WP4 – Long term governance

LONG TERM GOVERNANCE FOR RADIOACTIVE WASTE MANAGEMENT

FINAL REPORT OF COWAM2 - WORK PACKAGE 4




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It has to be mentioned that after the last seminar held in Antwerp in July 2006, Lorraine MANN, from Scotland Against Nuclear Dumping, decided to withdraw her support to the work package in the light of the EC position about how COWAM could be used by the EU to justify a new generation of nuclear power stations throughout Europe.

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FOREWORD

This report aims at identifying key features for the long term governance of radioactive waste. In that perspective, the proposals presented in this report have to be considered as a set of recommendations and good practices emerging from the work and discussions within the work package 4 of the COWAM2 project.

These proposals provide guidelines for the development of a practical waste management system adapted to each specific context (local, national or European) taking notably into account its historical dimension.

At the end of the COWAM2 project, the participants of the work package 4 identified a set of situations where the results may be used by the stakeholders themselves for:

- Addressing the issue of long term governance in dialogue processes on radioactive waste management, in their own context;
- Identifying ethical criteria and performance criteria which have never been addressed in their stakeholder groups by providing a framework for the analysis of these criteria;
- Discussing the different positions of the stakeholders on these criteria;
- Analysing the performance of concrete proposals for radioactive waste management with regard to long term governance;
- Addressing the social acceptability with regard to the issue of long term governance.

SUMMARY

The purpose of COWAM2 Work Package 4 (WP4) on "long term governance" was to identify, discuss and analyse the institutional, ethical, economic and legal considerations raised by long term radioactive waste storage or disposal on the three interrelated issues of: (i) responsibility and ownership of radioactive waste over long term, (ii) continuity of local dialogue between stakeholders and monitoring of radioactive waste management facilities, and (iii) compensation and sustainable development. The aim of WP4 was to propose guidelines in order to better address long term issues in decision-making processes and start long term governance.

Work organisation

The various issues of the COWAM2 project were addressed within a dedicated working group made up of stakeholders from different European countries and a research team. About 20 participants, having an interest on long term issues, attended twice a year the WP4 meetings. They were members of local liaison committees, NGOs, operators, regulators and experts from research and public institutes. They originated from Belgium, France, Germany, The Netherlands, Romania, Spain, Sweden, Switzerland, and United-Kingdom. Although different countries and categories of stakeholders were involved, the driving force for their participation was their willingness to address the issues of long term governance. The research team involved four different institutes from Belgium, France, and Switzerland and included expertise on ethics, radiation protection, economics, environmental assessment, and social sciences.

The approach adopted relied on the following steps: (i) establishment of the topics to be developed, (ii) preparation by the research team of topical documents ("definition" of long term, ethical considerations,...) and case studies (sustainability of protection systems, long term financing schemes,...) for discussion during the work package meetings, (iii) contribution of stakeholders (reflections on ethics, national and local contexts, financial mechanisms for long term governance,…), (iv) preparation of a draft final report by the research team, (v) comments and validation of this report by the participants (including a dedicated meeting).

It has to be mentioned that at the beginning of the project, several participants notified that, for them, a pre-requisite to their involvement in the governance of radioactive waste management would be to clearly address the articulation between energy policy scenarios and waste management scenarios. Although this issue was considered as an important one, all the WP4 participants acknowledged that COWAM2 was not the place to deal with it but that it required an adequate forum to be addressed (at the national level, with the relevant stakeholders and policy makers). Therefore, it was agreed to clearly quote this statement in the final report and, knowing this pre-requisite, to engage with all the participants of the work package the reflections on the long term governance.

Main results

The main topics investigated by the work package were the following: (i) meaning and stakes of long term, future generations and governance in the framework of radioactive waste management; (ii) ethical stakes regarding long term issues for radioactive waste management; (iii) continuity and sustainability of surveillance and monitoring; and (iv) efficiency of

financing schemes for the long term management of radioactive waste. On the basis of these investigations, some guidelines have been developed to provide stakeholders with an operational tool allowing a common technical and ethical elaboration of long term radioactive waste governance devices.

Meaning and stakes of long term, future generations and governance

There is not a unitary definition of the long term. From the technical point of view, long term is a concern for the operators of radioactive waste management facilities and the safety authorities in order to assess the performance of protection systems over periods of time in the order of several thousand of years, and beyond (up to million of years). Because of the various uncertainties associated with these timescales, there is no "absolute" guarantee for the very long term safety. Furthermore, this time dimension is far outside the current field usually considered for the prediction of the evolution of the society. From the societal perspective, considering timescales of the order of several thousands of years is meaningless.

The current generation is however concerned by the possible future, even in several thousands of years. Initially, the ethical reflections led to introduce the obligation for current societies to avoid “undue burdens” on future generations regarding radioactive waste management. Although the duty to protect future generations is of prime importance, the capability to really achieve this obligation is largely impacted by technical and scientific uncertainties, and depends also on the evolution of the society. Furthermore, the right to impose a behaviour to future generations is questionable. In that perspective, a reasonable approach to cope with this concern is, for the current generation, to create governance processes favouring a continuous transmission to the next generation(s) of a "safety heritage" (know-how, protection options, procedures, resources,...) in order to ensure the continuation of waste management.

This approach implies to cope with the past, the present and the future organisation of the radioactive waste management and to introduce an open process, allowing the future generations to intervene. In that perspective, the concept of retrievability introduces flexibility in the decision-making process. Nevertheless, it has to be kept in mind that to be flexible does not mean to postpone the decision but rather to keep options opened.

Not withstanding the technical options to be adopted, it is necessary to combine the two main concerns for long term issues (i.e. the technical one and the societal one). Indeed, from the safety and radiation protection point of view, an absolute performance on the considered timescale cannot be demonstrated. It is only through a transfer of responsibility between generations that the waste management can find a path. Therefore, the current generation has to investigate the efficiency and feasibility of technical options, but in association with a governance system allowing to address the societal demand in terms of a "safety heritage" transmission.

Guidelines for a common technical and ethical elaboration of long term radioactive waste governance devices

The investigation of the long term relationship between the technical processes and the ethical stakes lead to the idea of establishing guidelines allowing the stakeholders to engage a dialogue for a common elaboration of long term radioactive waste governance devices. This can be applied in various situations in Europe. The aim was to develop guidelines relevant both for a global (European) prospect and for a local/national prospect. Another point was

that such guidelines should link the technical process with the ethical stakes in taking into account the variety and the complexity of the institutional, financial and societal conditions. To develop the guidelines, the main topics to be considered by the stakeholders when elaborating long term governance devices has been identified (see following Table), and some of these topics were investigated within the work package in order to propose a set of ethical criteria as well as recommendations for the sustainability of long term surveillance and financing schemes (see following paragraphs).

Technical Processes	Institutional Conditions	Financial Conditions	Societal Conditions	Ethical Stakes
- Category of radioactive waste - Storage / Disposal / Transmutation - Combination of options over time - Development / reduction of nuclear energy production - Sustainable energy programme and link to the nuclear energy policy	- International / national agencies and programmes - Public / private ownership and its evolution over time - Co-operative management of the waste - Robustness of institutions in charge of information transfer - Procedures of transparency and access of official information	- Specific fund for the long term manage-ment of the waste - Provisions made by the operators or the state and their evolution over time - Financial support for the local development of municipalities and districts where radioactive waste management facilities are installed - External control of the fund evolution and its sustainability	- Intra-inter-trans generation relations - Networks of territories / municipalities / citizens involved in radioactive waste management - Involvement and empowerment of local population - Availability and accessibility over time of nternational / national / local expertise on radioactive waste management - Co-operative inquiry and management of waste	- Long term protection of health/environment - Freedom of choice for the local population over time - Conservation of memory and transfer of information, knowledge and skills - Socio-economic benefit and development of local communities - Control of energy consumption and waste production

The objective of the proposed guidelines is to favour a dialogue between the various categories of stakeholders in order to set up the key principles for developing long term governance devices relevant for their own context. Furthermore, it should be mentioned that the elaboration of these devices should be envisaged as a continuous process, largely influenced by the past and present situations. In that perspective, the devices should be regularly revisited and updated in order to cope with the evolution of the context.

Ethical stakes regarding long term issues for radioactive waste management

The ethical, organizational or political dimensions have been explored in the past within the radioactive waste management community (IAEA, OECD/NEA, KASAM, Seaborn Commission, …). One of the main conclusions is to consider that the driving principle for the elaboration of waste management options is to avoid "undue burden" for the future

generations. In COWAM2, the developments were oriented towards the creation of the best conditions to favour the transfer to the next and following generations of the whole waste management system. This led to the identification of three major ethical principles as key issues for the long term governance of radioactive waste: responsibility, justice and democracy. The analysis of these principles led to the elaboration of 20 ethical criteria, such as:

The future generations should be provided with some appropriate sustainable means (processes, money, institutions, knowledge, know-how,…) for the implementation and the assessment of radioactive waste management systems (…).

Our generation should provide a contribution that takes into account our current advantages compared to the disadvantages of the future generations. This contribution should be proportionate to the efforts (research and development, etc) needed to manage the radioactive waste and to optimise the cost of the radioactive waste management systems (…).

The institutions in charge of the radioactive waste management should be subjected to a democratic control and be counter-balanced by the political empowerment of the citizens through generations.

Continuity and sustainability of surveillance and monitoring

Whatever the type of radioactive waste management facility (geological disposal, short-term or long-term storage), the generic term of "surveillance" can include several aspects of the protection system, which may also vary with time, such as: the surveillance of the site; the technical monitoring of the facility environment; the technical maintenance of the facility; the management of any actions on site, including possible retrieval of waste; the preservation and transmission of know-how concerning waste management; the training of the generations who will take over the radioactive waste management facility site and; the organisation of a multi-level vigilance.

The continuity and sustainability of surveillance over long term periods cannot be guaranteed nor decreed. However, some elements can be put in place which will favour the preservation of the vigilance (from the local, national and international levels) and its transfer through generations. Four main fields of actions have been identified:

- *The organisation of surveillance and vigilance*: A specific monitoring and surveillance programme has to integrate local and national actors and to clearly specify their fields of responsibility. The durability of such a programme will be favoured notably by the set up of regular meeting points with the Administration/State in order to evaluate its efficiency and to identify the needs for its evolution. A dedicated sustainable financing system need to be associated with this programme. The capability to mobilize, when necessary, international resources should also be studied.
- *The development of a centre of competence*: The objectives of such a centre should be focused on the development, use and transfer through generations of expertise and knowledge regarding the operation, maintenance and surveillance of a radioactive waste management facility. It should beneficiate from local, national and international expertise. The capabilities to use the expertise of this centre in various places or in other fields should be favoured, as well as the involvement of stakeholders in its management.

- *Integration of the radioactive waste management facility and its surveillance in a local/regional socio-economic development:* The surveillance function should be integrated within a global project for a sustainable territorial socio-economic development. Such a project should be elaborated notably with a view to maintain the "life" around the radioactive waste management facility, as the stability of the local and regional demography is one of the key issues for the durability of the surveillance. The development of economic activities linked for example with the environmental surveillance and monitoring, and in interaction with the scientific and technological competence at the regional level should also be studied.
- *Need for an equitable distribution of responsibilities between territories and generations*: An efficient protection system needs a clear distribution of responsibilities between local, national and international actors. Moreover, the notion of "safety heritage" should be developed in order to create a "safety link" between these actors, and between generations. Finally, reflections on the interest of an international convention on the "protection of radioactive waste management facilities" should also be developed.

Efficiency of financing schemes for the long term management of radioactive waste

The capability of future generations to implement radioactive waste management options and to continue the surveillance and monitoring rely notably on the financial resources which will be available in the future. The analysis of the financing schemes for the management of radioactive waste put in place in some European countries pointed out some of the main issues to be addressed to evaluate the performance of such a financing scheme in a long term perspective:

- *Distribution of responsibilities regarding the management of radioactive waste:* These responsibilities include the ownership of the waste, the responsibility for financing, for implementing a radioactive waste management facility, for surveillance,... Furthermore, the transfer of these responsibility and liability over time should be planned in advance.
- *Transparency on cost estimates and use of the funds:* The decision-making process for defining the level of the funds or provisions and its use should be explained, as well as the radioactive waste management scenario used to determine the level of the financial needs in the future. In particular, it is necessary to consider the costs associated with the long term surveillance or the financial accompaniment for a sustainable development of the territories. The ability of the fund to evolve with time should be clarified. External audit of the funds or provisions should be done on a regular basis by the State in collaboration with national and local stakeholders, e.g. through the involvement of a Local Commission in the follow-up of the fund management.
- *Financial guarantees*: The financing schemes should integrate financial guarantees to be used if the cost of radioactive waste management is higher than expected or if there is a bankrupt of a waste producer. It should also comprise specific systems to ensure (as much as possible) that the provisioned money will be available when necessary.

Future prospects

The perspectives opened by this project concern: (i) the implementation of the guidelines in specific contexts to take account of the long term dimensions in the elaboration of radioactive waste management systems, (ii) the needs for further developments on practical mechanisms for the organisation of long term governance, and (iii) the dissemination and the sharing of feedback experiences on the use of the guidelines.

Implementation of the guidelines in specific contexts

The aim of the proposed guidelines is to favour the elaboration of long term radioactive waste governance devices by a set of stakeholders (local, national and/or European), taking into account the technical, institutional, financial, societal and ethical considerations. The purpose is not to be prescriptive but to promote a common reflection and elaboration on this issue in a specific context, based on a structured approach. Therefore, the next step concerns the implementation of the guidelines by different stakeholders to favour dialogue and identification of common issues regarding long term governance, and to point out the remaining disagreements.

