tunnel is not backfilled during the operation and the second one is after the backfill of the disposal tunnel. In our concept of research phase, the materials can be retrieved by reverse process in the first monitoring stage, but in the second monitoring stage, we don't consider the retrievability yet.</p>	<p>Nothing is decided on this matter because we are now at the beginning stage of retrievability and/or reversibility. We think that the main factor to influence decision on reversal and/or retrieval is the appearance of an innovative technology, which could enhance the safety of the repository and remarkably reduce the volume of the wastes.</p>	<p>Cost of reversibility and/or retrievability and/or recoverability have not been estimated yet.</p>	<p>Technical limitations in implementing the reversibility and/or retrievability are</p> <ul style="list-style-type: none"> - The potential negative effects because of conventional safety and radiological exposure of workers engaged in extended storage operations - The increased opportunity for unauthorized access to the repository - Increased financial costs because the repository should open for longer.
Spain	<p>Specific regulatory provisions were developed to facilitate the retrievability of waste packages in the LILW near surface disposal.</p> <p>In the case of HLW, there is not any regulatory provision regarding reversibility or retrievability. However, it has to be noted that the issue of the waste ownership and the responsibility of any repository surveillance after closure have already been established by the law 11/2009, of October 26th, anticipating in this way these issues related with the potential implementation of the reversibility and retrievability concepts: "The State shall be the owner of radioactive wastes once these have been definitively disposed of. Likewise, it shall undertake whatever surveillance might be required after the closure of a nuclear facility, following the period of time established in the corresponding declaration of</p>	<p>At the current state of the Spanish repository programme there is no specification on the possible monitoring requirements.</p> <p>It is recognized that at later stages some monitoring will probably have to be implemented, and that if retrievability and/or reversibility are considered, monitoring could be necessary.</p>	<p>It has not been defined.</p>	<p>Provisions taken for the retrievability incorporation in the design of the LILW disposal facility had an impact in the construction costs, which were estimate at that time (1978-1992).</p> <p>In the case of the HLW disposal, several alternatives to the main reference concept have been studied in order to facilitate retrievability of waste packages, but only during the operational phase of the repository. Nothing has been studied in order to incorporate retrievability in the post-closure phase.</p> <p>These alternatives include a combination of measures like using a different liner, providing clean areas without canisters in the disposal galleries or using shorter disposal galleries. The extra costs ranges from 2% to 11% in the case of granite and from 3% to 16% for clay.</p>	<p>In the case of the LILW disposal, the original proposed design was modified in order to facilitate the recoverability of the waste packages, using robust and hardly tested cubic concrete containers, for the emplacement of the immobilized waste drums inside the disposal cells, piled up without any bonding between them. This design modification added an additional engineering safety barrier.</p> <p>The current generic design for the HLW and Spent Fuel repository allows for the retrieval of waste packages, although it has not been developed with that criterion. Nevertheless, some preliminary studies have been made separately by the CSN and ENRESA in order to analyse the implications of a disposal concept with enhanced retrievability capabilities. These studies showed that some design modifications and operational measures would facilitate the waste package retrieval, new long-term safety</p>

