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Fostering a Durable Relationship Between a Waste Management Facility and its Host Community

Adding Value Through Design and Process

NEA No. 6176

NUCLEAR ENERGY AGENCY
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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In these and related tasks, the NEA works in close collaboration with the International Atomic Energy Agency in Vienna, with which it has a Co-operation Agreement, as well as with other international organisations in the nuclear field.

FOREWORD

The Forum on Stakeholder Confidence (FSC) was created under a mandate from the OECD Nuclear Energy Agency's Radioactive Waste Management Committee to facilitate the sharing of international experience in addressing the societal dimension of radioactive waste management. It explores means of ensuring an effective dialogue amongst all stakeholders, and considers ways to strengthen confidence in decision-making processes. The working definition given to the term *stakeholder*[1] is: any actor – institution, group or individual – with an interest or with a role to play in the process.

It is a special challenge to assure safe radioactive waste management (RWM) over the long term. The greatest challenge, from both technical and societal perspectives, may be to create a local operating facility to fulfil that mission over generations. Several conditions are needed: scientific knowledge and technical competency, resources for implementing an agreed approach, and continued willingness to live with and maintain the facility. In other words, a sustainable relationship must be created between the host community and the site installation. The present report explores this need, by asking how may a facility and its site be better integrated with its host community, and be made attractive for the long term? To meet the challenges, the local facility in fact should actively improve a community's prospects for *quality of life* across the generations.

Traditionally, local benefits to be drawn from a radioactive waste management facility are discussed in terms of hosting fees and socio-economic development packages (such as accompanying employment and infrastructure). These are meant to offset real and perceived impacts. Beyond traditional benefits and land-use compensations, however, there has been little exploration of how else the presence of the installation may help improve the quality of life in the region. The report investigates features of waste facilities and sites that

1. *Italicised* words are defined and discussed in Appendix 2 (Glossary).

would provide *added value* in both the short and long term and thereby help to build a sustainable relationship with the host community/region. Improving quality of life may be as straightforward and relatively inexpensive as providing a special coat of paint (as at the Vandellós site in Spain), or as complex and rich as engaging community processes to design an integrated radioactive waste management project (as in the "local partnership" approach created in Belgium).

Numerous stakeholders from inside and outside the FSC, including local communities, have provided input to this study. They show that stakeholders can identify long-term cultural and amenity value to be added by a radioactive waste management facility, as well as the economic opportunities to be seized in their context. Their experience may be useful for those discussing major projects to be implanted in a local community.

Different countries and regions are likely to have different socio-political realities and therefore best practices for one region may not be best for another. The exact definition of "added value" will be specific to each site, and more importantly to each community, and will have to be developed in consultation with local stakeholders. This report seeks to provide input to that debate and provides examples of initiatives that are being undertaken in this field. This report is not prescriptive, but fosters an exchange of ideas on the international level.

Broadly speaking, this report addresses two spheres of activity, and builds bridges between them. One sphere concerns developing installations for the long-term management of radioactive waste. Some people are specialised in this sphere of activity, comparable to other economic spheres concerned with delivering products and services. The second sphere is general, and concerns daily life where each of us seeks improved *quality of life* and, finally, happiness. Everybody participates in this sphere of activity, which could be called the personal sphere. To build a sustainable relationship between the radioactive waste management sphere and the personal sphere, designers have to make the radioactive waste management facility and site to suit peoples' needs, ambitions and likings.

The report is proposed to communities and to national radioactive waste management programmes in order to facilitate the discussion of added value and sustainability in their particular context.

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SUMMARY

Any long-term radioactive waste management project is likely to last decades to centuries. It requires a physical site and will impact in a great variety of ways on the surrounding community over that whole period. Short-term fixes to facilitate a project and installation are not good enough. The societal durability of an agreed solution, i.e., its sustainability over the long term is essential to success.

Sustainability is not gained solely through financial compensation and development opportunities. Whilst those economic means are important, radioactive waste management projects also offer opportunities to improve well-being, consolidate knowledge, fulfil value ideals, elaborate community identity and image, and live out desired social relationships. Planning for and implementing a facility should seize these opportunities. In these goals, how may a facility and its site be better integrated with the community? How may they be made attractive for the long term? Ultimately, how may they add value and improve a community's prospects for quality of life across the generations?

Improving quality of life may be as straightforward and relatively inexpensive as providing a special coat of paint (as at the Vandellós site in Spain), or as complex and rich as engaging community processes to design an integrated radioactive waste management project (as in the "local partnership" approach created in Belgium). A number of basic design elements that would favour building a durable relationship between the facility and its host community are identified, based on the analysis of numerous stakeholders' input and FSC experience. These design elements include functional, cultural, and physical features.