Proposals for future investigations

Currently, future investigations have been identified concerning the practical mechanisms for the organisation of long term governance. This mainly refers to:

- Concrete monitoring programmes: definition of criteria for assessing the performance of the radioactive waste management facility over long term; meaning of long term monitoring of a radioactive waste management facility.
- Transfer of knowledge and know-how: identification of research programmes for developing reflections on the long term governance of radioactive waste management facilities; regular checking of the relevance of the knowledge and know-how to cope with the "safety missions".
- Territories sustainable development projects and long term vigilance: analysis of the ways to integrate the vigilance and sustainable development objectives and to ensure the availability of expertise in concerned regions.
- Elaboration of financing mechanisms dealing with long term governance.

Dissemination and sharing of feedback experience regarding long term governance

A key dimension regarding long term governance relies on the existence of networks at local, national and European levels involving different categories of stakeholders. The dissemination and sharing of feedback experience on long term governance could play a key role for improving the current governance systems. It could also contribute to ensure a continuity of the surveillance and a solidarity between the different stakeholders and territories involved in the long term management of radioactive waste. In that respect, the existence of European networks is crucial for addressing the issues of long term governance and favouring the emergence of innovative approaches.

Finally, the promotion of the results of this report, in specific contexts, might lead to the identification of other investigations needs. This would then make it possible to further refine the issues already investigated in this work package regarding long term governance and to address them within a larger all inclusive governance approach, integrating local democracy, the influence of local actors on the national decision-making processes and the quality of decision-making processes.

1. INTRODUCTION

The long life of the radioactivity of the radioactive waste gives a new timescale dimension, never previously experienced by the society for the development of protection systems.

In the framework of the European Commission research project "COWAM2" (COmmunity WAste Management[1]) related to the governance of radioactive waste management, the issues of "long term governance" have been addressed, in a dedicated work package (WP4 - long term governance). The purpose of this work package was to identify, discuss and analyse the institutional, ethical, economic and legal considerations raised by long term radioactive waste storage or disposal on the three interrelated issues of (i) responsibility and ownership, (ii) continuity of local dialogue and monitoring, and (iii) compensation and sustainable development. Its aim was to identify a set of practical recommendations in order to better address long term issues in decision-making processes and start long term governance.

This report presents the results of the work performed during this 3-year project. After a brief presentation of the approach adopted for the development of the work, the five following chapters describe the results related to:

- *Meaning of long term, future generations and governance:* this chapter is dedicated to "long term" from technical and societal points of view as well as the qualification of the long term perspective in terms of governance.

- *Guidelines for a common technical and ethical elaboration of long term radioactive waste governance devices:* these guidelines are dedicated to the stakeholders participating in the elaboration of radioactive waste management systems in order to address technical and ethical long term issues. They specifically address three issues which are developed in the next chapters: ethical stakes, continuity and sustainability of surveillance and monitoring as well as the efficiency of financing schemes.

- *Ethical stakes regarding long term issues for radioactive waste management:* this chapter addresses the rights and duties of current and future generations, long term responsibility, democracy and justice.

- *Continuity and sustainability of surveillance and monitoring:* this chapter provides recommendations related to the memory and knowledge conservation and transfer, the local and regional economic development as well as the distribution of responsibilities between territories and generations.

- *Efficiency of financing schemes for the long term management of radioactive waste:* this chapter discusses the dimension of responsibilities and liability with regard to long term financing schemes as well as the issues of transparency and long term evolution, surveillance and guarantees of these schemes.

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[1] Web site: http://www.cowam.org

Finally, the last chapter points out the perspectives opened by this work: implementation of the guidelines in specific contexts (local, national or European) to take into account the long term dimensions in the elaboration of radioactive waste management systems, the needs for further developments on practical mechanisms for the organisation of long term governance, and the dissemination and the sharing of feedback experiences on the use of the guidelines.

At the end of each chapter, points of views from some WP4 participants are provided.

An Annex Report (see Table of content in Appendix 2) has also been elaborated. It includes the full contributions and working papers from the research team as well as from some participants of the stakeholder reference group.

2. WORK ORGANISATION

The originality of the COWAM2 project is that it addressed the various issues within working groups made up of stakeholders from different origins and European countries and a research team. About 20 participants, having an interest on long term issues, attended twice a year the meetings of the work package on long term governance. They were members of local liaison committees, NGOs, operators, regulators and experts from research and public institutes. They originated from the following countries: Belgium, France, Germany, The Netherlands, Romania, Spain, Sweden, Switzerland, and United-Kingdom. Although different countries and categories of stakeholders were involved in the work package, the driving force for their participation was their willingness to address the issues of long term governance.

The research team involved four different institutes from Belgium, France, and Switzerland and included expertise on ethics, radiation protection, economics, environmental assessment, and social sciences.

In order to perform the work, the approach adopted relied on the following steps:

- Establishment of the topics to be developed: for this purpose, the first meeting (in April 2004) was dedicated to the identification of participants' expectations which allowed to define the work programme.
- Preparation of topical documents and reviews of case studies by the research team for discussion during the work package meetings, and notably the discussion of ethical issues.
- Contribution of stakeholders: presentations of reflections on ethics, presentations of national and local contexts regarding long term issues, presentation of financing mechanisms for long term governance.
- Preparation of a draft final report by the research team.
- Comments and validation of the final report by the participants (including a dedicated meeting).

The detailed list of meetings is provided in Appendix 1. It has to be mentioned that two meetings of the work package were held in Gartow (Germany, near Gorleben) at the invitation of Pastor Eckhard Kruse and included a visit of the underground exploratory mine of the Gorleben salt dome (thanks to Jürgen Wollrath from BfS - Federal Office for Radiation Protection - Germany) and a debate with local stakeholders on the issue of geological disposal of high-level radioactive waste in Germany. Another meeting was held in Barcelona (Spain) with specific emphasis on the reflection of COWAM Spain regarding long term issues.

It is important to mention that at the beginning of the project, several participants notified that, for them, a pre-requisite to their involvement in the governance of radioactive waste management would be to clearly address the articulation between energy policy scenarios and long term waste management scenarios. Although this was considered to be an important issue, all the WP4 participants acknowledged that COWAM2 - WP4 was not the place to open this debate. It was considered that an adequate forum has to involve different local and national stakeholders and energy policy-makers. Therefore, it was agreed to clearly quote this need in the final report and, knowing this pre-requisite, to engage with all the participants of the work package the reflections on the long term governance.

The objective of this report is not to present a consensus on all the topics. A lot of discussions during the meetings as well as the stakeholders contributions allowed to identify the topics on which there is an agreement between the different participants and those where there is disagreement or a need for further reflections. Therefore, the report tries to reflect as much as possible this situation and mentions when necessary the different points of view.

3. LONG TERM, FUTURE GENERATIONS AND GOVERNANCE

Considering long term issues immediately raises the question of the delineation of the time scale considered. In fact, it clearly appears that there is not a unitary definition of the long term. What "long-term" means largely depends on the chosen perspectives – who defines, what the context is, what it is defined for. Therefore, it is essential to first delineate what is at stake in terms of time dimension when dealing with long term governance. Regarding radioactive waste management, two long term perspectives have to be considered: a technical perspective and a societal perspective. This chapter points out the key issues associated with these two perspectives and identifies the main features for the long term governance. Additional considerations can be found in the Annex Report.

3.1. Long term from a technical perspective

From a technical point of view, the introduction of time dimensions into the analysis of the radioactive waste management facilities refers to:

- the evolution of the radioactivity and thermal characteristics of the waste package;
- the duration of the technical options envisaged for managing the waste;
- the assessment of the impact on long term periods and the associated safety criteria.

Radioactive and thermal evolution of the waste packages

The first component of the timescale refers to the radionuclides half life and to their radiological toxicity. This aspect is illustrated by the case of vitrified radioactive waste. In the following example, the initial characteristics considered for a vitrified waste package are:

- Activity: 36,700 TBq
- Dose rate at 1 meter distance: 50 $Sv.h^{-1}$
- Thermal power: 3,000 W

The Table 1 presents some rough reduction factors according to timescale (100 years, 1,000 years and 10,000 years) calculated for a vitrified waste package [Lochard et al., 2000]. It points out the variation of timescale considerations according to the nuclide or indicator considered.

Table 1. Rounded reduction factors calculated for a vitrified waste package

	100 y	**1,000 y**	**10,000 y**
Radionuclide activity			
Pu (all isotopes)	20	60	200
Actinides	4	20	1,000
Fission products	15	10^6	$4.\ 10^{10}$
Dose rate (1 meter)	20	$25.\ 10^6$	n.d.
Thermal power	10	300	n.d.

Technical options envisaged for managing the radioactive waste

According to the initial characteristics of the radioactive waste and their time evolution, different technical options are envisaged in order to provide an adequate protection for public, workers and the environment. Without considering the recycling options or potential specific treatments of the radioactive waste, three main types of technical options can be distinguished: interim storage, long term interim storage, and geological disposal.

Interim storage

Currently, in a number of European countries, interim storages are put in place associated with the power plant itself or in a centralised location. These storages mainly receive waste packages directly from the power plant (irradiated fuel) or from the reprocessing plant (vitrified waste). Their design aims at providing technical conditions for cooling the packages and ensuring the radiological protection of workers, the public and the environment. Generally, they are planned to last several decades, before envisaging new destinations for the radioactive waste.

Long term interim storage

Recently, new designs for interim storage have been developed or are under reflection in some countries, in order to cope with longer durations. The key difference in their objective, compared to the current interim storage, is to provide a technical option able to last about one century (or more) without significant operation and maintenance requirements. Several concepts are envisaged from surface to near surface or underground storage.

Geological disposal

The consideration of timescale is of course a key feature of the geological disposal safety assessment, as it is clearly its objective to provide a protection system able to cope with very long periods. In order to address the time dimension of this option, four characteristic periods or phases are usually identified, from the operational phase to and after repository closure [OECD/NEA, 2004]:

- The operational phase is the period covering waste emplacement and repository closure, and it can last several decades.
- The thermal phase is the phase during which the heat generating waste significantly increases the temperature in and around the repository; its duration is approximately 300 years for vitrified waste and 2,000 years for UO_2 spent fuel.
- The isolation phase refers to the phase where the radionuclide releases from the disposal system are negligible; for example, in case of deep geological disposal of high level waste in the Boom Clay/Belgium, this phase is situated between 1,000 and 10,000 years after the repository closure.
- The geological phase considers the period for which the repository enters the geological timescales (10,000 till million years after closure); the main estimated radiological impact associated with normal situations is situated in this phase.

Assessment of the impact on long term periods and associated safety criteria

For interim storage, safety criteria are those traditionally used for the assessment of current nuclear installations. Only the development of long term interim storage could require an adaptation of some criteria in order to address the duration of the protection system. Nevertheless, these installations have to be regularly controlled and therefore, the time dimension does not introduce too many differences regarding the safety criteria.

At the opposite, when dealing with geological disposal of high-level radioactive waste, the assessment of the impact on long term periods is essential from a safety point of view. It is usually planned to site radioactive waste repositories in stable geological environments in which key characteristics that provide safety, such as mechanical stability, low groundwater flow and favourable geochemical conditions, are unlikely to change significantly in the course of time. Over long enough timescales, however, even the most stable engineered materials and geological environments are subject to perturbing events and changes [OECD/NEA, 2004]. These events and changes are associated with uncertainties, which generally increase with time and must be taken into account in safety assessments. Eventually, but at very different times for different parts of the system, uncertainties are so large that predictions regarding the evolution of the repository and its environment cannot meaningfully be made (see Figure 1).

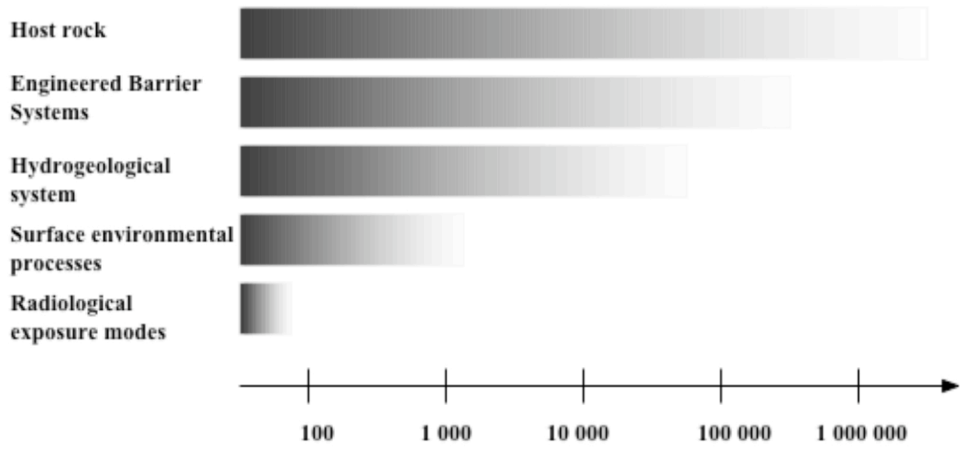

Figure 1. The limits of predictability of various aspects of a geological disposal system

Taking into account these limits, the principles and criteria adopted by the authorities for the safety assessment of the geological disposal system generally rely on:

- a first period of about 10,000 years during which the predictability of the system's performance is considered accessible;
- a very long term period, beyond 10,000 years, where the assessment is generally used only as an indication of the efficiency of the system.