	closure.”				analyses should be made to account for them and that some of these measures, like postponing the sealing of disposal galleries, could have severe consequences for safety.
Switzerland	The new (draft) HSK guideline specifies that waste retrieval should be described in a retrievability concept. This concept should take into account the specific conditions (temperature, radioactivity) caused by the presence of radioactive waste.	Monitoring and waste retrieval are closely linked. Waste should be retrievable up until repository closure, which will be preceded by an extended monitoring period. Monitoring of the pilot facility after the waste has been emplaced and the emplacement tunnels are backfilled and sealed will support the decision-making process leading to closure of the repository. This facility will provide ample possibilities for a broad instrumentation of all components of the disposal system which will allow for a comprehensive long-term monitoring of the hydraulic, chemical and mechanical conditions of the waste, the engineered barriers and the surrounding host rock. The monitoring concept will be developed for the general license application and refined at later stages of repository development.	The new (draft) HSK guideline briefly outlines safety-related reasons that would make waste retrieval necessary: - during the operational phase: the consequences of an accident have an impact on the long-term safety of a repository where waste has already been emplaced - during the monitoring phase: failure of (a component of) the engineered barrier system - after completing waste emplacement: the long-term safety cannot be demonstrated. It further specifies that the expected radiation exposure for staff and populations outside of the operation area at the time of retrieval should be evaluated.	The EKRA report states that “facilitated retrievability of the waste is part of the requirement for reversibility and necessitates both technical and financial means. If retrieval is effected for safety reasons, then the case is one of liability which has to be regulated by law. If retrieval is implemented for other reasons, then no reserves require to be put aside by the generations who are benefiting from the use of nuclear energy.” In the current programme, provisions have been made for ensuring that the waste is retrievable (e.g. costs of RD&D prior to the operating license application, costs of operation of the pilot facility, etc.). The costs of the actual retrieval of the waste, if it became necessary, have not been part of the cost estimates so far.	The nuclear energy legislation indicates that the ability to retrieve the waste should not affect the safety barriers. Furthermore, the new (draft) HSK guideline specifies that waste retrieval should be described in a retrievability concept. This concept should take into account the specific conditions (temperature, radioactivity) caused by the presence of the waste itself.
UK, excluding Scotland	There are no regulatory requirements specific to the reversal of steps in repository development. In their recently published consultation on draft guidance, the environmental regulators state that their guidance does not require the waste to be capable of retrieval after the act of disposal (i.e. emplacement of	It is envisaged that monitoring will be carried out at each stage of repository development to ensure that the condition of repository components, the waste packages and the repository environment have remained consistent with requirements for safety, security and environmental protection. We do not see a link between	In the UK retrievability is viewed as a possible means of affording flexibility of future actions rather than to meet some pre-defined decision or need to retrieve waste subject to a full case being made at some future point. Formalised reversibility of decision-making is not part of the UK programme.	The costs resulting from incorporating retrievability into a reference ILW repository have been estimated previously by the NDA’s predecessor organization, Nirex, using a parameterized cost model where the component costs for example of maintaining a controlled vault environment or of maintaining underground openings are well established. This assessment will	Retrievability is not seen as having a relationship to safety except in the sense that it will have to be shown that retrievability does not introduce an unacceptable detriment to safety. No absolute limitation has been identified provided that society will be willing and able to continually refurbish or replace

	the waste). If provisions for retrieval are included, they should not damage the environmental safety case, for example due to potential degradation of waste packages during any extended period for which the facility is kept open.	reversibility and/ or retrievability and “repository performance confirmation”. CoRWM concluded in its recommendations to Government that for some people the period of monitoring associated with keeping the waste relatively accessible represents an important check, but cannot provide reassurance about repository performance in the long term, which is usually the period of greatest concern.		need to be updated in light of the new policy.	disposal vaults and tunnels and other underground openings and retain the skilled workforce necessary to undertake this work. To date it has been found that design features and host geology features are unlikely to be limiting but will demand different technological approaches to affording the option of retrievability.
UK - Scotland	N/A	N/A	N/A	N/A	N/A
USA	A decision to abandon the repository or a portion of the repository for safety reasons, and retrieve some or all of the waste could occur if the site, design, or a portion of either the site or design were found to be unsuitable (i.e., not protective of public health and safety). Such a decision would be made through NRC’s licensing process.	The performance confirmation program, which may include monitoring, would be used to inform a safety decision to retrieve waste prior to permanent closure. Any decision to retrieve waste after permanent closure, however, would be a far more complicated decision that is neither anticipated nor prescribed in legislation or NRC regulations. DOE needs to design (and build) the repository in such a way that the retrieval option is not rendered impractical or impossible. The retrieval operation would be an unusual event and may be difficult and expensive.	The retrieval decision based on safety, whether proposed by the DOE or mandated by the NRC, is determined through NRC’s licensing process. This process would not vary between stages. Any decision to retrieve waste based on economic reasons would need to be the result of a change in national policy. At the WIPP, the decision to remove specific waste packages has been made on two occasions. These decisions have been based on the determination that the packages did not comply with regulatory requirements. In general, the same decision-making process would be applied at all stages.	Precise costs associated with reversibility and retrieval have not been estimated. As a general matter, repository costs are paid through the Nuclear Waste Fund. If retrieval is ever conducted the costs would be expected to come from the waste fund if the decision is safety-related. However, if a retrieval decision were made for economic reasons, its costs would be paid out of general revenues.	DOE needs to develop retrieval plans that are feasible and reasonable. DOE needs to design (and build) the repository in such a way that the retrieval option is not rendered impractical or impossible. Even after permanent closure the entire system can be re-opened and taken apart, albeit at great cost and considerable difficulty. Clearly, there is a balance to be struck between demanding long-term retrievability and the need to provide for nuclear safety and security. Repositories must be sealed in such a way as to make re-entry a costly and difficult enterprise to discourage unauthorized re-entry and retrieval operations.

