The Environmental and Ethical Basis of Geological Disposal of Long-Lived Radioactive Wastes

A Collective Opinion of the Radioactive Waste Management Committee of the OECD Nuclear Energy Agency

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Foreword

The safe disposal of radioactive wastes, and specifically the need to protect humans and the environment in the far future, is given particular attention in all countries engaged in nuclear power generation. It is also a concern in many other countries making use of radioactive materials for medical, industrial, or research purposes.

As for many environmental protection situations linked to industrial development, including the management of hazardous chemical materials, the safe disposal of radioactive wastes requires consideration of a broad range of scientific and technical factors relating to potential impacts on the biosphere, as well as basic ethical principles that reflect the expectations of society.

Whilst the state-of-the-art in this field is relatively advanced and known, diverging views are often expressed calling, from time to time, for a reappraisal of the proposed approaches and actions. As in many other areas, extensive international exchanges of views help in clarifying the issues involved and in formulating consensus positions which may assist national authorities in their search for appropriate solutions.

This report presents such a consensus position in the form of a Collective Opinion of the Radioactive Waste Management Committee (RWMC) of the OECD Nuclear Energy Agency. It addresses the strategy for the final disposal of long-lived radioactive wastes seen from an environmental and ethical perspective, including considerations of equity and fairness within and between generations. This Collective Opinion, by professionals having responsibilities at a national level in the field of radioactive waste management, is intended to contribute to an informed and constructive debate on this subject. It is based on recent work reported from NEA countries and on extensive discussions held at an NEA workshop organised in Paris in September 1994 on the Environmental and Ethical Aspects of Long-lived Radioactive Waste Disposal. Of particular importance in these discussions was the participation of the OECD Environment Directorate, and of independent experts from academic and environmental policy centres. The full proceedings of this workshop have been published by the OECD.

This report is published on the responsibility of the Secretary-General of the OECD. The opinions expressed do not necessarily reflect the position of national authorities in NEA Member countries or of international organisations.

The Environmental and Ethical Basis of the Geological Disposal of Long-lived Radioactive Waste

Collective Opinion of the Radioactive Waste Management Committee

As part of its continuing review of the general situation in the field of radioactive waste management, and with particular reference to the extensive discussions at the recent NEA Workshop on Environmental and Ethical Aspects of Radioactive Waste Disposal [1], the RWMC reassessed the basis for the geological disposal strategy from an environmental and ethical perspective at its Special Session in March 1995. In particular, the RWMC focused its attention on fairness and equity considerations:

- between generations (intergenerational equity), concerning the responsibilities of current generations who might be leaving potential risks and burdens to future generations; and

- within contemporary generations (intragenerational equity), concerning the balance of resource allocation and the involvement of various sections of contemporary society in a fair and open decision-making process related to the waste management solutions to be implemented.

After a careful review of the environmental and ethical issues, as presented later and discussed in detail in the proceedings of the NEA Workshop, the members of the NEA Radioactive Waste Management Committee:

- consider that the ethical principles of intergenerational and intragenerational equity must be taken into account in assessing the acceptability of strategies for the long-term management of radioactive wastes;

- consider that from an ethical standpoint, including long-term safety considerations, our responsibilities to future generations are better discharged by a strategy of final disposal than by reliance on stores which require surveillance, bequeath long-term responsibilities of care, and may in due course be neglected by future societies whose structural stability should not be presumed;

- note that, after consideration of the options for achieving the required degree of isolation of such wastes from the biosphere, geological disposal is currently the most favoured strategy;

- believe that the strategy of geological disposal of long-lived radioactive wastes:

    - takes intergenerational equity issues into account, notably by applying the same standards of risk in the far future as it does to the present, and by limiting the liabilities bequeathed to future generations; and

    - takes intragenerational equity issues into account, notably by proposing implementation through an incremental process over several decades, considering the results of scientific progress; this process will allow consultation with interested parties, including the public, at all stages;

- note that the geological disposal concept does not require deliberate provision for retrieval of wastes from the repository, but that even after closure it would not be impossible to retrieve the wastes, albeit at a cost;