Amongst the functional features, multi-functionality or polyvalence may be singled out, meaning that the facility and its site are conceived to serve multiple uses. Other important functional features include adaptability and flexibility. Amongst the cultural features, distinctiveness may be mentioned, indicating that the facility or site is attractive and like no other, and has the potential of becoming an icon, lending a positive reputation and drawing visitors. Other cultural features include aesthetic quality and "understandability", whereby the

installation can be tied in with existing knowledge and related to everyday life. “Memorialisation” is another cultural feature, meaning that both physical and cultural markers identify the site and tell its story, so that people will grasp and remember what is there. Finally, physical design features include integration, amenity, and accessibility, which can help the facility and site correspond to the local definition of a safe, unthreatening environment. Examples of practical implementation are provided.

The very process of working out the desired features of a radioactive waste management facility and site can bring added value to the community. This has been the conclusion of local stakeholders who take an active role in site investigations, or who participate with implementers in formal partnerships. Social capital – networks, norms and trust – is built up, equipping the community to face other decisions and issues. Local stakeholders may also focus their work on community identity, image and profile. Even when not favourable to hosting a radioactive waste management facility, communities can use the opportunity to develop quality-of-life indicators and reflect on the direction they want to take in coming years. Other benefits that may be accrued are an enhanced educational level in the host community related to the influx of highly skilled workers. Not least important, when host communities demand training and participate in monitoring site development and operations, they are building their capacity to act as guardians and therefore ensure another layer of defence-in-depth. These added-value aspects of facility planning and implementation should also be capitalised upon.

Added cultural and amenity value is specific to each context, and while it is may be possible to formulate general principles, no universal recipes can be provided. Examples gathered in this report show, however, that there is a practicable path towards building facilities that favour a sustainable relationship with the community.

Sustainability and value-added themes are clearly a new topic in radioactive waste management stakeholder discussions. It is hoped that this study report, with input from a wide range of contexts, may be beneficial to both communities and national radioactive waste management programmes in designing their paths forward.

1. INTRODUCTION

The length and complexity of the radioactive waste management task represents a particular challenge to our society. Planning, siting, constructing, operating and, finally, decommissioning a radioactive waste management facility is not a simple linear affair and it takes decades to accomplish. It implies many different types of assessment, evaluation and decision, and involves many different types of actors. All the decisions cannot be taken at once: there will be evolution in the type of administrative assessments that will be required, in the level of technical knowledge available, in the political climate from decade to decade. There will be a renewal of actors as new ones, as yet unborn, enter the scene. In such a context, the societal durability of an agreed solution and its sustainability over the long term are key to success.

Many *stakeholders* agree that the chosen radioactive waste management solution must first deliver an agreed level of safety for man and the environment, and then meet requirements for fairness (including fulfilling the "producer pays" principle), and finally, address other aspects of individual and social acceptability. We will argue that all these dimensions benefit from early study and planning in a participative manner, and that the positive gains to be sought on each level may reinforce each other.

This report looks into features and strategies that maximise the chances for a radioactive waste management facility to better fit into the personal sphere of those hosting it over the generations. A long-term relationship may be facilitated by designing and implementing facilities in ways that provide added *cultural* and *amenity* value to the *local community* and beyond. By cultural and amenity value we mean: agreeable additions to quality of life, through such features as distinctiveness, aesthetic quality, convenience and meaningfulness; through providing opportunities for residents and visitors to meet, learn, relax, enjoy…; through fostering community improvements in areas like educational level, image definition, or problem-solving capacity. It is the opposite to

2. *Italicised* words are defined and discussed in Appendix 2 (Glossary).
3. We quote de Swiss expert group EKRA, and a similar hierarchy of concerns was expressed by stakeholders who gave input to our study.

building an ugly, threatening facility that upsets or repels people, and remains like a stranger or an unwelcome presence in the community.

Added cultural and amenity value brings direct gains in quality of life; it can foster socio-economic gains by making a place more attractive to visitors or future residents. In the best of cases, added cultural and amenity value will start a virtuous circle, bringing benefits now, encouraging an on-going relationship with the facility, and strengthening the community such that in future years it can face challenges and continue to improve quality of life.

The *added value* to be sought when designing and negotiating a radioactive waste management facility is not a secondary detail. We believe it is one of the conditions that will help assure safe management of radioactive waste over the generations. Making a facility into an important, positive part of its community may be vital for making sure that the facility is understood and remembered over time by residents and not only by the technical people.

Different cultural contexts may have varying approaches to these issues. This report is offered as an input into site – and community-specific discussions on the development of radioactive waste management facilities. It provides examples of initiatives that communities may want to consider. What constitutes added value will need to be discussed and agreed with the local stakeholders in potential host communities and will reflect their particular circumstances. A "one-size-fits-all" solution cannot be offered.

Alongside reading this report and setting up discussions, radioactive waste management stakeholders are encouraged to investigate the experience of other industries in similar settings and with comparable challenges. They may learn in this way from specific solutions that have produced added value within a given local framework.