THE RWMC REVERSIBILITY AND RETRIEVABILITY PROJECT QUESTIONNAIRE AND GUIDELINES

At the Topical Session on Reversibility & Retrievability at RWMC-41 in March 2008, it was agreed that the guidelines/questionnaire that were presented at that session would be revised in response to comments at the session and distributed to all Member countries. The revisions have been completed, and the revised guidelines/questionnaire are provided in this document. Each Member organization (or country) is requested to provide its **response to the Secretariat by 15 August**, in order that the project working group can analyze the responses and begin drafting its report on the role of R&R in Member countries' disposal programmes.

Member organizations are also invited to nominate representatives to join the working group for this project. **Nominations should be sent to the Secretariat, Claudio.Pescatore@oecd.org and John.Stein@oecd.org by 15 August at the latest.** Nominations before 15 August are appreciated.

The first meeting of the working group will be held in Toronto, Canada on October 8-10 2008.

GUIDELINES

Purpose of the questionnaire

The purpose of the RWMC questionnaire is to obtain information about the concepts of reversibility and retrievability as they apply in various national programmes for the long-term management and disposal of radioactive wastes. The results will be used as input to a comparative study on reversibility and retrievability in NEA member countries, whose goal is to further develop and update the findings of the 2001 NEA report "Reversibility and Retrievability in Geologic Disposal of Radioactive Waste - Reflections at the International Level" (NEA-3140, ISBN 92-64-18471-6).

Scope of information

We are looking for information on how these terms or closely related terms are used in your country, how they are applied within national programmes for radioactive waste management, and how the current situation developed historically. We are also looking to better understand how the concepts are applied in policy making, regulation, implementation and public communication, and what factors led to their adoption and/or influenced their application.

If the concepts of reversibility and/or retrievability play an important role in decision making (e.g. in a stepwise decision making process), we would like to elucidate the relationship between the concepts and the decision making process.

Focus

The focus of the study is on geologic disposal, specifically for high-level radioactive waste, long-lived intermediate-level radioactive waste and spent nuclear fuel if it is disposed of as waste.

The study will also take into consideration any (optional) related information that member countries choose to provide on how reversibility and/or retrievability may affect programmes for disposal of other types of radioactive waste.

Terminology

For the purpose of this study, we use the following key terms:

- *Reversibility*, meaning the ability to reverse decisions or processes;
- *Retrievability*, meaning the ability to retrieve entire waste packages;
- *Recoverability*, meaning the ability to recover emplaced materials.

Guidance for responding

As guidance for the expected responses, we have posed a few broad questions. Each broad question is further illustrated by one or more questions at a more detailed level. However, in order to avoid biasing or limiting the results by the specific questions asked, it is not intended that the questions be prescriptive or that the answers respond only to the questions given. If some of the questions do not seem applicable to your country's programme, please do not constrain your responses to fit the questions. If there is information relevant to reversibility and/or retrievability in your country's programme that is not addressed by these guidelines, we hope that you will feel free to supply it even if it is not directly related to one of the questions we have posed.

If possible, we would like to know how the concepts of reversibility and/or retrievability impact your country's national programme for radioactive waste management. If the terms are used and applied differently in different organizations or different constituencies (including stakeholder groups, if information is available), we would like to have information about the differences and how they arose. The objective is to obtain as complete an understanding as possible about the range of approaches/views that exist.

We are also interested in obtaining information about key reference documents for these concepts used in your country, regardless of whether they are available in English or only in your national language.

We thank you for your participation in this project.

QUESTIONNAIRE

1. Definitions and Scope of Application

Describe whether reversibility and/or retrievability are considered in your country's programme, and if so how they are defined and applied.