A second consideration for elaborating safety criteria refers to the evolution of the disposal system:

- the "normal evolution" of the system for which usually an individual dose criteria is considered and calculations are made for a critical (or reference) group assuming habits for the different periods of time considered;
- the existence of "deteriorated or accidental situations" for which additionally a probability of occurrence of such situations is generally introduced. These situations include different intrusion scenarios or climatic evolutions for very long term periods.

The reference individual dose criteria usually vary from 0.1 to 0.3 $mSv.y^{-1}$ for the reference individual or group, while the range of risk probability considered for the deteriorated situations usually refers to 10^{-6} to 10^{-5} as an individual risk of death per year. The rationale for these values is at least to get the same level of protection as current generations and refers to a fraction of the current annual dose limit for the public (1 mSv per year) or to a comparison with variations of the natural background levels.

It has also to be noticed that the time integration is not clearly established: some authorities request to limit the detailed calculations to the first 10,000 years while others ask for periods up to 1 million years, and in several countries, no time limitation is specified.

One has to keep in mind that beyond the different criteria adopted by the national safety authorities, the treatment of uncertainties associated with the assessment of performance of the disposal system for very long timescales is still a matter of debate at national and international levels.

3.2. Long term from a societal perspective

The different elements presented above show that the time dimension taken into account within the technical evaluations of safety for the geological disposal option are outside the current field usually considered for the prediction of the evolution of the society. It can also be noted that for a long term interim storage option, although the degree of reliability of the predictions is much higher from a technical point of view, it is still a matter of "long term", from the societal point of view, as the timescale considered is in the order of one (or several) century.

Introducing the transfer between generations

First of all, it is essential to recognize that the long term governance of radioactive waste cannot be reduced to a technical issue. Given the potential risks associated with radioactive waste, and especially the time dimension of these risks, the management of radioactive waste induces a new complexity regarding the decision process and the institutional and societal control over timescales which have never been experimented before. Therefore, it is essential to acknowledge that the whole society is concerned by this issue and not only the waste producers or the operators in charge of managing the waste. The waste producers, the waste operators and the authorities are, of course, responsible for the implementation of the waste management options but it is the whole society which is embarked now into a long term waste management process, introducing a responsibility toward future generations.

From the societal perspective, considering timescales of the order of several thousands of years is meaningless. It is not possible to envisage how the society will be organised in the far future. Even in several decades, a lot of evolutions may occur, stopping the ability to define what will happen, what will be the economic, social and environmental situations as well as how society will behave. The current generation is however concerned by the possible future, even in several thousands of years. This is notably the core of the ethical reflections regarding the precautionary principle and the sustainable development in order to preserve the resources and the environment for the future generations. On this basis, the obligation for the current generation to avoid "undue burdens" on future generations regarding radioactive waste management was notably introduced. Although the duty to protect future generations is of prime importance, the capability to really achieve this obligation is largely impacted by technical and scientific uncertainties, and depends also on the evolution of the society. Furthermore, the right to impose a certain behaviour on future generations is questionable. In that perspective, it has been acknowledged within the participants of the COWAM2 - WP4 that a reasonable approach to cope with the long term duration of waste radioactivity is, for the current generation, to create management and governance processes favouring a continuous transmission to the next generation(s) of a "safety heritage" (know-how, protection options, procedures, resources,...) in order to ensure the continuation of waste management.

These management processes or governance processes may evolve with time, but the current generation needs to consider how they can be set up in order to achieve a number of "missions" which will be transmitted to the next generation. It will be the responsibility of the next generations to continue and/or reconsider these processes and to adapt them with the aim of ensuring the realisation of these different missions.

Having introduced the need for a transfer between generations, it appears obvious that the timescale to be considered from a societal point of view differs from the one adopted from the technical point of view. The key features of the time dimension rely on the legacy including the transfer of a safety patrimony for ensuring the protection of future generations and their environment. Therefore, the consideration of the long term from a societal point of view implies to cope with the past, the present and the future organisation of the radioactive waste management. The Figure 2 illustrates this perspective and the transfer between generations.

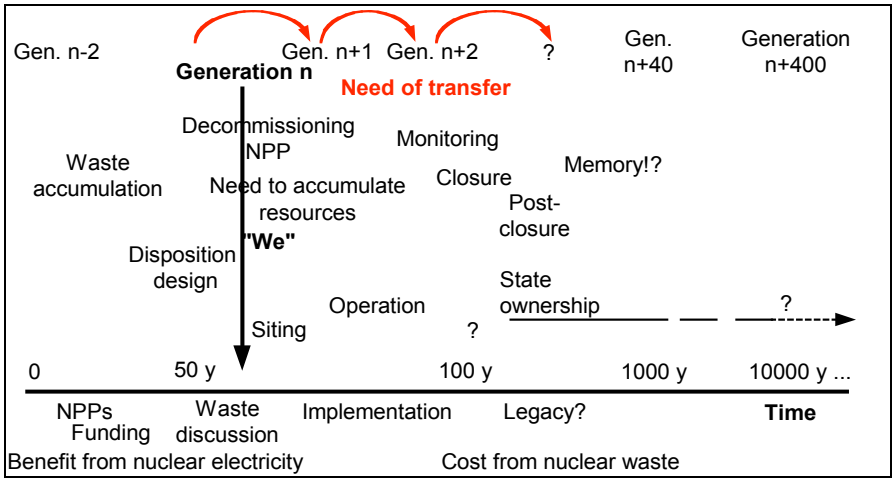

Figure 2. A possible illustration of 'long term' from the societal perspective

Openness of the process and retrievability

Introducing the principle of a transfer of legacy to the next generations raises immediately the question of the openness of the process: how will future generations be able to intervene on the technical choices made by the current generation? In that perspective, the concept of retrievability has been discussed within the participants of COWAM2 - WP4.

First of all, it was quoted by most of the participants that safety is the paramount aspect in ethical considerations on long term radioactive waste management. Nevertheless, as the future can't be decided nor anticipated by the current generation, retrievability is considered as providing flexibility for the decision process. This gives the possibility of adopting better future solutions over a longer period and to address some of the uncertainties identified from a technical point of view.

It has to be mentioned that in all cases, the operational phase of a disposal facility (repository) will last during at least 2 generations. During this period, the retrievability of waste should always be possible. Some participants consider that retrievability is mainly a matter of financial resources because the know-how and technology needed to do so already exists, including the retrieval of waste from a closed repository. Thus, there is a difference between the technical retrievability of the waste and the social reversibility of a process.

It has to be noted here that an integrated cooperation programme, (ESDRED[2]), involving European waste management agencies and research centres, is currently investigating certain engineering and technology aspects of repository design in order to demonstrate the technical feasibility of activities related to construction, operation and closure of a deep geological repository. Several presentations, and subsequent discussions, during the course of COWAM2 - WP4 meetings highlighted the successful and ongoing development of waste package handling methods and equipment. The availability of suitable equipment is a key issue when dealing with the retrievability option.

Beyond the issue of the technical feasibility for retrievable, the adoption of a stepwise process, moving from storage to disposal could better cope with the issue of retrievability. In that sense, the closure agreement can be discussed in due time for some parts of the disposal facility according to the knowledge and the will of the society at that time. This requires the definition of clear criteria and decision making processes with a regulatory body, although this definition of criteria may appear to be difficult: only indications or proposals for such criteria could be made for the next generation, who will have to adopt its own criteria.

Finally, it has to be kept in mind that to be flexible does not mean to postpone the decision but rather to keep options open. It was stated by the participants of the work package that if retrievability is adopted, it should not be considered as evidence of acceptability of the current

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[2] ESDRED: Engineering Studies and Demonstrations of Repository Design. For more details, see the Annex Report.

option but rather as a means for future generations to be involved in the decision making process.

3.3. Some points of view on long term from WP4 participants

Contribution from Miquel Ferrus - GMF - Spain

From a political point of view, most of the Spanish local authorities believe that it is only possible to address the long term issues when the current problems are solved. In fact, the current situation is part of the long term: today begins the future.

Safety and transparency are conditions sine qua non for the "correct governance" of the radioactive waste management, and it means it is required today and it will be needed tomorrow as well.

Contribution from Olov Holmstrand - The Waste Network - Sweden

Based on Swedish conditions short term could be the next 100 years coinciding with the supposed operation time of the interim storage CLAB. Real long term could be beyond the next 1000 years. The period 100-1000 years might be regarded as a less controversial medium term period. Three figures describing long term often appear in the Swedish debate.

5,000 - 10,000 years.
The period ends with the next glaciation. SKB claims the KBS method to be "absolutely" safe, but NGOs claim that safety is not proved and radioactivity might reach groundwater and biosphere probably before the end of this period.

100,000 years.
This figure is normally mentioned to describe the end of responsibility for the waste. Within this period one or more glaciations might occur. SKB still claims the deposit to be safe, but not so absolutely. NGOs claim the risks during a glaciation to be unknown, ignored and considerable.

1,000,000 years.
This is beyond normal human conception. SKB claims the waste to be harmless. NGOs claim that parts of the waste still have not declined totally and could be spread out completely long before it has became harmless.

Contribution from Shelly Mobbs – HPA/RPD - United-Kingdom

Although it is easy to talk about long timescales and possible to run mathematical models to estimate the impacts of waste management options out to long times in the future, we should understand what these long timescales really mean. If we think about how we react to the problems and issues that were important a few hundred years ago, for example 250 years ago at the time of Mozart, we can get some idea of how difficult it is to maintain memory and interest in issues for hundreds of years. Thus the question of how many decisions we should take now and how much we should leave to future generations should be considered in this context. For waste management decisions, the question is 'What is the overall optimum option for protecting people?' Long term governance is therefore one of the important issues to be taken into account.

Contribution from Jürgen Wollrath - BfS - Germany

Proposal of the Bundesamt für Strahlenschutz (BfS) for time frames to be considered for radioactive waste repositories:

➢ ***Period in which monitoring of measurements from the repository system is possible (~ 50 yrs)***

This is the period during which the repository has the highest inventory activity and in which the effects of mining on the geological barriers are greatest.

➢ ***Period for which it is highly probable that information about the repository can be preserved (~ 500 yrs)***

In this period a considerable portion of the inventory activity has decayed. Inadvertent human intrusion should be prevented. The disposal locations of the waste within the repository should remain known. This means that during this period it is basically possible to retrieve the waste, although recovery is not intended.

➢ ***Period during which the repository´s barrier system is only subject to minor changes (~ 10,000 yrs)***

The inventory activity is still high enough to present a hazard to man and the environment. The effects of heat and gas originating from the waste on the geological barriers is diminishing. A reliable description of the properties of all barriers should be possible.

➢ ***Period for which a good description and assessment of the retention of pollutants in the isolating rock zone is possible (~ $1 \cdot 10^6$ yrs)***

By the end of this period the inventory activity is falling off considerably, but containment is still necessary. It can not be assumed that the near-surface conditions and the living conditions for humans, fauna and flora will remain intact.

➢ ***Period for which only qualitative statements about retention are possible (>~ $1 \cdot 10^6$ yrs)***

The inventory activity is determined by radionuclides with very long half-lives. By now it is only changing very slowly. Quantitative proof of safety is no longer meaningful in view of the increasing uncertainty in the assessment as time goes on.

3.4. Conclusions on long term, future generations and governance

In conclusion, if we consider the time dimension from the technical and societal perspective, it clearly appears that the concerns are not the same, both approaches deal with uncertainties but of a different nature:

- From the technical point of view, long term deals with the uncertainties associated with the performance of the disposal system over periods of time in the order of several thousand of years, and beyond;

- From the societal point of view, the main concern is the organisation of the transfer of a whole waste management system, including a safety heritage, from the present generation to the next generation, and then to the following generations.

In order to overpass these differences, the reference to governance allows to promote a new approach for long term management. Governance appears as a complementary option rather than a substitute to the traditional government policy. As Rosenau [Rosenau et al., 2000] says : '*Governance is not synonymous with government. Both refer to purposive behaviour, to goal-oriented activities, to systems of rule ; but government suggests activities that are backed by formal authority, by police powers to ensure the implementation of duly constituted policies, whereas governance refers to activities backed by shared goals that may or may not derive from legal and formally prescribed responsibilities and that do not necessarily rely on police powers to overcome defiance and attain compliance. Governance, in other words, is a more encompassing phenomenon than government. It embraces governmental institutions, but it also subsumes informal, non-governmental mechanisms whereby those persons and organizations within its purview move ahead, satisfy their needs, and fulfil their wants*'.

Similarly, Gerry Stocker [Stocker, 1998] identifies five aspects of governance :

(1) Governance refers to a set of institutions which does not belong all to the government sphere;
(2) The frontiers and responsibilities are less clear in the field of economic and social policy;
(3) There is an interdependence between the power of the institutions implied into collective action;
(4) Some autonomous actors networks are called to intervene into the processes;
(5) The principle is the possibility to do things without the power or the authority of the State.

The perspective of long term governance for radioactive waste implies embracing the various levels of complexity: timescales and schedules, scientific analysis, technological devices, legal issues, ethical stakes, institutional frames, financing mechanisms, … It also requires linking up the various levels of complexity on the basis of a principle of cooperation between the policy makers, the safety authorities, the technical experts, the nuclear operators, the waste management agencies and the civil society concerned by a set of initiatives and projects, be they local, national or international. The concern with the long term means that the concrete governance processes must be able to guarantee a degree of flexibility between

the decisions to be made by the current generation and the future decisions to remain open for the generations to come.