This report does not look into "*spin-off*", thematically unrelated infrastructure projects that may accompany the building of a radioactive waste management facility, nor into *incentives* or *compensation*, although our findings may be useful in these areas. It is recognised that as decades pass, the importance of monetary compensation may recede, while the importance of good relations and durable added value will increase.

Section 2 of this report summarises the argument in favour of developing a sustainable relationship between a community and a radioactive waste management facility through added cultural and amenity value. In section 3 the report identifies design considerations – functional, cultural and physical – that may help facilities and sites fit into their community in an acceptable and

sustainable manner. Each design feature is illustrated with examples. The fourth section discusses the benefits that may be gained from the very process of planning radioactive waste management projects that target sustainability and quality of life. These benefits – capacity building, local image refinement – should be understood as cultural added value in and of themselves. Finally, conclusions are highlighted.

Illustrations are drawn from FSC publications, a literature review, specific interviews and stakeholder responses to a questionnaire. Appendix 1 acknowledges the many stakeholders who gave detailed input. Appendix 2 is a glossary of terms (whose first appearance in the report is *italicised*) and identifies FSC references.

2. ADDED VALUE AS A MEANS TO A SUSTAINABLE RELATIONSHIP BETWEEN A FACILITY AND THE HOST COMMUNITY

Because a radioactive waste management facility and site will be present in a host community for a very long time, a fruitful, positive relationship must be established with those residing there, now and later. Both the ongoing quality of life in the host community, and indeed future societal capacity to watch over the wastes there, depend on building a sustainable relationship. This section defines what we mean in this report by "sustainability", and by "local community". It shows how cultural and amenity value added by a radioactive waste management facility may foster a sustainable relationship, and tells why this added value should be considered early on.

Many countries have committed to the sustainability principle. Sustainable development "meets the needs of the present without compromising the ability of future generations to meet their own needs". It is "...not a fixed state of harmony, but rather a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs".[4] Because the physical environment is our primary resource base, the first pillar of sustainable development (SD) is ecology: we ought not to harvest resources faster than they can be regenerated, nor emit wastes faster than the environment can assimilate them. The three other pillars of SD are economic, social, and ethical. Altogether, SD targets not only material (ecological and economic) needs but also social, spiritual and cultural needs.

How can radioactive waste management contribute to sustainability? Waste, by definition, cannot be recycled directly into a useable physical resource. However, all four pillars of SD should be kept in view. In principle, radioactive waste management should become a source of further development for a community, through adding economic, social and/or ethical value. Economic added value is a relatively familiar concept, and economic development packages (as well as incentives and compensations) have been already widely

4. United Nations World Commission on Environment and Development (WCED) (1987) *Our Common Future* (Brundtland Report), §27 and §30.

discussed.[5] On the other hand, social and ethical added value may be more difficult to grasp. The National Academy of Public Administration[6] explains those intangible values: "Each generation creates and uses resources (over and above natural resources) that are very future-oriented. The most important examples are the education system, opportunities for contributions to social and economic needs, the capabilities for research and scientific investigation, and literature that analyses and records our understanding of our own acts. Each generation must use some of its current resources to enrich these intellectual resources for the ultimate benefit of future generations". In this way, "sustainability is also an opportunity". Furthermore, we would argue, if value is added to a community by a radioactive waste management facility, this value is like a capital whose benefits can accrue over time. In this report, we will give some examples of how radioactive waste management has contributed to communities what we call cultural added value, made up in particular of future-oriented resources as described by NAPA.

In a sustainability perspective, radioactive waste management facility and site should not only avoid disrupting but should in fact improve community living conditions over the full life cycle of the facility.[7] The installation can provide community growth potential – not only through financial compensation and development opportunities. Whilst those economic means are important, radioactive waste management projects also offer opportunities to improve well-being, consolidate knowledge, fulfil value ideals, elaborate community identity and image, and live out desired social relationships. Planning for a facility should seize these opportunities.

In this report, *local community* is a generic term for the group of personal actors that become involved in deliberations about radioactive waste management facility siting and operations. It is a social group of any size whose members reside in a specific locality, share government, and often have a common cultural and historical heritage. Community is not tied firmly to a geographic area. Frequently today, extended local units, groupings of townships, or regions are brought to consider the place of a radioactive waste management facility or site in their territorial identity.

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5. See for instance Kotra, J. (2003) "How to Address Social Concerns? Round Table Discussions during Session II of the FSC Workshop in Canada", in NEA (2003) (the full reference for NEA, 2003 is found at the end of this report in Appendix 2).
6. NAPA (1997) *Deciding for the Future: Balancing Risks, Costs, and Benefits Fairly Across Generations.* Report by a Panel of the National Academy of Public Administration for the U.S. Department of Energy. Washington, DC: National Academy of Public Administration, June.
7. The facility life cycle includes planning and construction, operation, monitoring and when appropriate, decommissioning.