- caution that, in pursuing the reduction of risk from a geological disposal strategy for radioactive wastes, current generations should keep in perspective the resource deployment in other areas where there is potential for greater reduction of risks to humans or the environment, and consider whether resources may be used more effectively elsewhere;

Keeping these considerations in mind, the Committee members:

- confirm that the geological disposal strategy can be designed and implemented in a manner that is sensitive and responsive to fundamental ethical and environmental considerations;

- conclude that it is justified, both environmentally and ethically, to continue development of geological repositories for those long-lived radioactive wastes which should be isolated from the biosphere for more than a few hundred years; and

- conclude that stepwise implementation of plans for geological disposal leaves open the possibility of adaptation, in the light of scientific progress and social acceptability, over several decades, and does not exclude the possibility that other options could be developed at a later stage.

Ethical and Environmental Considerations in the Long-term Management of Radioactive Wastes

Ethical and Environmental Background to the Management of Waste

The development and welfare of modern societies depend to a large extent upon the contribution of technology and industrial processes, such as the generation and widespread use of electricity. These processes are, in general, associated with the production of wastes, some of which are unavoidable, unrecyclable and hazardous. Such wastes require careful management to ensure adequate protection of humans and the environment. The timescales over which such protection is required can extend, in the case of wastes containing toxic chemical elements or long-lived radioactive isotopes, well beyond the lifespans of current or forthcoming generations, i.e., many thousands of years into the future. Hence there is an ethical imperative to care about future generations and to act in such a way as to preserve, as much as possible, their options to enjoy and benefit from the Earth's resources. Such a concern for the protection of human health and the environment in a developing world has been illustrated by the concept of "sustainable development" put forward by the World Commission on Environment and Development, "the Brundtland Commission", in 1987 [2]. This concept, which is principally an ethical one, was defined as "satisfying the needs of the present, without compromising the ability of future generations to meet their own needs".

The concept of "sustainable development" was chosen as the main theme of the United Nations Conference on Environment and Development in Rio de Janeiro in 1992, and was therefore extensively discussed. It is appropriate that the principles of this concept be applied to complex environmental issues such as the ones resulting from the production of potentially harmful wastes. Current environmental protection policies are increasingly concerned with issues of a global nature related to long-term consequences of, for example, ozone depletion and climate changes. In this context, an evolving environmental consciousness, coupled with the emergence of strong ethical concerns, indicate the importance attached to morally correct human conduct [3]. This trend should contribute to the adoption of public policies integrating both technical and ethical considerations to maximise the benefits and limit the potential adverse effects of industrial development now and in the future. It is therefore welcome that ethical issues are currently being integrated into the environmental debate.

This debate, however, is affected by the judgmental nature of ethical values which are themselves influenced by the professional, cultural and social backgrounds of the participants. As a result, a balanced and objective understanding of environmental or health impacts is often difficult to separate from the interests of those involved in the debate, particularly those who may be directly affected and those who have an obvious interest. It is, therefore, of some importance that the discussion of ethical and other considerations be approached with an open mind and involve a broad spectrum of public representatives in order to create the conditions for a sound analysis of all the relevant aspects. This Collective Opinion is intended to contribute to that analysis by presenting the view of the national representatives comprising the Radioactive Waste Management Committee of NEA, having considered carefully the results of the Workshop referred to above.

In the management of wastes having a long-term potential for harm, interest focuses on two classes of ethical concerns.