Notwithstanding the technical options to be adopted for the long term management of radioactive waste, it is necessary to combine the two main concerns for long term issues (i.e. the technical one and the societal one). Indeed, from the safety point of view, an absolute performance on the considered time scale cannot be demonstrated. It is only through a transfer of responsibility between generations that the waste management can find a path. Therefore, the current generation has to investigate the efficiency and feasibility of technical options, but these options should be associated with a governance system that makes it possible to address the societal demands in terms of a "safety heritage" transmission. Concretely, this governance system will have to cope with the following questions:

- Which degree of flexibility for the future generations is needed and how to design the stepwise decision-making process?
- Which knowledge and know-how are necessary to ensure the long term safety?
- How to facilitate the transfer of this safety heritage?
- Which level of surveillance is planned and how to organise the long term surveillance?
- How to link the issue of long term surveillance with the territorial sustainable development?
- Which financing mechanisms will provide the resources for allowing the flexibility of the governance system?

4. GUIDELINES FOR A COMMON TECHNICAL AND ETHICAL ELABORATION OF LONG TERM RADIOACTIVE WASTE GOVERNANCE DEVICES

The investigation of the long term relationship between the technical processes and the ethical stakes lead to the idea of establishing guidelines allowing the stakeholders to engage a dialogue for a common elaboration of long term radioactive waste governance devices. This can be applied in various situations in Europe. It is necessary to provide the stakeholders involved in sometimes very different national and local contexts with a comparative methodological tool helpful for the assessment of their own situation. There is no doubt that for the stakeholders participating in COWAM2 the opportunity to make comparisons with other countries, other situations and other stakeholders is of great value to them.

The aim was to develop guidelines relevant both for a global (European) prospect and for a local/national prospect. Another point was that such guidelines should link the technical process with the ethical stakes in taking into account the variety and the complexity of the institutional, financial and societal conditions. Indeed, the direct relationship between technical and ethical aspects should be tuned by some specific conditions that make the guidelines more accurate and relevant for a given national and local situation. Lastly, the guidelines should introduce a long term perspective which underlines the roles of the current and future generations into the management of the radioactive waste.

To develop the guidelines, the main topics to be considered by the stakeholders when elaborating long term governance devices have been identified (see Table 2), and some of these topics were investigated within the work package in order to propose a set of ethical criteria as well as recommendations for the sustainability of long term surveillance and financing schemes (see following chapters).

In fact, these guidelines are more a *virtual picture* of what can possibly be relevant in terms of governance for the stakeholders involved in a long term process than a fixed list of standards that one should apply to be compliant with it. Besides, the separation of the topics in five thematic fields is not a perfect option, since, for instance, some conditions are both societal and institutional. In fact, the list of topics tries to identify some problems of governance, but it does not provide any ‘solution’, in that a solution is the one conceived by the stakeholders themselves on the basis of the specific conditions of their own situation. The general spirit is the following: ‘Don’t forget this criterion, it was considered relevant by a group of European actors: is it not also important for you?’. The various topics of the guidelines can refer to either a constraint or an opportunity, to a lack or a resource according to the context of the project. For instance, the international agencies or programmes (see ‘Institutional conditions’) can be a constraint or an opportunity for the stakeholders. The involvement of the local people can be a resource, whereas the empowerment can be a lack if the involvement does not empower them (see ‘Societal conditions’).

Table 2. Topics to be considered for the elaboration of long term governance devices

Technical Processes	Institutional Conditions	Financial Conditions	Societal Conditions	Ethical Stakes
- Category of radioactive waste - Storage / Disposal / Transmutation - Combination of options over time - Development / reduction of nuclear energy production - Sustainable energy programme and link to the nuclear energy policy	- International / national agencies and programmes - Public / private ownership over time and its evolution over time - Co-operative management of the waste - Robustness of institutions in charge of information transfer - Procedures of transparency and access of official information	- Specific fund for the long term management of the waste - Provisions made by the operators or the state and their evolution over time - Financial support for the local development of municipalities and districts - External control of the fund evolution and its sustainability	- Intra-inter-trans generation relations - Networks of territories / municipalities / citizens involved in radioactive waste management - Involvement and empowerment of local population - Availability and accessibility of International / national / local expertise on radioactive waste management - Co-operative inquiry and management of radioactive waste	- Long term protection of health/environment - Freedom of choice for the local population over time - Conservation of memory and transfer of information, knowledge and skills - Socio-economic benefit and development of local communities - Control of energy consumption and waste production

Hereafter is the proposed list of topics with a short explanation of their meaning.

Technical processes

- Categories of radioactive waste (i.e. Low Level, Intermediate Level, High Level, Short Lived or Long Lived)
- Storage / Disposal / Transmutation (what is the device/strategy planned for future management of radioactive waste?)
- Combination of options for radioactive waste management in time
- Development / reduction of nuclear energy (what is the long term trend for the nuclear energy?)
- Sustainable energy policy (what are the alternative energy devices or policies?)

Institutional conditions

- International / national agencies and programmes (what are the reference agencies or programmes?)
- Public / private ownership and its evolution over time (what is the structure of the ownership of the waste over long term periods?)
- Co-operative management of the waste (are the institution involved in radioactive waste management open to co-operation?)

- Robustness of institutions in charge of information transfer (are the institutions in charge of the transfer of information to the future generations reliable ?)
- Procedures of transparency and access to official information (are the information procedures of the institutions transparent and is the necessary information accessible, to what extent ?)

Financial conditions
- Specific fund for the long term management of the waste (are such finds available and is the institution managing the fund reliable?)
- Provisions made by the operators or the State and their evolution over time (has the operators made sufficient provisions to finance the management of the waste in the long term ?)
- Financial support for the local development of municipalities and districts where radioactive waste management facilities are installed (what is the financial device for the municipalities holding the waste ?)
- External control of the fund evolution and its sustainability (how to control the use of the specific fund ?)

Societal conditions
- Intra-inter-trans generation relations (what kind of relationship between generations?)
- Networks of territories / municipalities / citizens involved in radioactive waste management (what is the type of networks implemented?)
- Involvement and empowerment of local population (what is the strength of the local people?)
- Availability and accessibility of international / national / local expertise on radioactive waste management (can the local people resort to an external expertise?)
- Co-operative inquiry and management of radioactive waste (which co-operation with the authorities?)

Ethical stakes
- Long term protection of health / environment (how long is the protection of health and environment?)
- Freedom of choice for the local population over time (are the local people free to reject a project?)
- Conservation of memory and transfer of information, knowledge and skills (which long term devices exist or are planned?)
- Socio-economic benefit and development of local communities
- Control of energy consumption and waste production (what efforts applied to lower the quantities of waste produced ?)

In conclusion, one has to keep in mind that the objective of the proposed guidelines is to favour a dialogue between the various categories of stakeholders in order to set up the key principles for developing long term governance devices relevant for their own context. Furthermore, it should be mentioned that the elaboration of these devices should be envisaged as a continuous process, largely influenced by the past and present situations. In that perspective, the devices should be regularly revisited and updated in order to cope with the evolution of the context.

5. ETHICAL STAKES REGARDING LONG TERM ISSUES FOR RADIOACTIVE WASTE MANAGEMENT

5.1. Ethics and the management of radioactive waste

The importance of ethics in the long term management of radioactive waste was pretty well expressed fifteen years ago by the Board on Radioactive Waste Management (BRWM), a taskforce created by the US National Research Council. This taskforce gathered various independent experts from the National Academy of Science, from the National Academy of Engineering and from the Institute of Medicine. The BRMW 1990 report stressed an interesting point [BRWM, 1990]: "In the area of radioactive waste, ethical issues are as important as management and technical decisions. Interested parties approach the issues with different views about the right way to proceed, often due to differences in moral and value perspectives. As a result, an exploration of ethical issues can illuminate the fundamental policy debates in this field by showing the technical issues in their political and social context. Such an exploration also provides scientists with an opportunity to explore their own ethical responsibilities as they provide society with technical advice on controversial subjects."

The consideration of intergenerational issues has also been explored within the radioactive waste management community by: the International Atomic Energy Agency (IAEA) [IAEA, 1992], the Nuclear Energy Agency (NEA) of OECD [OECD/NEA, 1995], the Swedish Consultative Committee on Radioactive Waste Management (KASAM) [KASAM-SKN, 1988], and the Seaborn Commission in Canada. One of the main conclusions of these investigations was the statement that the driving principle for the elaboration of waste management options is to avoid "undue burden" for the future generations.

The NEA 1995 report set up several principles (protection of health, of environment, beyond national borders, of future generations) but insisted on the principle of undue burden (‘Principle 5: Burdens on future generations: Radioactive waste shall be managed in such a way that will not impose undue burdens on future generations’). For the NEA, the first concern was the achievement of "intergenerational equity" by choosing technologies and strategies which minimize the resource and risk burdens passed to future generations by the current generations which produce the radioactive waste. The second concern was 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 conclusions were the following:

1. The liabilities of waste management should be considered when undertaking new projects

2. Those who generate the waste 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

3. Waste 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.

4. 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.

In COWAM2, these NEA principles, especially the principle of 'undue burden', are given much attention, but they are regarded as insufficient ones. Therefore, the COWAM-2 developments were oriented towards the creation of the best conditions to favour the transfer to the next and following generations of the whole waste management system. One of the responsibilities of our generation is to organize a vigilance of the repository sites, but it is also to give the future generations a responsibility for the determination of their own future.

5.2. Philosophical background

5.2.1. What is a present generation and a future generation ?

The definition of a 'future generation' is a real problem for a wide range of issues (payment of pensions, protection of species, effects of climate change, …) and especially for the issue of long term governance of radioactive waste.

Time	**I**	**II**	**III**	**IV**	**V**	**VI**	---
Generations							
1	----	----	----				
2		----	----	----			
3			----	----	----		
4				----	----	----	

Some people consider that the duration of a 'present generation' is about 90 years, that is to say 3 generations (our generation n plus 2 other generations). In this case, the 'future generation' starts at generation n + 3, that is to say after 90 years. However it is pretty clear that the degree of relevance of a generation scale is the degree of information feedback: how far can we get reliable information about the future generations, about their will, their values, their belief, their socio-technical abilities ?

The reflection on the relationship between generations suggests several types:

Intra - generation	n (A/B)	'I and the people of my town'
Inter - generation	n (A) / n+1 (B)	'I and my children'
Trans - generation	n (A/B) / n+1 (A'/B')	'I and my neighbour / my children and my neighbour's children'

- The **intra-generation** relationship refers to the people sharing the same contemporary time, even if they belong to different generations (I, Mr Smith, 40 years old, my neighbour, Mrs Wallace, 60 years old, and my young nephew, Tom, 15 years old, all living in 2005).

- The **inter-generation** relationship refers to the people who does not belong to the same generation, for example a man or a woman and their children (I, Mr Smith, born in 1965 and my daughter Sarah, born in 1990).

- The **trans-generation** relationship is a kind of combination of the two previous ones, the one between people sharing the same time and the one between people belonging to different generations. The 'trans-generation relationship' refers to the link of the people sharing the same time (n) compared to the link of the people sharing the same time but at another period (n+6, for instance). For example, there is a 'trans-generation' relationship between (1) John Carpenter, an American land owner in Mississippi and Avery Thomson, one of his black slaves, both living in 1850 and (2) William Carpenter (grandson of John Carpenter) and Robert Thomson (grand son of Avery Thomson), both living in 1920.

For instance, in the case of the long term governance of radioactive waste, one can make a difference between:

- An intra-generation problem: for example, the fairness of the compensation in 2010 for the people accepting a waste repository on their territory, if one compares it with the living conditions in a waste-free territory (the municipality M with a waste repository compared with other municipalities without any waste repository).

- An inter-generation problem: the fairness of the compensation through generations if one takes into account the duration of the waste repository (for the municipality M, the generation n in 2010, the generation n+1 in 2040, the generation n+2 in 2070, etc ...).

- A trans-generation problem: the fairness of the compensation if one takes into account the relationship through generations between the people of the municipality M and the other people (for the people in a municipality M and the other people, the relationship for the generation n in 2010, for the generation n+1 in 2040, for the generation n+2 in 2070, etc…).

5.2.2. Responsibility to future generations

The issue of responsibility to future generations has been already addressed in the field of basic and applied philosophy. Hans Jonas in his famous book *The Imperative of Responsibility* stated that the conditions of contemporary human agency in a technological civilization resulted in enlarging the scope of responsibility in space and time [Jonas, 1990]. In comparison, the Industrial Revolution (18^{th} century) was still an era of limited responsibility, as regards the scale of the effects of human agency. But the growth of complex powerful technologies has widened the impacts of decisions and activities on the future generations in such a way that one can talk of a ‘long term global responsibility’. Now, Jonas suggested that the responsibility to future generations should be based on the ‘function of fear’ to raise awareness of the people and to urge their decisions.

This 'irrational' account of the long term responsibility was criticized by another philosopher, Dieter Birnbacher, who supports a more 'rational' approach of responsibility. In his famous book *Responsibility to future generations* [Birnbacher, 1994], Birnbacher asked a radical question about our relationship to the people of the future generations: 'Why should I care for those people?'. Birnbacher argued that, despite the numerous uncertainties of future-oriented actions, it is also rational to care for the next generations. He then made a distinction between three rational attitudes on this subject which are useful as philosophical material on the subject of radioactive waste:

- The rational selfish: He is not concerned with the profit of others, but he considers only the way he will be affected himself in the future by his own actions. He is able to think about problems and solutions in the mid run, but not beyond his own existence.