Without durable cultural and amenity value a facility will have less potential to survive over the generations, even in the presence of socio-economic provisions and institutional controls. In contrast, as one local stakeholder representative expressed it:

"With local community support for a facility from the outset of design and to the end of construction, and the development of a lasting amenity for the local and regional area for generations, I believe that the management of the facility is more likely to be continued through a number of generations. As well it is less likely to be seen to be a burden to the local area or future generations, as there is a benefit derived for those future generations."

It is thus important to investigate features of waste facilities and sites that may enhance quality of life in both the short and long term and thereby help build a sustainable relationship between a community and facility.

Integrative reflection on technical and socio-economic aspects, and on cultural and amenity value that could be added by a radioactive waste management facility, is best started from the very first planning stages even before final siting agreement is reached. It takes time to work out new ideas, new possibilities, and where the communities' own interests lie. The information, concepts and ideas gained from this reflection will form a part of the basis on which a local partner may agree to become a candidate community and then actively engage in the final siting stages.

Institutions generally cannot commit to the final form of a radioactive waste management facility before a specific site is agreed, nor to the ultimate fate of the facility and site. As well, the relationship between a community and a facility or site will depend in part upon external events (for instance, safety performance in the nuclear or radioactive waste management realm; attitudes and statements by political actors; etc.). Still, feasibility studies and social science investigations early in the decision-making process can provide meaningful preparation. This approach is supported by e.g., the *UNECE Aarhus Convention*.

Often it can be difficult to hold a mutually satisfying discussion on compensation and development measures, one that will create no perception of "*bribery*" by the implementer, nor of a "mercenary" attitude on the part of the potential host community. Just as the Environmental Impact Assessment (EIA) has proved to be a good umbrella process for discussing stakeholders' concerns, the added cultural and amenity value theme could drive sustainability dialogues, facilitating more productive exchanges on compensation as well as other, long-term provisions.

3. VALUE ADDED BY FACILITY DESIGN FEATURES

In the 1st century BC, classical Roman architect Vitruvius outlined what good architecture should achieve. He stated that a structure must exhibit the three qualities of *firmitas, utilitas, venustas*: it must be strong or durable, useful, and beautiful. These are qualities that can be sought for the radioactive waste management installation, for both the physical building structures, and for what the installation can bring to the community.

This part of the report reviews each design consideration that helps a radioactive waste management installation to maximise the value added – that is, to maximise its contribution to potential sustainability and well-being in the community. Relevant design features relate to functional, cultural, or physical aspects. It is important to note that while the design features can be separated out for discussion, often, in practice, they are tightly linked.

Illustrations from stakeholder experience are given, including some from industries or areas outside radioactive waste management. Probably many more illustrations can be found.

Table 1 below summarises the design features that may help the facility and site to add durable value to the community. These features tend to maximise the potential of a facility to be "adopted" by the members of the host community, by fitting in, adapting to and, moreover, contributing directly to their preferred way of life.

Table 1. Design features that help to maximise the added value brought to a community by a radioactive waste management facility

Functional aspects	Cultural aspects	Physical aspects
Multi-functionality or polyvalence	Distinctiveness	Integration
Adaptability	Aesthetic quality	Amenity
Flexibility	Understandability	Accessibility
	Memorialisation	

3.1 Functional design features

"Function" concerns the uses to which the facility and site may be put. The radioactive waste management facility must serve the primary purpose of assuring safe and secure long-term management of radioactive waste. Careful functional design can add value, by allowing parallel uses that are of direct interest to residents and visitors. Table 2 summarises design features and characteristics related to facility function, as well as the value that may be added to the community, and finally, possible strategies to achieve each feature.

Table 2. Functional design features that help to maximise the added value brought to a community by a radioactive waste management facility

Design feature	Characteristics	Value added	Possible strategies to achieve the desired feature
Multi-functionality or polyvalence	The installation serves several functions at the same time: it assures its mission of safely managing radioactive waste and also supports other uses like recreation or education.	Offers opportunities for a wider range of persons to come into contact with the installation and to bring it into their lives. Offers opportunities for the community to draw a range of benefits (prosperity, amenity…).	Designers and community stakeholders explore community needs for additional functions, work closely with regulators to reconcile demands for safety and for parallel uses
Adaptability	Foreseeable functions can be accommodated at acceptable or no cost.	Supports the near-term multi-functionality of the installation.	Designers choose appropriate materials and structures to accommodate foreseeable uses and to make necessary transformations easy.
Flexibility	New and unforeseen functions can be accommodated at acceptable cost.	Supports longer-term multi-functionality, including complete transformation of structure or uses.	Designers anticipate that new functions will be introduced by future users; they assure robustness and avoid building in features that narrowly restrict potential uses.