The first is the achievement of "intergenerational equity" by choosing technologies and strategies which minimise the resource and risk burdens passed to future generations by the current generations which produce the wastes. It is a fact of life that each generation leaves a heritage to posterity, involving a mix of burdens and benefits, and that today's decisions may foreclose options or open new horizons for the future. This is unavoidable, but our actions and decisions will be more acceptable if appropriate degrees of equity or justice are respected, and we do not unduly restrict the freedom of choice of future generations. In the case of nuclear energy production and the management of radioactive wastes, as with various other aspects of industrial activity, the balance between the benefits which are enjoyed by present and future generations through sustained technological development, and the liabilities which may be imposed on future gene-rations over a long period, must be carefully scrutinised. As radioactive wastes already exist, as a result of past and current activities, the issue of waste management has to be faced regardless of the future of nuclear energy. The objective is to manage the wastes in such a way that potential future impacts are kept at a level that is acceptable both ethically and in terms of safety. In the context of financial provisions for future liabilities there are real concerns whether the value of an invested monetary provision will compensate a society faced, many generations later, with the physical task which the provision was intended to fund. The preferred strategy is to accomplish key tasks of technology development and repository siting within the timescale of current generations.

The second concern is the achievement of "intragenerational equity" and in particular an ethical approach to the handling, within current generations, of questions of resource allocation and of public involvement in the decision-making process. The form of this process is shaped to some extent by national institutions and political factors, and it was not therefore included in the NEA Workshop background papers, but the need for public involvement was emphasised in the workshop discussions and its importance in making key decisions, such as the timing of waste disposal actions, is clear. When considering resource allocation, risks from radioactive wastes must be kept in perspective with competing projects in the area of human health and environmental protection. Also relevant in this context is the consideration of equity and fairness for communities which are judged to be affected by the construction and operation of a centralised national facility such as a geological repository for long-lived wastes.

Consideration of these concerns leads to a set of principles to be used as a guide in making ethical choices about waste management strategy:

- the liabilities of waste management should be considered when undertaking new projects;
- those who generate the wastes should take responsibility, and provide the resources, for the management of these materials in a way which will not impose undue burdens on future generations;
- wastes should be managed in a way that secures an acceptable level of protection for human health and the environment, and affords to future generations at least the level of safety which is acceptable today; there seems to be no ethical basis for discounting future health and environmental damage risks;
- a waste management strategy should not be based on a presumption of a stable societal structure for the indefinite future, nor of technological advance; rather it should aim at bequeathing a passively safe situation which places no reliance on active institutional controls.

Clearly, the development of waste management policy and plans should be openly discussed with representatives from all concerned sections of society.

The Radioactive Waste Management Responsibility

The need to protect humans and the environment from the potentially adverse effects of radioactive wastes is clearly recognized, particularly for long-lived wastes such as nuclear spent fuels or wastes from spent fuel reprocessing. In fact, consideration of the very long-term and future generations became at an early stage a fundamental concern in the management of radioactive wastes, arising from the principle that current generations producing the wastes should bear, to the extent possible, the responsibility to manage it [4]. Accordingly, a strategy was developed for the isolation of radioactive wastes from humans and the environment for times sufficiently long to ensure that any future releases of radioactive substances to the environment be at a level that would not be unacceptable today. This strategy, which explicitly acknowledges the potential long- term radiological hazard, has the objective of ensuring that future populations are protected at a level at least equal to that acceptable for ourselves and are not committed to the continued expenditure of resources to ensure that this is so.

This objective should be achieved in a way which reconciles the various factors underlying our responsibilities to current and future generations. Broadly these factors are:

- the ethical principles of intergenerational and intragenerational equity described above;
- the technical requirements to ensure, and give confidence in, safety now and in the future;
- the availability of resources for technology development and implementation.

It is evident that these responsibilities are taken very seriously in OECD countries in the late 20th century. There is increasing distrust of the "out of sight - out of mind" philosophy which seemed to underlie some early hazardous waste management practices.

In a recent review of the principles of safe management of radioactive wastes (Annex I) the International Atomic Energy Agency provided confirmation of these basic responsibilities.

In technical and economic terms the exact measures preferred to achieve isolation of the different types of waste depend upon their physical and chemical characteristics. The types of processing, packaging and transportation required also vary between wastes. It is characteristic of radioactive wastes, with the exception of the natural radioactive residues from uranium mining, that their volume is relatively very small. In the case of some wastes from power stations, medical applications and research, the half-lives of the radioactive substances in the wastes are short enough that effective isolation is achievable by deposition in supervised near-surface vaults, or by other means of storage, whilst decay takes place. The present discussion concerns those longer-lived radioactive wastes which, like wastes containing unavoidable, non-recyclable toxic chemical elements, require isolation for times beyond the surveillance capability of current generations.