- *If applicable, how is the terminology for reversibility and/or retrievability defined in your country? Do you use the same definitions as given in the 2001 NEA report on Reversibility and Retrievability¹? Is retrievability considered to be a special case of reversibility or vice-versa, or are they considered to be independent concepts?*
- *Are there other concepts or terms relevant to the topics of reversibility and retrievability, or to related topics, used in your country's programme, e.g., the concepts of "adaptability", "accessibility" and/or "recoverability"? If so, what are they and how are they defined?*
- *What are the stages of repository development envisaged in your country's programme? At which of these stages are formal regulatory, governmental (local or national) or parliamentary decisions required?*
- *Is reversibility foreseen for all stages of repository development, only during certain stages, only for a limited period of time, or not at all? For instance do you have "reversibility" in order simply to allow accessibility, control and maintenance of repository features?*
- *Is retrievability of packages and/or recoverability of materials envisaged post-closure, pre-closure, only during certain stages of repository development, only for a limited period of time, or not at all? If only during certain stages, please explain which.*
- *If applicable, is the same terminology used for all stages of repository development, or does the terminology or its application vary depending on the stage?*
- *For which sites, if any, do reversibility and/or retrievability apply, i.e. are they considered generic or site-specific?*
- *For which categories of waste, if any, do reversibility and/or retrievability apply?*

2. Historical Development

Describe the history of the development of your country's current policy with particular attention to aspects related to reversibility and/or retrievability and discuss the factors that influenced this history.

- *What discussions, if any, were held on the technical, safety, ethical and social aspects of reversibility and/or retrievability both within your programme and with a broad range of stakeholders, interested individuals and organizations?*
- *If applicable, what role did these discussions play in the development of the programme?*
- *If applicable, which were the conflicting points of view and how were they resolved during the process?*
- *If reversibility and/or retrievability were considered during the development of your national programme, what were the main drivers or motivations for considering these elements?*
- *If reversibility and/or retrievability were considered during the development of your national programme, what reasons are now expressed for their incorporation or non-incorporation in the programme?*
- *Are reversibility and/or retrievability considered to be safety-related issues, economic or social issues, or a combination of issues?*

¹ <http://www.nea.fr/html/rwm/reports/2001/nea3140.pdf>

"Reversibility denotes the possibility of reversing one or a series of steps in repository planning at any stage of the programme. Retrievability denotes the possibility of reversing the action of waste emplacement"

3. Current Policy

3.1 General

Describe the extent of and the means by which reversibility and/or retrievability are incorporated in your national programme for radioactive waste management.

- *If applicable, what is the administrative basis for this incorporation (e.g. imposed by legislation, or by the implementer in response to public concerns)?*
- *Even if reversibility and/or retrievability are not requirements, is it expected that their presence or absence could contribute to regulatory and political decision making? For example, might they contribute to choices among disposal options? Have you used them as such?*
- *If applicable, how do reversibility and/or retrievability impact upon or contribute to social acceptance?*
- *If at all, how do reversibility and/or retrievability requirements differ for different categories of waste?*
- *Do reversibility requirements, if any, vary between stages of repository development or with time? If so, please describe how.*
- *Do retrievability requirements, if any, vary between stages of repository development or with time? If so, please describe how.*
- *Have responsibilities been allocated for decision making about reversibility and/or retrievability aspects of your country's programme? If so, please describe them.*

3.2 Communications with stakeholders and part of stakeholders in decision making

Describe how communications with stakeholders and their involvement in decision making are considered in your programme with respect to reversibility and/or retrievability.

- *Are there communications approaches in place or planned to inform stakeholders about reversibility and/or retrievability aspects of your country's programme? If so, please describe them.*
- *Do stakeholders take part in decision making related to the incorporation of reversibility and/or retrievability in your programme? If so, how?*
- *If applicable, have responsibilities been allocated for decision making about whether to reverse steps or, if envisaged, to retrieve packages or recover materials? If so, please describe them.*
- *If applicable, are there communications measures in place or planned to communicate information to stakeholders about decision making related to the reversal of decisions or, if envisaged, the retrieval of packages or recovery of materials? If so, please describe them.*
- *If applicable, is it anticipated that stakeholders could take part in decision making related to the actual reversal of decisions, or if envisaged, the retrieval of packages or recovery of materials? If so, how would this take place and what communications measures would be used to facilitate the participation?*

3.3 Stepwise decision-making

Describe the extent to which reversibility and/or retrievability are considered to be part of a stepwise decision making process in your national programme.