Not every square metre of a radioactive waste management facility can be put to multiple uses. The desirability of multi-functionality and the ways to achieve it should be decided in each context, by the stakeholders involved.

Multi-functionality

Industrial facilities are often mono-functional, dedicated only to serving their engineering purpose. In the past managers and politicians sometimes pressured communities to accept facilities in the name of glorious technological progress or "the greater good", and relied on financial incentives and compensations to make the facility attractive. In contrast, FSC workshops in Canada and Belgium[8] have highlighted the desirability, and necessity, of integrating radioactive waste management facilities into people's way of life and vision for growth. Like mobile phones that also serve as personal planners and cameras, or living spaces employed for many different activities, radioactive waste management facilities may more easily become part of people's lives if they have multiple uses. Similarly to other products and services, if a radioactive waste management facility does not make positive contributions to the consumer cycle, it may soon be left aside or resented.

"Multi-functionality" means that the radioactive waste management facility or site can be used by the community for other purposes. These functions may be exploited by the community immediately or in the future. They might provide economic benefit, enjoyment, learning or socialising opportunities. In all these ways, the facility or site provides added value.

There is a difference here with "spin-off" opportunities or unrelated infrastructure that may be offered to a community as an incentive or supplementary grant. Multi-functional facilities and sites (for example, scientific, cultural and recreational facilities built within site confines) are designed to deliver, in and of themselves, added cultural and amenity value closely tied to the radioactive waste management project itself. In this way, the added value helps to fit the radioactive waste management facility or site into community life over the generations.

We have found examples of multi-functionality providing added cultural and amenity value, as well as traditional economic value.

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8. NEA (2003) *Public Confidence in the Management of Radioactive Waste: The Canadian Context*, OECD, Paris.
NEA (2004) *Dealing with Interests, Values and Knowledge in Managing Risk*, OECD, Paris.

- In Canada, the Port Hope End Use Advisory Committee developed a "vision" for multi-functional use of the Long Term Low Level Radioactive Waste Management Facility. The Committee highlights design features that could create durable cultural and amenity value. Options discussed for parallel uses of the site include an "interpretative centre" or museum. This would pass along history on the nuclear industry and "how we got to be what we are" in Port Hope. Another option is based on the assumption that green space will be the resource most lacking in 500 years, and one that certainly will be appreciated: the committee proposes a National Heritage and Passive Recreation Area ("permanent" flower gardens, walking paths, and observation stations). Finally, active recreation uses are being considered, addressing a more immediate need in the community.

- Two waste storage facilities in France, the Centre de stockage de l'Aube (CSA) and Centre de stockage de la Manche (CSM), function as tourist destinations, providing revenue to the region. At CSA, a museum-like visitors' centre informs about local geology and archaeology, and the storage area can be toured. The extendible hangar design has been noted and copied by visiting farmers.

- In Nord-Pas-de-Calais, France, a mining museum also contains a cultural centre, where lectures and concerts can take place. One could extend such a concept to a surface building on a radioactive waste management site: community members could use the building for their own agreed purposes, for cultural advancement or enjoyment.

Added scientific value too can be generated through multiple uses of polyvalent radioactive waste management facilities.

- Underground installations offer unique opportunities to carry out research requiring an exceptional environment. Zero-gravity experiments are carried out at Japan's Tono Mine underground laboratory, and the North America Deep Underground Science and Engineering Laboratory foresees a number of experiments unrelated to waste management that may be carried out at WIPP.

- Laboratory facilities at Spain's El Cabril and WIPP in the US are available for use by universities and administrations. This up-to-date infrastructure serves for research and for regional environmental analysis or monitoring.

The link between scientific *culture* and "everyday" culture can be made in multi-purpose, interactive facilities. This represents added value for the users of

these facilities, and over time can help improve the educational capital of society as a whole.

- At Äspö, Sweden's hard rock laboratory includes a demonstration component, providing knowledge to scientists through research and to the public through a hands-on museum experience.
- The Association of Swedish Municipalities with Nuclear Facilities (KSO) Secretariat gave ideas for cultural added value installations. In an environmentally oriented bio-geo-science centre or "Experimenter Facility", visitors could create things themselves with the help of computers, see rock samples, play games with scientific content in physics, chemistry and biology, and learn about up-to-date geologic knowledge and even the history of the stone industry of the Oskarshamn area or iron-work industry of Forsmark. The geo-scientific centre could be complemented by a large outdoor stage (dug in the bedrock) for music and theatre performances in a true "Mountain King" concert hall. The outdoor stage area could have a geo-scientific trail with stations explaining bedrock types, fossils etc.

Radiation protection and safety needs push engineering solutions towards isolating the waste. Is it really possible to create a multi-functional facility while preserving safety? In principle the answer is yes: if this is taken into account from the beginning, architects and engineers can lay side-by-side the "hardhat and dosimeter" waste-management area with the part welcoming visitors for other pursuits. This is the case for the El Cabril and WIPP laboratories cited above, and for museums and visitors' centres at other repositories. The concept in principle can be extended to any installation, and a wider variety of uses imagined.