- The rational collectivist: He will take into consideration only the people from a group (his own family, a religious group, his country or his nation, …) and he will not pay attention to the consequences of his actions in the long run. He is able to go beyond his own interest, but just partly.

- The rational universalist: He will take into consideration with some objectivity the set of people affected by his actions and choices, in considering each viewpoint. He is able to go beyond his own interests as fully as possible, to avoid any discrimination among the people affected by his choice.

It seems that from an ethical point of view, the attitude of the rational universalist is the most appropriate one for the issues of long term governance of radioactive waste. Indeed the rational universalist is able to make a rational evaluation of the future beyond his own interests, not only for the people of his generation but also for the people of the future generations.

The relationship between generations is based upon two basic rules: one is the *justification rule* (the general reason why we should transfer something to the next generation) and the other is the *substantive rule* (the general 'amount' that we should transfer to the next generation). These rules can be expressed as follows:

- Justification rule: *' We owe something to the next generation because we got something from the previous generation '*

- Substantive rule: *'We are to transfer to the next generation as much as we got from the previous generation'*

This philosophical background can contribute to the understanding of the ethical principles related to the management of the radioactive waste.

5.3. Elaboration of ethical criteria

The analysis performed within the COWAM2-WP4 on long term governance processes for radioactive waste management led to the identification of three major ethical principles as key issues for the long term governance of radioactive waste: responsibility, justice and

democracy. These principles have been analysed by the stakeholders participating in the project in order to formulate ethical criteria specific to radioactive waste management to be used as aiding tools to evaluate on an ethical ground the various technical processes which can be proposed.

Some additional reflections were proposed within the work package, relating to the difficulty of a inter-generation equity, arguing that any fair system can only achieve an intra-generation one. Furthermore, the issue of financial compensation was studied pointing out the conflict between financial short term strategies and ethical issues regarding long term responsibilities (see Annex Report, contributions from G. Bombaerts and M. Bovy).

5.3.1. Long term responsibility

The issue of long term responsibility, especially in the case of radioactive waste, suggests that there is no reciprocity between generations. Indeed, the generation *n* will no longer be alive at the time of generation *n+50*, even if its actions can have long term consequences. But the lack of reciprocity is not a reason for putting aside any responsibility, and on the contrary, it is an opportunity for creating a new kind of responsibility between generations. The ethical criteria formulated within the work package according to the responsibility principle are presented hereafter.

In order that future generations can make relevant decisions about the future of radioactive waste, from their own point of view:

1. *The future generations should be provided with some appropriate sustainable means (processes, money, institutions, knowledge, know-how,…) for the implementation and the assessment of radioactive waste management systems.*

2. *These sustainable means should also be designed to guarantee the long term protection of health and environment.*

3. *Regarding long term public health and environmental protection, the public sector should regulate the distribution of responsibilities between public and private sectors and its evolution over time.*

4. *Appropriate policy, organization or network should be designed to keep information, knowledge and skills about the radioactive waste.*

5. *These elements should be sustainable and available for the actors and for the education of the future generations.*

6. *A responsible long term radioactive waste management policy should articulate in a flexible way the current decisions with the future capacity of actions.*

The implementation of such criteria implies to address various issues such as:

- Ownership: Who is the current owner and who will be the future owner of radioactive waste and storage/disposal sites? What are the conditions at present and for the future for the legal and financial responsibility? Who will be held responsible in case of further damages?

- Surveillance: Who is in charge of and who participate to the maintenance and the surveillance of the radioactive waste management facilities? Is the need for technical maintenance and surveillance coherent with the duration of institutions?

- Education: How are knowledge and skills on radioactive waste management transmitted through generations?

5.3.2. Long term justice

Justice is an evaluation of actions on the basis of a principle of equality or proportion as far as the relationship of individuals to the community is concerned. The issue of long term justice suggests that a generation *n* responsible for the increase of radioactive waste must give a proportionate contribution for the people affected by this waste. The people can belong to the same generation *n* (local people), or to future generations (for instance, *n+50*). This lead the participants of the work package to formulate the following ethical criteria.

7. *The fairness of the situations should be evaluated in terms of advantages and disadvantages on the basis of intra/inter/trans-generation relationships.*

8. *This evaluation should integrate quantitative and qualitative aspects of the living conditions, and of probable economic, social or technical trends or backgrounds.*

9. *Our generation should provide a contribution that takes into account our current advantages compared to the disadvantages of the future generations.*

10. *This contribution should be proportionate to the efforts (research and development, etc) needed to manage the radioactive waste and to optimise the cost of the radioactive waste management systems.*

11. *A municipality accepting to manage the radioactive waste of a country should benefit from a long term solidarity in all respect from the rest of the nation.*

12. *In case that there is an agreement on the construction of a radioactive waste management facility, the local populations and municipalities should be entitled to socio-economic development funding.*

13. *The funding is aimed at supporting a sustainable development of the territories in order to ensure the continuity of the vigilance of local population and the surveillance of the site of the radioactive waste management facility.*

The implementation of such criteria implies to address various issues such as:

- Fairness: How to maintain a form of equity between generations as far as consideration and recognition of the role of local people is concerned? Does the relation between generations correspond to an intra-generation, an inter-generation, or a trans-generation relation?

- Compensation: How to avoid that the compensation is just a financial bargain, a way of buying local consent? Will the money be dedicated to an appropriate local development?

- Recognition: How to give sense to and to recognize the effort of local people accepting radioactive waste on their territory? Does the valuation of the effort of people imply for them to have a special political representation or participation concerning the decision process in radioactive waste management?

It is important to realize that the issue of the recognition of the effort of a local territory accepting the waste and the question of the solidarity of the nation will not only be solved with the financial contribution to a sustainable development of the region. There is also a need for a sort of "moral" recognition to be built among generations and through generations, using various means like the empowerment of citizens, the consideration for their demands or the recognition of their role in the long term process.

5.3.3. Long term democracy

Democracy (*demos*, people, *kratos*, power) is a political regime whose legitimacy lies in the representation or the participation of the people into the collective deliberation and the decision-making process. Regarding the long term governance of radioactive waste, the following ethical criteria were proposed by the work package participants:

14. *A system of long term democratic governance requires a balanced flexible political procedure or organization combining representation, participation and deliberation of the people.*

15. *The long term governance of the radioactive waste implies that the technical options and participatory democracy are linked.*

16. *A democratic organization or procedure of governance should gather a variety of people belonging to several generations and to various backgrounds (local/national/international, authorities/experts/citizens/NGOs/operators/...).*

17. *An organization which is at least financially independent from political or technical authorities is more likely to guarantee the continuity of participation as well as the plurality of expertise, of information and of conceptions and values.*

18. *The institutions in charge of the radioactive waste management should be subjected to a democratic control and be counter-balanced by the political empowerment of the citizens through generations.*

19. *In order that the issue of radioactive waste remains a permanent topic of the democratic debates, it must be scheduled regularly on the political agenda of governmental and non-governmental organizations at local, national and international level.*

20. *All citizens must be provided with the means and information needed to fully participate in the process and to exercise their rights.*

The implementation of such criteria implies to address various issues such as:

- Participation: How to organize the participation of citizens in the long term consultations and decisions concerning the management of radioactive waste? Should the participation be limited to the local people, or enlarged to some representatives from the national community?

- Control: What could be the long term democratic control by the citizens over the decisions made by the institutional representatives? Will there be some confrontations between institutional and non institutional expertise? What kind of institutions may guarantee the continuity of the waste' surveillance?

- Consultation: Is the issue of the management of radioactive waste scheduled regularly on the agenda of the Parliament? Will there be regular consultation of local / national people for key issues to be addressed or key decisions to be made?

The need to elaborate a democratic process ensuring the participation of stakeholders in the decision making process is thus essential to open the question of radioactive waste management to the non-technical issues and build sustainable decisions including ethical and social aspects. These stakeholders come as well from the local level (elected people, economic actors, members of local commission of information, NGOs,...) as from the national level (State representatives, nuclear industry, waste management organizations, ...) or European level.

5.4. Some points of views of WP4 participants on ethical considerations

Contribution from Herman Damveld - Independent researcher and publicist - The Netherlands

In the field of radioactive waste management, the making of choice for the future is the task of ethics. We should promote an ethics of justice whose universal standards would avoid a 'discounting' of generations and would enable the future ones to have the same possibilities as the present ones.

- Justice: We have to put ourselves in the position of future people developing cancer as a result of stored nuclear waste. The storage has to be justified by the present generations, knowing that the ones who benefit are not the same as the ones who pay for the nuclear waste. Now, the compensation pleaded by the industry can be interpreted by the people as a signal of danger or a bribery attempt. A local partnership should be based upon a micro-level representative democracy and compensation should apply to future generations.

- Risk acceptance: The acceptability of a decision depends on the extent to which the people affected by the decision feel they can take part in the decision process. Various factors are influential in the acceptance of risk: time-space distribution of risk, involuntariness, trust in government and science, familiarity with risk, personal controllability and reversibility, possibility to avoid,… This acceptance should depend on the following conditions: the understanding of the acceptor of the decision taken by those in power, the belief that the decision is for the common good and that the decision is in the interest of the acceptor.

- Democracy: It is necessary that all groups that have interest in the issue should have the possibility to join the discussion and that conclusions are open. From the beginning, it should be clear that ethical and societal factors play a full role in the discussion. In the starting phase of a discussion, participating parties should state clearly their values, ethical principles and criteria for the judgement on nuclear waste storage. It has to be reminded that a discussion will not automatically succeed. A discussion has to deal with general questions about storage and not about the suitability of locations on a prepared list of locations. The appropriate authority to organise the discussion is not the government, but an independent authority. Those who are critical to storage should be given funds to found their arguments, so that there is no financial inequality among the participants. Discussion is only possible on the basis of a clear definition of the amounts of waste that are involved, and on the basis of guarantees from the government not to build nuclear plants without consulting the people (for example, through a binding referendum).

- Responsibility: The lack of knowledge concerning the long term consequences ought to be a reason for great reserves. A practical application of this is the prescription to take more heed of bad expectations than of the good expectations. In order to have nuclear energy at our disposal for perhaps the next 50 years, we create radioactive waste that continues to be dangerous for thousands of generations. A minority (the present generation) makes a decision the majority (future generations) will be charged for.

- Fairness: The procedural fairness means that the citizens should control the decision-making process, the final decision, have influence on the quality of the procedure, and be sure that the procedure is unbiased. The nuclear incidents liability law particularly protects the nuclear industry, as stated in the treaties of Paris and Brussels (1960, 1963). It is unacceptable that the nuclear industry is of greater value than the population and the environment: the unlimited liability should be guaranteed, or the nuclear power plants should be closed.

Waste: The main thing for the control of the waste flow is not so much the volume but the radioactivity of the waste.

(see full text in Annex report)

Contribution from Olov Holmstrand - The Waste Network - Sweden

NGOs in Sweden often claim that nuclear waste must be defined in two categories, the waste that already exists and the waste that still has not been produced. The first category is inevitable, but the second category can be avoided by shutting the nuclear reactors. We all have a moral duty to take care of the first category, even if some of us never have approved the production of it. This is not valid concerning the second category. Thus, the further production of nuclear waste must be validated concerning all the risks and environmental effects of nuclear technology. Nuclear waste must therefore be looked upon considering the nuclear technology as a whole.

Even if NGOs in Sweden have no agreed ethical standpoints on nuclear waste the following have been discussed and put forward to other stakeholders:

- *The ethical ambition should be not to expose us or future generations to unnecessary risks, responsibilities or costs due to produced nuclear waste.*
- *Based on this overall ethical ambition three functional conditions, partly contradictory, were formulated in the 1990s, partly coinciding with the principles presented by KASAM (Swedish National Council for Nuclear Waste):*
  - *The deposit should be designed not to demand supervision or maintenance.*
  - *The deposit should be designed to admit retrieval if and when this is found necessary for repair and improvement.*
  - *The deposit should be designed to admit breaking the possibility of retrieval, if future generations find this necessary, e. g. if retrievability is supposed to be too risky.*

Reasons for implementing a fast solution (pessimistic):

- *Those who have benefited from nuclear power should also take the whole responsibility to solve the waste deposition.*
- *It is not possible to relay on the stability of the society either from technical, moral or economical viewpoint.*
- *The Swedish nuclear waste fund might not be sufficient in the future due to wrong calculations, later technical or organisational problems or a general economic collapse.*

Reasons for not implementing a fast solution (optimistic):

- *It is up to future generations to find an acceptable solution, as we are not able to do that today.*
- *It is wrong to finalize a deposit now, which might not be accepted by future generations and which makes it difficult for them to change if they want to.*
- *We should not finalize a deposit now, which is not completely safe. It is better to continue keeping the waste in a guarded interim storage.*
- *Future generations will probably develop methods for eliminating the waste completely.*

Contribution from Eckhard Kruse – Gartow church representative - Germany

In the radioactive waste management, it is necessary on the one hand to ask ourselves the question of 'Responsibility' and 'Liability' and on the other hand to elaborate some 'ethical guidelines'.

We try to look at the whole scope, whereas an expert would focus on a very special technical topic, as he is convinced to know very well the solution of an engineering problem. He may organize a lot of meetings with other experts in the worldwide nuclear community, and even may find a way of involving people in a local, national and international "Decision making process". But maybe the Dilemma of radioactive waste will still exist.