In comparison with many chemicals the toxicity of radioactive substances is well understood. However, unlike some industrial chemical wastes, most of the radioactive inventory of nuclear wastes is the inevitable by-product of power generation by nuclear fission and, except in the sense of packaging into a small volume, is not very amenable to further reduction by recycling or process improvement.

In the management of long-lived radioactive substances, as for other hazardous substances, there are essentially three options for wastes which cannot be recycled or eliminated by alternative technologies. The first is to dilute and disperse, the second is to store and monitor, and the third is to dispose by containment and isolation [5]. It has been argued that another option is the actual destruction of the toxic atoms by nuclear transmutation but for many wastes this is certainly impractical for the foreseeable future. In any case, the efficiency of the nuclear transmutation process would not be sufficient to eliminate all long-lived radioactive wastes and thereby avoid the need for a long-term isolation strategy [6].

The dilution and dispersal of wastes in the air and water of the biosphere is now approached with great caution and is subject to strict regulatory control. The emergence of global warming as a possible consequence of CO2 dispersal in the atmosphere is a good example of the unexpected risks that may appear. In the nuclear industry, and increasingly in the more traditional chemical industries, it is normal practice to decontaminate aqueous and gaseous waste streams to a high degree before dispersal; the product of this action is a solid material for disposal or re-use.

The objective of disposal is to isolate the wastes from the biosphere for extremely long periods of time, ensure that residual radioactive substances reaching the biosphere will be at concentrations that are insignificant compared, for example, with the natural background levels of radioactivity, and provide reasonable assurance that any risk from inadvertent human intrusion would be very small [7]. Geological disposal, which is discussed in more detail in the next section, is the method widely proposed for achieving this.

In almost all countries with nuclear activities, specific planning and project work leading towards geological disposal is underway. Nevertheless, in many countries there is a continuing public debate on the ethical case for geological disposal as a preferred means of passively safe isolation, and also on the question of when to implement the strategy and of its reversibility. Is the ethical course of action one in which the current generation, which has the use of the nuclear power, disposes of the associated wastes now in a way which is predicted to require no action by succeeding generations? Or should the current generation leave the wastes in supervised, retrievable stores so that future generations of technologists have all options for action open to them?

The indefinite storage and monitoring strategy has indeed a number of technical and ethical arguments in its favour, particularly if it were to be accompanied by suitable efforts to ensure continued development or improvement of options for final solutions and to ensure that financial resources would be available when needed at all times in the future. One interpretation of the concept of sustainability would support such an approach, wherein one generation would pass on to the next generation a world with "equal opportunity", and so on for the generations coming after, thus preserving options and avoiding the difficulty of predicting the far future. According to this idea of a "rolling present" the current generation would have a responsibility to provide to the next succeeding generation the skills, resources and opportunities to deal with any problem the current generation passes on. However, if the present generation delays the construction of a disposal facility to await advances in technology, or because storage is cheaper, it should not expect future generations to make a different decision. Such an approach in effect would always pass responsibility for real action to future generations and for this reason could be judged unethical.

A most significant deficiency of the indefinite storage strategy is related to the presumption of stability of future societies and their continuing ability to carry out the required safety and institutional measures. There is also a natural tendency of society to become accustomed to the existence and proximity of storage facilities and progressively to ignore the associated risks. Such risks would actually increase with time in the absence of proper surveillance and maintenance, leading at some indefinite future time to possible serious health and environmental damage. There are many well- known examples of bad environmental situations inherited from the past which show that this deficiency of a waiting strategy should not be underestimated.