- In Canada, the Port Hope community worked with the federal safety authority to check the feasibility of the public-use projects they would like to see within the low level waste storage area.

Adaptability and flexibility

"Adaptability" and "flexibility" are necessary for achieving multi-functionality. They mean that designers do not lock the facility or site into a single purpose. Instead, designers choose forms and materials that may allow a graceful transition to parallel or new, unforeseen uses.

- A typical example is seen in modern exhibit or theatre spaces that can be transformed according to need (walls and seats are modular and mobile). On the scale of an entire construction, the "innards" of the building – heat, waste and ventilation conducts – can be placed along

the margins, so as to facilitate new organisation of the open central space. As for radioactive waste management installations, such a concept could be extended to the entire site, designing and placing protected areas in such a way that they do not hinder a large array of expected or unexpected site uses.

When creating a new facility, it is necessary to foresee the end of its useful life. If future needs are not anticipated, there is a risk that the facility will become a liability for the community. Proper foresight – on the end use of the facility and site, or technical provisions for quick transitions to other types of facilities – provides better assurance to the host community that there will be flexibility in future planning capacity.

- In France, a tumulus formed of mining waste has been adapted into a ski slope. This required engineering foresight to provide the correct slant and access arrangements.
- In Kävlinge, the town hosting Sweden's Barsebäck nuclear power plant (NPP), the municipality views that the operating reactor is a valuable asset and should go on running for economic and environmental reasons. If Government decides to decommission, the community does not want to be tied for 30 years to a restricted, unproductive site.[9] The municipal preference would be to turn the site very quickly into a new seaside housing area. The choice of land use reflects both the changing demography of the region and the municipal need to generate revenue. If the older type of reactor had been built with design provisions that favour a prompt dismantling – like current plants – there would be a shorter lead time to the decommissioning of the reactor and there would be a smoother transition to a final and accepted new condition.
- At the Dounreay NPP in Scotland, the process of setting decontamination priorities and radiological target levels will take some years. Stakeholders are currently working to find agreement on which surface buildings should be maintained, which areas should be accessible to visitors, and which new uses should be created. Because at the time of construction and in the early years of operation the future need for such decisions was not taken into account, clean-up and transformation of site elements may be a heavy and costly task. The famous domed reactor building has been proposed as a national

9. Palmqvist, R. (2005) "The Municipality as a Stakeholder". In WPDD Topical Session on Stakeholder Involvement in Decommissioning, November 2005. NEA/RWM/WPDD(2006)5; www.nea.fr/html/rwm/docs/2006/.

monument, but the cost associated with its maintenance under that regime appears too high, as would be the cost of dismantling or transformation. Today many local stakeholders with family employment ties are sentimentally attached to the landmarks of the no-longer operating site, but in any case it appears that there is little choice to be made regarding whether to keep or eliminate the reactor dome. It may be an unused landmark, admired or not, for generations to come.

An adaptable, flexible facility can provide enjoyment during its operation and also make possible the transition to a full community facility when its industrial use is no longer needed. This preserves the potential for local culture to develop further according to future needs. Cultural identity takes decades to centuries to form. Radioactive waste management projects should be sensitive to present and also evolving cultural identity. A flexible, multi-purpose facility can contribute to the latter, as it is likely to last for generations of social use and enjoyment.

- The city of Rome is an outstanding example of how cultural identity is formed through the layering of sites and buildings from many eras of history. Ancient religious sites were rebuilt over the centuries with churches that show architectural and decorative features from many successive eras, and they are still in use today. Throughout the historic centre, major facilities constructed to serve the institutions of their time have been adopted and transformed to suit successive needs. While some stand as museums, many more house today's institutions. Ancient vestiges and newer constructions co-exist in a living manner, integrated in today's practices. Remnants of the past are completely adapted in a vibrant modern community.

Facilities built to store today's waste must have the technical potential to last over the centuries. The visible layering of history in the city of Rome offers an example of how radioactive waste management host communities may hope to construct for the future. They can envision how today's site may best be given a form around which future developments may grow. Along with careful planning for radiological safety on-site, adaptability and flexibility will leave development pathways open.

3.2 Cultural design features

"Cultural value" is found in arrangements that reflect and strengthen a given society's knowledge, tastes, aspirations, ethical views, or beliefs. It lies in all that is meant to help to transmit an honoured legacy, to communicate symbolic meaning, or to advance ideals.

Culture has been defined as "the set of distinctive spiritual, material, intellectual and emotional features of society or a social group, encompassing, in addition to art and literature, lifestyles, ways of living together, value systems, traditions and beliefs".[10] In this way, culture may be assimilated to shared meaning and practices. Culture is not a fixed-for-ever set of features, and facility designers must give attention to what may help culture to develop further.