I am convinced that we have to bring those different views together: We need people with a vision, and we need experts with the sight.

The recommendations from our working group would be:
1. Ethical issues are as important as management and technical decisions.
2. Governance of Radioactive Waste Management needs a continuous, but a very slow and sustainable process.

A slow and sustainable process means a process with enough time to find the same language and meanings to share, so that when words are used, there is an agreement of what they mean and what lies behind them. The outcome of WP4 is that we are able to say: The presented "ethical guidelines" are our common sense and not the opinion of one expert.

(see full text in Annex report)

5.5. Conclusions on ethical issues

The 'added value' of the COWAM2-WP4 dedicated to the issue of *Long Term Governance* is to go beyond the ethical principles mentioned in most of the international reports on the subject. In particular, the work package participants agreed more or less implicitly on the need to go beyond the principle of 'undue burdens' to future generations. This principle, indeed, can be interpreted in very different and sometimes contradictory ways, according to the people's beliefs and values. The ethical criteria developed within the work package were elaborated in order to specify the scope of the moral and legal obligations in the implementation of radioactive waste management policy. This led the work package participants to agree on three issues to be addressed and investigated to develop ethical criteria: Responsibility, Justice and Democracy. Each of the participants among the stakeholders gave their own opinion on ethical criteria to be given priority within this report. There has been a consensus-based agreement on the majority of these criteria, although for some of them, different views were expressed. However, one has to keep in mind that these principles are just a common ground for more context-oriented discussions which may result in questioning the relevance of such and such principle as far as its application to a specific context is concerned.

6. CONTINUITY AND SUSTAINABILITY OF THE SURVEILLANCE OF RADIOACTIVE WASTE REPOSITORIES

One of the key issues for long term governance is to set up now protection systems which will last as long as possible. Even if, as seen in the Section 3 of this report, it can be considered, from a societal point of view, that it is not possible (nor relevant) to predict how the society will be organised for the surveillance and the control of radioactive waste management facilities within several years or tens of years, it is however possible to identify some key issues which should be addressed in order to favour the durability of the protection system and to create the conditions for its transfer from generation to generation. Several case studies have been investigated for this purpose. Issues such as the organisation of the surveillance, the role of expertise and the distribution of responsibilities were addressed.

6.1. Case studies

In order to identify key issues related to the continuity and durability of protection systems through the transfer to the next generation(s) of a "safety heritage" (know-how, protection options, procedures, resources,...), the main fields of investigations performed within the work package were the following:

- ***The sharing of responsibility*** between national and local communities for the long term safety of the radioactive waste management facilities. This was studied notably on the basis of lessons learnt from the analysis of the effectiveness of the system put in place by UNESCO for the protection of world heritage sites.

- ***The sustainability of surveillance and protection systems***. This was mainly studied from an analysis of the management of old iron mines in France.

- ***The durability of protection systems through their integration in a sustainable socio-economic development project for the territory***. This topic benefited notably from the proposals of MONA, the local stakeholder group set up in the municipality of Mol (Belgium) to discuss the disposal of low and intermediate level radioactive waste with ONDRAF/NIRAS (Belgian Agency for Radioactive Waste and Enriched Fissile Materials), and from proposals formulated during the French National Public Debate on Radioactive Waste Management, which occurred in France from September 2005 to January 2006.

6.1.1 Responsibility over long term periods - Lessons learnt from the protection of UNESCO world heritage sites

The UNESCO convention on the protection of the world heritage, signed in Paris in 1972, set in place a system which established, for a certain number of specific locations considered specifically significant for humanity, the terms and conditions of management combining concerted actions by the international community, the government involved and the local population [UNESCO, 1972]. Three main characteristics of this protection system contribute to its durability and effectiveness and are of interest for long term radioactive waste management [Hériard Dubreuil et al, 2003]:

➢ The capacity to prevent or identify a failure in the protection system through the organization of a regular surveillance and monitoring.

This capacity is primarily based on the recognition of the existence of an heritage that is common to local, national and international actors, and the establishment of a clear division of responsibilities between them over time. Everyday management of a site is handled by a local organization in contact with the local inhabitants. The national level sets up a regulatory framework, provides legal guarantees and makes technical and financial contributions to protection-related actions. At the international level, UNESCO monitors the permanence and durability of the local and national protection actions and initiates procedures in the event of any shortcomings, mobilising technical and financial resources as necessary. Effectiveness also depends on the procedures for listing and monitoring the sites to be protected, which stipulates that the State Parties have the responsibility to ensure '*the identification, nomination, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage found within their territory*' [UNESCO, 2005].

➢ The capacity to mobilize expertise (from the local, national and international levels).

When expertise is needed for a site protection or restoration, the local and national levels can ask for an international expertise. In this case, the main objective of the international team will be to start a programme for training national or local experts, in order to transmit their knowledge. Moreover, international teams are also very often involving local actors in order to benefit from their experience of the local situation.

➢ The capacity to mobilize financial resources (from the local, national and international levels).

Apart from recognition that responsibility for heritage sites is more the affair of the government involved than UNESCO, the projects that have arisen in the context of the 1972 Convention all recognise the need to link site conservation to sustainable development of the area to encourage the local population to play a positive role in taking care of the site. This integration is fostered by the creation of centres of activity handling both safeguard issues and those relating to development (tourism, and the fostering of intellectual and technical skills for instance). It can also be noted that, when a protected site is "in danger", the Convention plans the mobilization of international resources to guarantee the protection of this site.

6.1.2. The sustainability of surveillance and protection systems – Lessons learnt from the management of the legacy of mining in the Lorraine Basin

Iron mines were worked in Lorraine during the 19th and 20th centuries. The last mines were closed in the early nineteen nineties, resulting in transfer of surveillance of the cavities from the operators to the French State. The end of regular maintenance resulted in severe ground subsidence in a number of areas, the first one being in 1996. In this case, it is important to note that the issues associated with a lack of a long term management system appeared in a very short period after the closure of the mines: only a few years. In a simplified way, the main issues are notably characterised by:

- A loss of information, skills and know-how after the mine closure,
- The disappearance of the actors who would have managed the issues raised by the ancient mines (which were previously managed by the operators).

In order to face this near-crisis situation, a mobilization of the various actors made it possible to set in place a system for the long term management of risks based on the following elements [Hériard Dubreuil et al, 2003; Schneider, 2005]:

➢ The setting up of an expertise and research system.

This included the creation of a centre of expertise on the risks of collapse, to support the government authorities (GEODERIS), as well as a centre for scientific research into systems of detection and prevention of collapse (GISOS). It can also be noted that a regional committee for the evaluation of the terms and conditions of the cessation of mining work and surveillance of the installations was created. This committee combines civil servants, local politicians and non-governmental organisations.

➢ Placing the actions at the heart of a dynamic of local and regional development.

Without entering into a complete analysis of the system set in place and without judging its global efficiency, one particularly important dimension which has to be highlighted in the perspective of long term management of radioactive waste, concerns the fact that the expertise and surveillance actions were placed at the heart of a dynamic of local and regional development.

The emergence of problems associated with settlement in former iron-mining areas is clearly linked with the cessation of mining throughout the region. The termination of this economic activity in the region has resulted in the absence of real concerns for the long term surveillance within the socio-economic activity at the local or regional level. This situation shows that the continuity of the surveillance relies on the presence in the territories of local population involved actively in this surveillance. If the territories are becoming depopulated by a lack of economic development, the link of the population with the surveillance of the site will be lost. In fact, a sustainable vigilance of the society's actors cannot exist without the emergence of a sustainable economic development of the region. However, in the case of the mines, the low economical value of lands and properties in a region already facing an economic crisis is an issue and necessitates the direct intervention of the State. It has to be noticed that, with a view to long-term management of the situation, local politicians and populations have requested that State consideration be given to the economic future of the region.

As regards increased surveillance of the mines after closure, the system of expert appraisals set in place through the creation of GEODERIS and GISOS is based, on the one hand, on a search for a mobilization of local and regional skills (expert appraisal organisations present in the region, and their creation in collaboration with the university), and, on the other hand, on the desire to make use of such special knowledge in other regions. The local and regional mobilization on the issues associated with the ground subsidence becomes then a negotiable "value" and allows the region to propose its duties to the national level.

This case study shows also that the local actors cannot be expected to clear out alone such a large scale problem caused by disappeared actors. The responsibility and the organisation of the crisis management need to be shared by the national level to provide more efficient and acceptable solutions.

6.1.3. The durability of protection systems through their integration in a sustainable socio-economic development project for the territories – MONA proposals.

In Belgium, the management of radioactive waste is taken care of by ONDRAF/NIRAS. In 1998, ONDRAF/NIRAS started a partnership approach to discuss the disposal of "category A" radioactive waste[3] with local stakeholders. Four municipalities have been contacted: Dessel, Farciennes, Fleurus and Mol. The local partnership of Mol, called MONA [Meus et al., 2003], was set up in February 2000. Among its numerous recommendations regarding the socio-economic development of the territory of Mol [MONA, 2005], MONA proposes the creation of a fund to improve the quality of life of the inhabitants of Mol and the wider region because they face up to the repository at a close range. For them, a fund offers the possibility to respond to the changing of societal needs and makes for a sustainable and visible link with the repository enhancing an integrated approach.

The fund's mission statement proposed by MONA is the following:

- The fund is created to improve the quality of life of the inhabitants of Mol and the wider region;
- The fund is created to achieve this by implementing a broad range of projects (social, economic, cultural, on environment, health and education);
- There should be projects for the short, medium and long term;
- The projects must be result-driven and sustainable and must produce long-lasting positive effects in their own field. They must have a broad societal support;
- The fund must be managed by an autonomous, independent entity;
- The fund should regularly investigate the social/societal needs and then devise strategic goals;
- The fund advocates a high-quality operation. The final assignment of projects, the follow-up and the evaluation must occur with professionalism and high quality. To this end the fund will also call upon external experts;
- The fund will communicate on a permanent basis about the operation of the repository and the concrete realisation of projects. The fund wants to emphasize constantly the link between the repository and the projects.

[3] Category A concerns short live - low and medium activity waste

6.1.4. The durability of protection systems through their integration in a sustainable socio-economic development project for the territories – Proposals made during the French National Public Debate on Radioactive Waste Management

In France, a national public debate on radioactive waste management was organised by an independent authority (National Commission of Public Debate – CNDP). This debate was held from September 2005 to January 2006 at the request of the Ministry of Ecology and Sustainable Development and the Ministry of Industry in the perspective of the preparation of the new law on radioactive waste management to be issued in 2006 (finally adopted in June 2006). A number of meetings were organised in different locations in France, 4 of them being dedicated to "democracy and radioactive waste". Among the issues addressed during this debate, the sustainable economic development of the territory where the ANDRA research laboratory is installed, in order to guarantee for the long term surveillance of the installation, was discussed in depth [CPDP, 2006]. The main proposals in order to ensure this development were the following:

- ➢ There is a need to address the issue of a "cross-solidarity" between a territory receiving radioactive waste management facilities and a nation involved for the sustainability of the region. This issue will notably be discussed within a local/national committee involving the nuclear industry and research centres together with local elected people.
- ➢ A key factor for the success of this development is the establishment by the local stakeholders of their own project for the future development of their territory. They have to propose and value their advantages for attracting new activities. This preparation phase will put them in a better position to negotiate with the nuclear industry, the State and other organizations for establishing a cooperation framework.
- ➢ It is proposed that the law integrates the establishment of a contract defining the respective responsibilities of the different actors (local and national level) regarding the economic development if a sustainable option for the management of radioactive waste had to be adopted in one specific region.
- ➢ One of the guarantees for the long term surveillance of the installation being the existence of life around the installation, it is proposed to establish a clear link between sustainable development projects and the surveillance and vigilance of the radioactive waste management facility. In that perspective, it is mentioned that:
  - there is a need not only to keep the memory of the radioactive waste management facility, but also to keep and transmit the ability to organise its surveillance;
  - this ability implies the existence of competence and expertise, which have to be linked with the local economic development;
  - the involvement of local stakeholders in the surveillance of the installation is a key feature of the sustainability of the vigilance on the long term.

6.2. Key issues and proposals for the continuity and sustainability of the surveillance of radioactive waste repositories

Whatever the type of radioactive waste management facility (geological disposal, short-term or long-term storage), the generic term of "surveillance" can include several aspects of the protection system, which may also vary with time, such as:

- The control of human activities in the vicinity of the site (control of human intrusion);
- The technical monitoring of the environment of the radioactive waste management facility (control of radionuclide excursion);
- The technical maintenance of the site, the reassessment of its safety level over time according to social acceptability criteria, the management of any actions on site, including possible retrieval of waste (according to the type of radioactive waste management facility);
- The preservation and transmission of know-how concerning waste management, and the training of the generations who will take over;
- The organisation of a local/national vigilance through notably the creation of local commissions.

The analysis of the previous case studies makes it possible to identify several fields which should be studied in the elaboration of a surveillance system around a radioactive waste management facility in order to favour the sustainability of this system over long term periods:

- The organisation of surveillance and vigilance;
- The development of a centre of competence;
- The integration of the radioactive waste management facility in a local/regional economic development;
- The distribution of responsibilities between territories and generations.

Organisation of surveillance and vigilance

➢ The transfer between generations of the surveillance system has to be studied to favour an active conservation of the memory. For this purpose, it is notably necessary to allow an evolution of the management and surveillance systems with time.

➢ Local stakeholders should be involved in the surveillance system of the site, as they are key actors of the vigilance and of the transfer between generations. For example, a local commission could be created to gather the various stakeholders.