What is needed is an evaluation of the good and bad aspects of alternative courses of action, given the principles listed earlier. One important factor is the argument that we cannot be sure that future society will maintain the knowledge and the institutions necessary for the protection of humans and the environment from hazards inherent in a strategy of supervised storage. Perhaps more important is the assertion that present generations have the direct benefits of nuclear power production and applications of radioisotopes in medicine and industry, and should not leave future generations to bear burdens of responsibility and resource cost if that can be avoided by action during the lifetime of current generations. Action can nevertheless be spread over several decades to resolve technical uncertainties about long-term waste isolation methods, or issues of social acceptability.

A variety of motivations influence social acceptability. Some of them are of an ethical nature, whilst others concern public opinion, trends and fashions. It is important in this respect to make a distinction between social convictions and ethical justifications, in order to avoid reducing the question of morality to one of acceptability or the question of acceptance to what can be justified ethically.

Today, the question is whether the proposed course of action is sufficiently safe and whether, given today's alternatives, it best meets the ethical principles discussed above. The answer is neither simple nor unequivocal. Existing methods, such as cost-benefit analysis and cost discounting (which cannot reasonably be applied over times longer than 20-30 years) have been considered for evaluation of intergenerational liabilities involved in different management strategies. None of them, however, can take account, quantitatively or qualitatively, of the ethical questions involved in bequeathing liabilities over many generations. In such circumstances, it should be the role of decision-makers to consider all issues, including ethics and public acceptability, to arrive at a balanced appreciation of the responsibilities of current generations to posterity.

In this context, it is important to remember that the health and environment detriment from disposed radioactive wastes is planned and regulated to be always at an acceptable level, and should not therefore be seen as one of the larger liabilities which are passed to future generations. There are issues of population control, depletion of natural resources and the dispersal of chemical by-products such as carbon dioxide, sulphur oxides and nitrogen oxides which potentially have much greater global consequences.

The Geological Disposal Strategy for Radioactive Wastes

There is today a broad international consensus on the technical merits of the disposal of long-lived radioactive wastes in deep and stable geological formations. Through a system of multiple containment barriers, this strategy would isolate the wastes from the biosphere for extremely long periods of time, ensure that residual radioactive substances reaching the biosphere after many thousands of years would be at concentrations insignificant compared for example with the natural background of radioactivity, and render the risk from inadvertent human intrusion acceptably small. Such a final disposal solution would be essentially passive and permanent, with no requirement for further intervention or institutional control by humans, although it may be assumed that siting records and routine surveillance would in practice be maintained for many years if society evolves in a stable manner.

Other disposal options aiming at long-term isolation of wastes from the biosphere were also considered, but not pursued, during many years of evolution of the geological disposal strategy. They include:

- disposal concepts such as deposition in polar ice caps or extraterrestrial space which are difficult to implement and poorly controllable; and
- disposal under the deep ocean floor, for which international agreement would be difficult to obtain.

New options might conceivably emerge over the next few decades. Certainly research on any credible alternative disposal option should be encouraged to allow, from time to time, a reappraisal of all potential options.

Currently, geological disposal can be shown to have the potential to provide the required level and duration of isolation. Moreover, it could be reversible, in contrast to the other disposal options considered. The principle of long-term isolation used in geological disposal is already the means by which the biosphere is protected from the vastly greater quantities of toxic and radioactive minerals naturally present in the earth. It is not a cheap waste management concept, but certainly in the case of nuclear power production its cost can be recovered according to the "Polluter Pays Principle", as a small fraction of the cost of nuclear electricity.

An essential aspect of the waste isolation strategy is that long-term safety of geologic disposal must be convincingly presented, and accepted, prior to actual waste emplacement. This can be achieved through safety assessments addressing timescales far beyond the normal horizon of social and technical planning, in practice many thousands of years. Scientific and technical assessments provide the principal means to investigate, quantify and explain long-term safety of any selected disposal concept and site to the appropriate authorities and the public. Their feasibility and reliability, including uncertainties unavoidably associated with the assessment of future situations, were addressed and confirmed in a previous international Collective Opinion published by NEA in 1991 (see Annex II for the Executive Summary of this Collective Opinion).