Four design features are found to be part of how designers and communities can instil meaning into a radioactive waste management facility and site. Table 3 summarises these features and their characteristics, the value they may add to the community, and strategies for achieving them.

Table 3. Cultural design features that help to maximise the added value brought to a community by a radioactive waste management facility

Design feature	Characteristics	Value added	Possible strategies to achieve the desired feature
Distinctiveness	The installation is attractive, recognisable and "like no other".	The installation may become an icon, a well-known, emblematic and admired feature of the place. People may draw pride from the presence of the installation; it can become a positive part of local identity.	Artists and architects apply their highest creative and design skills; incorporate state-of-the-art and/or traditional materials; introduce innovative engineering…
Aesthetic quality	The installation is nice to look at and to "experience".	People may draw pleasure from the presence of the installation rather than avoiding it or rejecting it.	Architect, artists and community stakeholders consult on desirable "look", layout and landscaping.

10. UNESCO Universal Declaration on Cultural Diversity, 2001, 2004. Online at http://unesdoc.unesco.org/ (consulted 19 September 2006).

Table 3. Cultural design features that help to maximise the added value brought to a community by a radioactive waste management facility (Contd)

Design feature	Characteristics	Value added	Possible strategies to achieve the desired feature
Understandability	The installation and its functions are understand-able.	People can connect the radioactive waste management project and installation to various parts of their lives and their knowledge.	Stakeholders (technical and societal) engage in an open, transparent and collaborative process to work out the radio-active waste manage-ment project. Information and education programmes.
Memorialisation	The facility and site are marked so that people (now and later) know both what is there and something about its context.	People can integrate into their sense of place the meaning of what the site is and why it is there. Features of local identity and culture are preserved and showcased. Society's choices and achievements are recorded.	Interactive museums. Art installations. Durable markers.

Distinctiveness and aesthetic quality

Attention should be given to making the facility less ugly, and more of an object of community pride. "Distinctiveness" means that the radioactive waste management facility or site is attractive, recognisable and like no other. The facility and site may become an icon, lending a positive reputation and drawing visitors to the locality.

- The household-waste treatment facilities at Spittelau near Vienna were transformed into a delightful landmark when they were given a new outer shell by artist Hundertwasser.
- The Oskarshamn municipality feel that a future SNF and HLW facility could be a showcase for Swedish innovation and design. They call for a national architectural competition to be held.

The visual impact of industrial installations is a real issue. As soon as you can see it, you are interacting with a facility; this interaction has to be made pleasant and desirable. “Aesthetic quality” means that the installation is nice to look at and to experience. If an installation is aesthetically pleasing, in sum, one would be happy to pose for a photograph with the site in the background. There are different ways to achieve this: through innovation, or through tradition.

- The Äspö surface buildings in Sweden look like handsome examples of regional architecture. They resemble classical wood houses and respect the traditional colour scheme of red siding, dark roofs and white trim.
- Artist C. Massart has visited waste facilities throughout the world and captured their particular beauty and identity in graphic works (photos, engravings, videos).
- In the Netherlands, the COVRA Habog interim storage installation is painted a warm saffron yellow and the different forms of the equation $E=mc^2$ are represented in monumental letters of aqua green on the four sides of the building. This landmark is included in regional architectural tours by universities. Beyond the pleasing colours, this treatment of the building is meant to communicate to the community that COVRA is committed to finding more aesthetic and acceptable ways of fitting in.

Understandability

“Understandability” means that people comprehend the facility and its functions – or that they have the means to learn about them. The installation can be tied in with existing knowledge and understanding, and members of the community can relate to the facility.

Understandability must be built up through relationships with the facility and site. Providing transparent, accessible information about the site can enhance people’s ability to relate to it. This can be achieved through visits, demonstrations, mock-ups, and hands-on interactive exhibits, or through archiving and transmission of data.

- In their final report, community members of the STOLA *integrative local partnership* (Dessel, Belgium) spelled out their requirements for accepting a facility: The repository project for low-level waste must integrate technical and social aspects, and moreover, must bring positive value to the community. STOLA set requirements to foster understanding of the facility and site, now and over the years. They stipulated that alongside a repository must be built a clearinghouse for

information regarding radioactivity, its applications and consequences. A small interactive science centre should be part of this.

- France's Centre de Stockage de la Manche can be toured and draws both tourists and regional inhabitants.
- Many industrial facilities, including nuclear power plants and operating waste management installations, hold "open door" days to build up relationships with the neighbours. Residents can visit the site, meet and talk with the people who work there, and participate in family activities that bring the facility closer to everyday experience.
- Cogema has demonstrated that it is possible to place cameras even in the "hot" areas of waste management facilities, allowing people to look in and form an image of what waste management really looks like (this feature must be considered in light of security constraints). Several implementers have displayed long-term containment structures for the waste so that people may distinguish these from more fragile engineering structures and build up their understanding of the waste containment systems.