➢ The long term monitoring and surveillance programme has to be clearly organised (who is in charge of the surveillance, what are the reporting procedures,...). Regular meeting points between the administration/state, the organisation in charge of the surveillance, and the local stakeholders (notably through the local commission) should be planned in advance to ensure the efficiency of the surveillance.

- ➢ Sustainable financing systems should be elaborated for the structure in charge of the surveillance.

- ➢ The capability to mobilize international resources should be studied.

Development of a centre of competence

- ➢ A centre of competence should be created for the operation, maintenance and surveillance of the radioactive waste management facility in the long term.

- ➢ A systems should be elaborated in order to maintain, develop and create knowledge and know-how to ensure an efficient surveillance and monitoring of the radioactive waste management facility with time.

- ➢ The capacity to mobilize expertise (from local, national and international level) should be studied and integrated in the functioning of the centre of competence.

- ➢ The conditions to ensure a transfer of expertise between generations should be created.

- ➢ The capabilities to use the expertise of the centre of competence in various places or in other fields than radioactive waste management should be favoured.

- ➢ The involvement of concerned stakeholders to the definition and follow-up of the activities of the centre of competence should be facilitated.

Integration of the radioactive waste management facility and its surveillance in a local/regional socio-economic development

- ➢ The surveillance function should be integrated within a global project for a sustainable territorial socio-economic development. Such a project should be elaborated, mainly by the local stakeholders, notably with a view to maintain the "life" around the radioactive waste management facility, as the stability of the local and regional demography is one of the key issues for the sustainability of the surveillance.

- ➢ The development of economic activities linked for example with the environmental surveillance and monitoring, and in interaction with the scientific and technological competence at the regional level should be studied.

- ➢ Dedicated systems should be set in place in order to guarantee that the storage/disposal is compatible with the territorial development.

Need for an equitable distribution of responsibilities between territories and generations

- ➢ An efficient protection system needs a clear distribution of responsibilities between local, national and international actors.

- ➢ The notion of "safety heritage" should be developed in order to create a "safety link" between local, national and international actors, and between generations.

- ➢ Reflections on the interest of an international convention on the "protection of radioactive waste management facilities" should be developed.

6.3. Some points of views from COWAM WP4 participants

Contribution from Miquel Ferrus - GMF - Spain

COWAM Spain conclusions:

COWAM Spain was an initiative of AMAC (the Spanish association of municipalities with nuclear facilities). It aimed at defining a participatory methodology for nuclear waste facility sitting regarding controversial projects. It focused on "how" to take the decision rather than "where" should be placed the facility. It produced a list of general recommendations to be considered in order to implement a democratic and participatory decision making process concerning radioactive waste management. These conclusions, presented hereafter, were published in 2005 in the book "La gestión democrática de los residuos radiactivos" (AMAC).

1. *The State Government has the responsibility to solve the problems associated with radioactive waste management.*
2. *The decision making process should be based on both political and institutional consensus, which are essential as a basis for the long term governance.*
3. *From this perspective, municipalities must be integrated in the process.*
4. *Regional governments should also participate in the design and execution of the decision making process. They are part of the political and administrative organisation of the State and they have competences in these matters.*
5. *Both National Parliament and Government have the responsibility to make explicit to the public the need to solve radioactive waste management, following the principles of political consensus, safety, public participation, information and transparency.*
6. *All territories are potential candidates to host the facility.*
7. *The ethical dimension has to be taken into account. It is a problem that shall be solved by the current generation since we have been using nuclear energy and generating the waste.*
8. *The connection between radioactive waste management and nuclear power plants has to be considered as a means to increase social and political awareness. The adoption of measures to ensure the participation of local authorities in national management bodies should be positively considered.*
9. *The participation of the municipalities in the process is completely voluntary and does not necessarily involve that they have to accept the facility.*
10. *Design and safety are paramount concerns as well as environmental and socioeconomic impacts. Economic instruments should not be prioritised but positive economic effects for the region should be considered.*
11. *A National Commission, consisting of social representatives of the territory, politicians and experts, could be an efficient tool to ensure transparency, democratic legitimacy and public participation.*
12. *The Government appoints the members of the National Commission after a proposal from the Parliament.*
13. *The national commission should:*
    - *Define the technical, environmental, social and economic conditions of the potential host communities.*
    - *Develop a public procedure with the purpose of inviting the interested municipalities.*
    - *Formulate a proposal of suitable locations in a limited number to the Government.*

- *Propose methodological recommendations to develop the processes of information and public participation at local level in the host areas.*

14. *The State Government, with regard to the proposals and recommendations of the National Commission and with suitable agreement with the Regional Governments and with the potential municipalities, should start the site selection procedure. It is specially recommended to create Local Information Commissions as a tool for public participation in the territories.*
15. *Once local acceptance has been achieved, the Government has to select the final host community and has to initiate the process for the administrative licensing of the storage facility.*
16. *The National Commission has to ensure that the general criteria of transparency, information and participation are met.*

Contribution from Olov Holmstrand - The Waste Network - Sweden

Swedish environmental non governmental organisations generally have the following standpoints on the Environmental Impact Assessment (EIA) process:

- *Continuation of nuclear waste production, also in connection with uranium mining, is inconsistent with sustainable development.*
- *The problems of nuclear waste management must be dealt with now and not left to an undecided future. However, this does not automatically mean that any final solution needs to be implemented within a short period of time.*
- *Irrespective of storage or disposal method nuclear waste is a possible source for nuclear weapons for a very long time and must therefore be subject to long-term safeguards.*
- *Any storage or disposal must be designed considering the risk of intentional or unintentional intrusion.*
- *The management of nuclear waste is a national task. The EIA process should thus be performed on a national scale, not as now in the municipal and to some extent regional scale.*
- *The choice of method should precede the choice of site.*
- *The choice of method should be made according to a systematic process and considering functional conditions set up in advance. Different alternatives should be evaluated and compared according to strict long-term environmental standards that comply with sustainable development. This demands extensive information on more than one possible method.*
- *The choice of site should also be made according to a systematic process and considering functional conditions set up in advance. A clear and understandable sieving process at a national scale should be performed to find the best possible site considering environmental conditions.*
- *Changes have to be made so that an independent body supervises the EIA process instead of the nuclear industry. This increases the chance that the choice of method and site gain legitimacy and acceptance in the eyes of ordinary citizens.*

Contribution from Olivier Laffitte, Member of the Administrative Board of ANCLI (the French National Association of Local Commission of Information), member of the CSPI Établissement de La Hague as representative of the Union SPAEN-UNSA

According to the schedule and to the law of 30th December 1991 (called "Bataille law "), the new law establishing the framework, the steps and the means for the management of radioactive materials and waste was published the 28th of June 2006.

This law created a national plan for the management of radioactive materials and waste and established a research and development programme, associated with a schedule until 2015 to implement the plan. Three major points are planned:

- *In order to search for a reduction of the amount of waste and for a preservation of Uranium resources, the spent nuclear fuel from nuclear power plants will be processed to be recycled in nuclear plants.*
- *The waste which cannot be recycled will be packed in robust containers, and then stored temporarily in a surface facility.*
- *After storage, the waste which cannot be disposed definitively in a surface facility will be placed in a deep geological retrievable disposal.*

This management programme seems capable to bring a safe solution to the issue of radioactive waste.

However, it is essential to give the citizens a share of the decisions which concern them, as the issues in such a sensible field as energy depend on a true society choice, and not on a choice from the only experts. Expertise is necessary, but it should also be pluralistic. Independent evaluations are necessary as well as information and consultation, in order that everybody can form its opinion and make sure that the solutions are safe.

For this purpose, the mission of the CLI (local commission of information) is essential and their competences should be reinforced. Their competences should also be enlarged to the control of the use of the fund paid by the operators.

The local commission of information should make sure that the facilities are integrated in a logic of sustainable development of the territory, including the financing of projects and environment-friendly technologies, and included in a true "Territorial Project".

It would be dangerous and bad that the waste disposal facilities - as well as nuclear, oil or chemical sites in general - be only subject to financial negotiations and compensations. The economic and environmental future of the concerned territories are depending on that, as well as the credibility and acceptability of all industrial projects.

Contribution from Meritxell MARTELL - ENVIROS - Spain

Conclusions of the Working Group on long term from COWAM Spain:

The aim of this dedicated working group of COWAM Spain was to assess the extent to which compensation offered to communities hosting radioactive waste management facilities contributes to sustainability. In particular, the project evaluated the effectiveness of the current compensation mechanisms as a means to improve the social, economic and environmental well-being of the municipalities and regions hosting radioactive waste management facilities over the long term. Host communities tend to perceive the facility as an unjust imposition upon their welfare and often claim that the local benefits received are small relative to the burdens.

The question to be raised is under what conditions is compensation helpful in maintaining and improving people's wellbeing over the long term. As conclusion, we can see that, at present, the funds from ENRESA have little effectiveness in securing socio-economic development in the municipalities in nuclear zones. So, the funds from ENRESA are not effective enough from the local authorities' point of view.

Rather socio-economic development depends on a number of variables such as leadership, political parties' commitment, vision, geographical situation, etc. The way the funds of ENRESA were formulated results in a situation where these resources are an end by themselves rather than a means to promote economic development.

Although these economic resources have allowed municipalities to improve more or less their social and economic environment, these should be combined with other mechanisms which enable nuclear regions to have an integrated development project shared by all stakeholders and supported by high institutional bodies.

In other words, the fact is that mayors want to receive the funds they are already receiving from ENRESA because of their solidarity with the other Spanish civilian: In NPP areas, the energy is produced, but the energy is spent everywhere. For that reason, it is asked for something else: a political agreement in order to develop projects for economic growth. It is required an economic development for a sustainable future. It has to be the guarantee of the future of these towns.

There was a high level of interaction between all COWAM Spain participants, especially during the general seminars. In that way, the working group on long term not only underlined the necessity of compensations, but also the necessity of creating Local Commissions of information because these bodies can be a good and useful tool for the surveillance of the process of decision making as well as for the operational time of the facility. Moreover, it can be very useful as well for the intergenerational transfer of information.

6.4. Conclusions on the continuity and sustainability of the surveillance of radioactive waste management facilities

The continuity and sustainability of surveillance over long term periods cannot be guaranteed nor decreed. However, some elements can be put in place which will favour the preservation of the vigilance and its transfer through generations. These elements concern as well the organisation in itself of the surveillance (responsibilities, regular meeting points and evaluation,...) as the development, use and transfer through generations of expertise and knowledge (creation of a centre of competence, ...), or the economic aspects with the search for a territorial sustainable development of the whole region around the radioactive waste management facility in order to maintain life and activities which are essential to maintain the vigilance by a community of actors. Regarding this last point, it has to be noticed that a project for a territorial development is an issue completely different than the financial compensations which are usually promised by the waste management organisation in the sitting process. These compensations are not dimensioned nor integrated in projects for the long term socio-economic development of a territory, and, as a consequence, are usually perceived as a way to "buy" the local stakeholders.

Finally, the case studies have also shown that there is a need to articulate the local, national and international levels, with a clear distribution of responsibilities, in order to create relays of the vigilance in space and time, together with a clear involvement of local stakeholders in the elaboration and follow-up of the surveillance programme.

7. THE NEED FOR EFFICIENT FINANCING SCHEMES FOR THE LONG TERM MANAGEMENT OF RADIOACTIVE WASTE

The capability of future generations to implement waste management options and to continue the surveillance and monitoring rely notably on the financial resources which will be available in the future. In order to discuss this topic, the financing schemes developed by some European countries for the long term management of radiaoctive waste were analysed in order to draw some recommendations, in the perspective of long term governance.

7.1 Analysis of some European financing schemes for the management of radioactive waste

Financing schemes for the management of radioactive waste need to integrate several components to cope with the short and long term cost estimates. The short term costs include the surveillance cost of already closed facilities, the operating cost of existing radioactive waste management facilities as well as the research and development costs for the construction of new facilities. These costs can be usually foreseen with a relatively high degree of certainty on periods of about five to ten years. Other costs which will incur in a medium term period or in the far future need to be provisioned: the long term surveillance cost of already existing facilities, the construction, operating and surveillance costs of future radioactive waste management facilities. The level of these costs can be more uncertain even if it is necessary to anticipate them and to integrate them into dedicated financing programmes.

In order to identify the main characteristics of current financing schemes and to raise some questions relating to the long term, the financing schemes for the management of waste put in place in some European countries (Belgium, Finland, France, Germany, Spain, Sweden, Switzerland) have been analysed [Cremona, 2005]. The following aspects were studied:
- The distribution of responsibilities/liabilities;
- The type of financing schemes;
- The legal frameworks;
- The decision making mechanisms;
- The possibilities of re-evaluation;
- The guarantees.

This section presents only a summary of the main elements of this analysis. Furthermore, it presents data regarding only radioactive waste and does not address the dismantling of nuclear facilities even if the later beneficiates from the same or similar financing schemes.

7.1.1. Distribution of responsibilities

In all countries, the polluter-pays principle is applied and consequently, the waste producers are responsible for financing the management and disposal of their waste.

Different types of waste management organisations have been created:
- Public organisations, established by national government like in Belgium (ONDRAF), France (ANDRA) or Spain (ENRESA).

- Private organisations, established and owned by the waste producers like in Finland (POSIVA OY), Sweden (SKB) or Switzerland (NAGRA).

In Germany, the safe disposal of all types of radioactive waste is a Federal task. The responsibility lies with the Federal Government, represented by the Federal Office for Radiation Protection (BfS), a State Office.