Another important element of the geological disposal strategy is the timing of the incremental process leading to the emplacement of waste, which in many national programmes would not occur until well into the next century. The main successive phases of this process consist of conceptual and technological development, site- screening, surface and in-situ characterisation studies, selection of a site, construction and operation (waste emplacement) of an underground facility and, eventually, sealing of all the accesses, dismantling of surface installations and closing of the facility to leave it in a passively safe state. Each phase of this long sequence will last many years, if not decades, and will be subjected to public debate and close scrutiny by the regulatory authorities, who will have to be satisfied with the results obtained before giving authorisation to proceed with the next phase. It is important to note that technical safety is not dependent on any particular rate of progress through the incremental process since supervised storage of the wastes, whilst not an acceptable strategy for the long term, is itself a very safe interim procedure.

During this incremental process, scientific information will be continuously collected from observations at and around the site and will contribute to both a better understanding of the regional and local geology and to increasingly refined performance assessments. This process, which must be flexible in order to accommodate inputs from research programmes and from public consultation, would provide ample opportunity for review. At any point in the process, if there were an indication that the objectives of safe disposal could not be met, it would be possible to cease disposal operations and retrieve the wastes.

The geological disposal concept does not require deliberate provision for waste retrieval after site closure. Interventions will, in principle, never be needed after repository closure since the disposal concept requires that the presence of waste may safely be forgotten, after a period of institutional control to prevent early inadvertent intrusion. For the extreme case of retrieval from a sealed repository, engineering procedures might be difficult and costly, but not impossible, and somewhat analogous to the extraction of toxic mineral ores.

Retrievability is an important ethical consideration since deep geological disposal should not necessarily be looked at as a totally irreversible process, completely foreclosing possible future changes in policy. In this context, it should be noted that sealing of a site and its access will always require a specific decision and that such a decision could be delayed until well after the end of waste emplacement operations to continue to allow reversibility and flexibility in the process if considered necessary. Under such circumstances, the incremental process leading to the implementation of the geological disposal strategy incorporates the advantages of a temporary storage phase, as advocated by some, without letting this phase extend indefinitely.

It must be acknowledged that the most robust and passively safe system that can be devised by current generations may ultimately be compromised by the actions of a future society, through inadvertent intrusion. Consideration of the probabilities and consequences of such intrusions at well-chosen sites indicates that the risks would be very small.

Finally, the decision-making process involves representatives of the technical community and competent regulatory authorities at the national level, decision-makers at local and regional levels, and representatives of various public interest groups. An open process is required to ensure that ethical and social considerations are properly taken into account, necessitating, therefore, a broad range of participants in the process. All national geological disposal programmes recognise the need for such procedures, notably to allow the communities affected by the selection of specific sites to be consulted and to participate appropriately in decision-making.

What is clear is that environmental consciousness continues to evolve and will play an increasingly important role in technological decision-making. In the field of radioactive waste management, which is supported by strong international co-operation in research and development, experts have published a wealth of information on technical issues (including NEA "Collective Opinions"), but less attention has been drawn to the ethical basis of the plans. It is for this reason that the decision was taken to publish, in this Collective Opinion, the ethical principles which underly the strategies for deep disposal of radioactive wastes.

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Annexe I

IAEA Safety Fundamentals: the Principles of Radioactive Waste Management
(Extract from Safety Series no III-F - An IAEA publication within the RADWASS programme)

Fundamental Principles of Radioactive Waste Management

Principle 1 **Protection of Human Health**

Radioactive waste shall be managed in such a way as to secure an acceptable level of protection for human health.

Principle 2 **Protection of the environment**

Radioactive waste shall be managed in such a way as to provide an acceptable level of protection of the environment.

Principle 3 **Protection beyond national borders**

Radioactive waste shall be managed in such a way as to assure that possible effects on human health and the environment beyond national borders will be taken into account.

Principle 4 **Protection of future generations**

Radioactive waste shall be managed in such a way that predicted impacts on the health of future generations will not be greater than relevant levels of impact that are acceptable today.

Principle 5 **Burdens on future generations**

Radioactive waste shall be managed in such a way that will not impose undue burdens on future generations.