- *Does your country's programme incorporate a staged or stepwise decision making process?*

- *If so, do elements of reversibility and/or retrievability contribute to the decision making process? If they do, please describe how.*
- *Is it anticipated that increases in the difficulty of retrieval or recovery during repository development (from one step to the following) could affect the decision making process? If so, please describe how.*
- *If applicable, which features are considered to characterize such increases in the difficulty of retrieval or recovery (for instance: accessibility to the disposed waste, availability of technology for retrieval, package integrity, cost or dose associated with retrieval, etc.)?*
- *Does keeping the repository at a given (reversibility) stage become increasingly difficult with time? How does this affect the decision making process? Which features are considered to characterize such evolution (for instance: cost or dose, etc?)*

4. Practical Implementation Issues

4.1 Regulatory

Describe what regulatory provisions and processes, if any, are in place or planned to deal with reversibility and/or retrievability.

- *If decision making on reversal of steps in repository development is envisaged, are there regulatory requirements applicable to this decision making?*
- *If retrieval of packages or recovery of materials is envisaged as a possibility, are there regulatory requirements in place that are applicable to the process of retrieval or recovery?*
- *If retrieval of packages or recovery of materials is envisaged as a possibility, are there regulatory provisions in place for the management of recovered or retrieved wastes?*

4.2 Monitoring, demonstration, performance measures

Describe what monitoring, demonstration and performance measures, if any, are in place to support reversibility and/or retrievability in your national programme.

- *What role, if any, does monitoring play in reversibility and/or retrievability at each stage, and for how long at each stage?*
- *What research, development and demonstration, if any, is being done or is being planned on reversibility and/or retrievability from the point of view of demonstrating the capability to retrieve packages or recover materials or to reverse decisions before proceeding?*
- *During staged repository development, is it anticipated that progress in reversibility and/or retrievability demonstration at each stage would support the decision making process to go to the next stage?*
- *What research, development and demonstration, if any, is being done or is being planned on reversibility and/or retrievability from the point of view of repository performance demonstration as an aid to decision making during later stages?*
- *During repository development, is it anticipated that progress in repository performance confirmation at each stage would support the decision making process to go to the next stage?*

4.3 Procedural and operational issues; technical and other limitations

Describe the important operational issues (both procedural and technical) related to reversibility and/or retrievability.

Decision making process: criteria for reversal/retrieval, decision makers

- *To what extent has the decision making process for reversibility and/or retrievability been defined for various stages of repository development?*
- *If reversibility of decision making is part of your country's programme, what criteria have been established for determining when a decision would be reversed, and who would make that decision? Does this vary depending on the stage of repository development?*
- *If retrieval of packages or recovery of materials is envisaged as a possibility in your country's programme, what criteria have been established for determining when packages would be retrieved or materials recovered, and who would make that decision? Does this vary depending on the stage of repository development?*
- *If applicable, what are the main factors expected to influence decisions on reversal of steps and/or on retrieval of packages or recovery of materials (e.g. new technology, access to resources, safety issues, cost)?*

Financial aspects

- *Have the costs resulting from incorporating reversibility and/or retrievability into the programme been estimated or provided for, and if so how?*
- *Have the costs of actually reversing decisions, retrieving packages or recovering materials been estimated or provided for, and if so how?*
- *If retrieval of packages or recovery of materials are envisaged as possibilities, are there provisions in place (procedures, ancillary facilities, etc.) for the management of the retrieved packages or recovered materials and how have the resulting costs been estimated or provided for?*

Technical aspects

- *How do reversibility and/or retrievability contribute to repository system design and what is their relationship to safety? Please describe.*
- *What technical (engineering, geological, safety or safeguards) limitations on the ability to implement reversibility and/or retrievability, if any, have been identified in your programme?*
- *To what extent do specific repository design features and/or host geology features limit the ability to implement reversibility and/or retrievability, as they affect the development of your programme?*