In all countries, the waste producer remains wholly responsible for its waste as long as they are in its possession. The physical responsibility (but not necessarily legal ownership and financial responsibility) passes to the waste management organisation when they receive the waste.

Various situations are encountered regarding the transfer of waste property. Three main groups of countries can be identified:
- Countries where the waste property remains to the waste producer without any time limitation (France).
- Countries where the property is transferred to the waste management organisation, when the waste is accepted by this organisation (Belgium and Spain). It can be noticed that, in Belgium, the waste producer remains responsible in case of a waste package failure during 50 years after the transfer.
- Countries where the waste property is transferred from the waste producer to the State, either when the waste packages arrive at the radioactive waste disposal facility (Germany), either at the closure of the radioactive waste disposal facility (Finland, Sweden, Switzerland).

7.1.2. Type of financing schemes and legal framework

Three main types of financing schemes can be distinguished:
- The settlement of financial provisions on the account of the waste producers, associated with a set of dedicated assets (e.g. for the French utility EDF and the nuclear group AREVA). These assets can be payable immediately, if necessary, by the waste producer.
- The settlement of a dedicated fund with annual contributions of the waste producer. This fund can be managed by the waste management organisation (e.g. Belgium and Spain), or by a specific organisation (e.g. Sweden - The Nuclear Waste Fund, Finland - The State Nuclear Waste Management Fund, and Switzerland - Fund for the management of nuclear power plants radioactive waste).

The financing systems are usually created by dedicated laws or decrees. The main references are the following:
- Belgium: included in the Arrêté Royal determining the missions and operating rules of ONDRAF (30th March 1981);
- France: Programme Law related to the sustainable management of radioactive materials and waste, n°2006-739 – 28 June 2006;
- Germany: Waste Disposal Advance Payments (28th April 1982, lastly modified the 26th of July 2004);
- Spain: Royal Decree n°1899 - 1st August 1984;
- Sweden: the Financing Act (1992:1537) - the Studsvik Act (1988:597);

- Switzerland: Ordinance on the fund for the management of nuclear power plant radioactive waste (6th march 2000).

7.1.3. Decision-making and re-evaluation of the funds

The decision regarding the amount of provisions or contribution to be paid by the waste producer depends on the type of financing scheme[4].

In Finland and Sweden where a dedicated fund has been created and managed by a specific organisation, the amount of the contribution is decided by the government after a proposal from the waste management organisation, and an advice of the Safety Authority. In both countries, this amount has to be re-evaluated each year.

In France, where the provisions are included in the waste producer accounts, the level of the contribution is decided by the waste producers themselves, usually according to data provided by the waste management organisations regarding the foreseen costs. The Cour des Comptes (performing external control of public accounts), can perform an external audit of the financing scheme followed by recommendations to the Republic President regarding notably the amount of the fund (Cour des Comptes, 2005). Moreover, the new 2006 law has created a national commission of evaluation for the financing of dismantling and waste management, which will have to provide each 3 years a report to the Parliament and to a specific committee ("Haut Comité pour la transparence et l'information sur la sécurité nucléaire").

In Germany, the payments for financing a repository are calculated on the basis of the volumes of waste arising. These payments are subject to the Disposal Advance Payments Ordinance. The financial provisions are managed by the waste producers.

In Belgium, where the fund is managed by the waste management organisation, the amount of the contribution is mainly determined by a proposal from a Supervisory Committee (called CCGE) which members are State and utilities representatives. A revision of the amount is planned on a 5 year basis.

In Spain, the waste management organisation ENRESA in charge of managing the fund determines each year the level of contribution from the waste producers.

In Switzerland, the level of contribution of waste producers to the Fund for the management of nuclear power plants radioactive waste is determined by the waste management organisation (NAGRA) and an Administrative Commission (with Federal States and utilities representatives) controls the use of the fund and revises on a 5-year basis the amount of the contributions.

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[4] It has to be noticed that, within this study, it was not possible to analyse the various scenarios used in each country to evaluate the needed amount of the contributions.

7.1.4. Guarantees

Two types of guarantees have been analysed: 1) guarantees to be used if the cost of waste management is higher than expected, and 2) guarantees in case of bankrupt of a waste producer.

In Sweden, the waste producers are obliged to settle on their own account a dedicated amount of provisions. This amount is re-evaluated each year and these provisions are based on a life duration of reactors of 25 years.

In Switzerland, if the fund is not sufficient to cope with the waste management expenses, the utilities must provide the needed amount of money within 3 years.

In Belgium, an additional guarantee fund has been created in order to prevent the bankrupt of a waste producer.

7.2. Key issues for the development of financing schemes for the long term management of radioactive waste

This brief analysis of the financing schemes put in place in some European countries for the management of radioactive waste makes it possible to identify the following issues to be addressed to evaluate the performance of any financing schemes:

Responsibilities

- The location of the responsibilities/liabilities regarding the management of waste should be clearly defined (for the waste producer, the waste management organisation or the State). These responsibilities include: the ownership of waste, the responsibility for financing, for implementing the waste management option, for surveillance,... The transfer of these responsibilities/liabilities over time should be planned in advance.

Transparency

- Several types of financing schemes have been identified: dedicated funds (managed by the waste producer, by the waste management organisation or separately by a specific entity) or provisions on the account of the waste producer. Whatever the adopted scheme, there is a need for transparency on the cost estimates.

- The decision-making process for defining the level of the funds or provisions and its use should be explained, as well as the waste management scenario used to determine the level of the financial needs in the future.

- In particular, it should be identified if costs like the long term surveillance or the financial accompaniment for a sustainable development of the territories are included in the evaluations. This issue has to be addressed with the concerned stakeholders.

- ➢ The ability of the fund to evolve with time should be clarified: How to take into account the possible evolution of the waste management options (reversibility, adaptation to new norms,...)?

- ➢ External audit of the funds or provisions should be done on a regular basis by the State in collaboration with national and local stakeholders, notably through the involvement of a Local Commission in the follow-up of the fund management.

Guarantees

- ➢ The financing schemes should integrate financial guarantees to be used if the cost of waste management is higher than expected or if there is a bankrupt of a waste producer.

- ➢ The financing scheme should comprise specific systems to ensure (as much as possible) that the provisioned money will be available when necessary.

7.3. Point of view from one participant to WP4 on financing schemes

Contribution from Olov Holmstrand - The Waste Netwok - Sweden

Nuclear waste management in Sweden is financed by a tax on nuclear energy. The money is collected in the Nuclear Waste Fund, founded in 1981 in accordance with the Financing Act.

NGOs have pointed out some weaknesses of the fund and the statutes of the fund:

- *The fund prescribes that one solution is to be decided and executed. When the chosen solution is completed, the fund should be empty. This does not allow any re-start if the chosen solution for some reason must be given up uncompleted.*
- *If the deposit has been completed and somewhat later needs maintenance or complementary actions, no money is available.*
- *If the deposit needs supervision, this is not foreseen in the statutes of the fund.*
- *The general risks of social and economic collapse.*

Money from the Fund is transferred to SKB for financing its research and development work. This reimbursement is decided by SKI (the Nuclear Safety Authority). SKI may also transfer some money to municipalities concerned by SKB activities. Some local NGO groups have secondly got limited grants by the municipalities. However, up to 2005, the Financing Act did not allow grants to be given directly from the fund to NGOs.

Due to a change of the law, from 2005 it is possible for NGOs to apply for grants from the Nuclear Waste Fund. The sum of 3 million SEK per year during 4 years has been made available for applications.

7.4. Conclusions on financing schemes

The financing of radioactive waste management is a crucial issue raising specific questions regarding its long term dimension. It is thus the responsibility of the generations producing the waste to settle financial provisions to be used by the future generations for the building, operation, closure and surveillance of the radioactive waste management facilities. Financial scheme should then be built with the aim of reducing the burdens transferred to future generations while ensuring them a capacity of choice and action regarding the waste management system. As for the surveillance, the sustainability of financial schemes over long term periods cannot be guaranteed with certainty, but key elements can contribute to the sustainability of the scheme and to the creation of a specific vigilance of the society around this issue. They concern notably: the distribution of responsibilities regarding waste management and their transfer over time, the transparency around the hypothesis used to evaluate the needed financial provisions, their use and management, the involvement of local and national stakeholders in the definition of the fund and in the regular audit of the system and the integration of financial guarantees to be used for any unplanned situation.

8. FUTURE PROSPECTS

Long term issues are inherent to radioactive waste management. The reflections performed within the COWAM2-WP4 pointed out the key responsibility of the current generation to create the conditions for transferring a safety heritage to future generations through the elaboration of a long term governance system. Therefore, the work performed on long term governance during the three year duration of the COWAM2 project allowed to particularly investigate the ethical stakes, the responsibilities and the vigilance over long term periods. These investigations lead to propose a set of guidelines for a common technical and ethical elaboration of long term radioactive waste governance devices.

The perspectives opened by this work concern: (i) the implementation of the guidelines in specific contexts (local, national or European) to take account the long term dimensions in the elaboration of radioactive waste management systems, (ii) the needs for further developments on practical mechanisms for the organisation of long term governance, and (iii) the dissemination and the sharing of feedback experiences on the use of the guidelines.

Implementation of the guidelines in specific contexts

The aim of the guidelines proposed in this report is to favour the elaboration of long term radioactive waste governance devices by a set of stakeholders (local, national and/or European), taking into account the technical, institutional, financial, societal and ethical considerations. The purpose is not to be prescriptive but to promote a common reflection and elaboration on this issue in a specific context, based on a structured approach.

Therefore, the next step really concerns the implementation of the guidelines by different stakeholders and to favour dialogue and identification of common issues regarding long term governance, and to point out the remaining disagreements. In this perspective, the guidelines can be used by:

- a specific category of stakeholders in order to elaborate their own strategy and to identify their key concerns regarding long term governance;
- a pluralistic group of stakeholders at the local, national or European levels in order to promote the dialogue on the long term governance issues and then to favour the elaboration of common solutions regarding waste management options for the long term;
- a set of countries, in order to favour the exchange of experiences on this topic.

According to the specific context in which the guidelines will be used, the focus will be on different dimensions of the long term governance and new issues, not addressed in this report, may be identified. It will be of interest to allow the evolution of the guidelines according to the feedback experience of the different stakeholders.

Proposals for future investigations

The first set identified for future investigations concerns the practical mechanisms for the organisation of long term governance. The main mechanisms requiring investigations are:

- Concrete monitoring programmes: definition of safety criteria for assessing the performance of the radioactive waste management facility over long term; meaning of long term monitoring of a radioactive waste management facility.

- Transfer of knowledge and know-how: identification of research programmes for developing reflections on the long term governance of radioactive waste management facility; regular checking of the relevance of the knowledge and know-how to cope with the "safety missions".

- Territories sustainable development projects and long term vigilance: analysis of the ways to integrate the vigilance and sustainable development objectives and to ensure the availability of expertise in concerned regions.

- Elaboration of financing mechanisms dealing with long term governance.

Dissemination and sharing of feedback experience regarding long term governance

A key dimension regarding long term governance relies on the existence of networks at local, national and European levels involving different categories of stakeholders. In fact, the dissemination and sharing of feedback experience regarding long term governance could play a key role for improving the current governance systems as well as for ensuring a continuity of the surveillance and a solidarity between the different stakeholders and territories involved in the long term management of radioactive waste. In that respect, the existence of European networks is crucial for addressing the issues of long term governance and favouring the emergence of innovative approaches.

Finally, it can be noticed that the promotion of the results of this report by local, national and European stakeholder groups, in specific contexts, might lead to the identification of other investigations needs. This would then make it possible to further refine the issues already investigated in this WP4 regarding long term governance and to address them within a larger all inclusive governance approach, concerning local democracy, the influence of local actors on the national decision-making processes and the quality of decision-making processes.

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APPENDIX 1 – MEETINGS OF COWAM WP4

- First meeting: 15-17 April, 2004, Gartow (Germany): 16 participants
- Second meeting: 7 July, 2004, Berlin (Germany): 19 participants
- Third meeting: 17-19 February, 2005, Gartow (Germany): 20 participants
- Fourth meeting: 5 July, 2005, Ljubljana (Slovenia): 19 participants
- Fifth meeting: 20-22 March, 2006, Barcelona (Spain): 18 participants
- Sixth meeting: 4-6 July, 2006, Antwerpen (Belgium): 23 participants

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2. Ethical guidelines: point of view of Eckhard Kruse – Gartow church representative - Germany

3. Nuclear waste management and long term considerations in Sweden - contribution from Olov Holmstrand - The Waste Network - Sweden

4. Radioactive waste management in Germany - overview of current status - Jürgen Wollrath - BfS - Germany

5. Recommendations by MONA regarding the socio-economic aspects associated with the installation of a nuclear waste disposal in Mol - H. Ceulemans, B. Meus, L. Vanhoof - MONA - Belgium

6. ESDRED & technology development - Contribution to Final COWAM II Report, Wolf Seidler - ANDRA - France

Additional papers from WP4 expert resource persons

1. Commission Particulière du débat public sur la gestion des déchets radioactifs - Extract from the Summary of the Final Minutes - January 2006

2. What is “long term”? Definitions and implications, T. Flüeler - ETH - Switzerland

3. Ethics of compensation and funding: which governance for the long term?, M. Bovy - SCK-CEN - Belgium

4. Strengths and weaknesses of ethical values and principles, G. Bombaerts, SCK-CEN