Principle 6 **National legal framework**

Radioactive waste shall be managed within an appropriate national legal framework including clear allocation of responsibilities and provision for independent regulatory functions.

Principle 7 **Control of radioactive waste generation**

Generation of radioactive waste shall be kept to the minimum practicable.

Principle 8 **Radioactive waste generation and management interdependencies**

Interdependencies among all steps in radioactive waste generation and management shall be appropriately taken into account.

Principle 9 **Safety of facilities**

The safety of facilities for radioactive waste management shall be appropriately assured during their lifetime.

Annexe II

Executive Summary of the Previous International Collective Opinion on Safety Assessments

"Radioactive waste disposal systems are designed to isolate the waste from humans and the environment for the necessary times to ensure that no potential future releases of radioactive substances to the environment would constitute an unacceptable risk. Such systems have been built at or near the surface for low-level and short-lived wastes, and are widely envisaged to be built deep underground in geological formations for high- level and long-lived wastes.

The long-term safety of any hazardous waste disposal system must be convincingly shown prior to its implementation. For radioactive wastes, safety assessments over timescales far beyond the normal horizon of social and technical planning have already been conducted in many countries. These assessments provide the principal means to investigate, quantify, and explain long-term safety of each selected disposal concept and site for the appropriate authorities and the public. Such assessments are based on four main elements: definition of the disposal system and its environment, identification of possible processes and events that may affect the integrity of the disposal system, quantification of the radiological impact by predictive modelling, and description of associated uncertainties.

The NEA Radioactive Waste Management Committee and the IAEA International Radioactive Waste Management Advisory Committee have carefully examined the current scientific methods for safety assessments of radioactive waste disposal systems, as briefly summarised in this report. The Committees have also reviewed the experience now available from using safety assessment methods in many countries, for different disposal concepts and formations, and in the framework of both nationally and internationally conducted studies, as referenced in this report.

Following this review, the NEA Radioactive Waste Management Committee and the IAEA International Radioactive Waste Management Advisory Committee:

- recognise that a correct and sufficient understanding of proposed disposal systems is a basic prerequisite for conducting meaningful safety assessments,
- note that the collection and evaluation of data from proposed disposal sites are the major tasks on which further progress is needed,
- acknowledge that significant progress in the ability to conduct safety assessment has been made,
- acknowledge that quantitative safety assessments will always be complemented by qualitative evidence, and
- note that safety assessment methods can and will be further developed as a result of ongoing research work.

Keeping these considerations in mind, the two Committees:

- confirm that safety assessment methods are available today to evaluate adequately the potential long-term radiological impacts of a carefully designed radioactive waste disposal system on humans and the environment, and
- consider that appropriate use of safety assessment methods, coupled with sufficient information from proposed disposal sites, can provide the technical basis to decide whether specific disposal systems would offer to society a satisfactory level of safety for both current and future generations.

This Collective Opinion is endorsed by the CEC Experts for the Community Plan of Action in the Field of Radioactive Waste Management."

Annexe III

List of Radioactive Wste Management Committee Members
(who took part in the deliberations concerning this Collective Opinion)

Australia	Dr. G. DURANCE, Australian Nuclear Science and Technology Organization (ANSTO).
	Dr. R. JEFFREE, Australian High Commission, London.
Austria	Dr. P. KREJSA, Österreichisches Forschungszentrum Seibersdorf.
Belgium	Dr. F. DECAMPS, Organisme national des déchets radioactifs et des matières fissiles (ONDRAF).
	Dr. P. DEJONGHE, Centre d'étude de l'énergie nucléaire.
Canada	Dr. C.J. ALLAN, Physical and Environment Sciences, Atomic Energy of Canada Limited, Whiteshell Laboratories.
	Mr. K. BRAGG, Wastes and Impacts Division, Atomic Energy Control Board.
	Dr. P.A. BROWN, Radioactive Waste and Radiation, Natural Resources Canada.
Finland	Mr. E.J. RUOKOLA, Finnish Centre for Radiation and Nuclear Safety, Nuclear Safety Department.
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