Understandability can be enhanced if community members are involved in working out details of the site function. Communities may wish to develop their understanding through training, which also equips them to monitor the proper running of the facility over the years.

- Mayor J. Castellnou of Hospitalet, the Vandellós nuclear plant host community (Spain), told the FSC[11] that local confidence – in the host community and beyond – rests on four pillars: safety, local training and knowledge development, socio-economic development, and future-oriented sustainable development mechanisms. Communities appreciate being part of checking for safety, and ask to be trained in the relevant areas. They thus build not only competence but also accrued, tangible safety mechanisms and the basis for long-term co-existence with the facility. This familiarity and control are part and parcel of the safety concept. Local stakeholders may one day be called to be the guardians of a facility or its memory.
- A regional university professor was given the role of "translating" the relevant technical concepts into plain language that local people on the Vandellós dismantling monitoring commission could understand. This

11. J. Castellnou, in Proceedings of the FSC topical session on "The link between RD&D and stakeholder confidence" held in June 2005; see OECD/NEA document NEA/RWM/FSC(2006)4.

increased members' grasp of the issues they were to monitor. At the same time, these concepts became part of a local narrative, giving a better integrated cultural presence to the facility.

Understandability may also mean that the community accepts the presence of waste and does not try to hide its existence. In questionnaires, most stakeholders contributing to this study indicated that they do not seek to camouflage the presence of radioactive waste in their community. A facility can be designed to show, rather than hide, the fact that waste is placed there.

- P. Gontier, an ecological architect, observed in an interview that "showing, not hiding" is a preference that has emerged relatively recently in the history of architecture and urban planning. It is both an ideological preference and a utilitarian one: when the function of an installation is hidden, it can be forgotten. He suggests that the best path to follow in designing a radioactive waste management installation is not to attempt to disguise its function, but, to render that function visible and understandable. In the architect's opinion, designers should seek out an aesthetic code that is distinctly appropriate for nuclear power (or for radioactive waste management). They should not borrow aesthetics from other domains. Doing so would be anti-transparent; it would comfort the notion that radioactive waste management has something to hide. The installations should look like what they are. The building should display its "truth", and moreover, "tell a story" in which the community will recognise itself. To discover the desired story implies consulting and involving the community.

The themes of "understandability" are closely linked to issues of "memorialisation".

Memorialisation

Sustaining a long-term, care-taking relationship with a radioactive waste management facility requires that the memory of the site be preserved. "Memorialisation" means that both physical and cultural measures are taken to mark the site and tell its story, so that people will grasp and remember what is there.

For decades technologists have reflected on the need to preserve site memory by constructing durable markers. Whilst the markers have a protective function, "marking" the facility can also be a means to add cultural and amenity value. These are important considerations if the memory of the radioactive

waste management facility and site is to be preserved over many, many generations into the far future – a future much longer than industrial experience to date.

- Artist C. Massart reminded the FSC Belgium workshop participants that we must archive information for the future, taking into account that present-day meaning will fade away or become unreadable. She showed how we can mark repository sites or facilities through symbolic, artistic means. In this way it is also possible to create new relationships, a new contemporary dialogue around waste management. Massart explained in an interview that everything that should be known, thought and retained about the actual repository site cannot be grasped in a single glance. The site cannot be fully archived with a simple label: neither a detailed technical presentation, nor an eloquent discourse on "what is here and what it has meant in our society" will assuredly be readable over tens, hundreds or thousands of years. Nor will simply reading produce in each person a maximum sense of "where he is" and the presence and form of the waste. Massart suggests we must multiply the means through which a visitor may approach and form a relationship with the repository site. The visitor may leave, each generation is likely to leave, without comprehending and possessing the full sense of what is there, but "at least our thoughts and questions are recorded".
- When mines are closed they have been transformed into mining museums, offering a new tourism industry while memorialising the activity that meant so much to the region and shaped it.

There is experience with memorialisation in the World Heritage programme. Monuments are identified for protection by the UNESCO World Heritage Commission, because they are considered of "outstanding universal significance" and represent a "unique achievement". Do long-term radioactive waste management facilities potentially resemble this type of cultural property? Considering the World Heritage inclusion criteria ("testimony to a time and place – exerting considerable influence – associated with significant ideas, beliefs, events" – etc.) may aid in conceiving and designing radioactive waste management facilities. The criteria may help identify specific dimensions of cultural value (artistic, historic, social, and scientific) that a local community, and our society, would like to see associated with a repository project.

A number of local stakeholders have proposed that waste management facilities and sites should be accompanied by science museums, visitors' or communication centres. These proposals show how our cultural design features of distinctiveness, understandability and memorialisation may be tightly linked

in practice. Several complementary aims are addressed by these community proposals: preservation of knowledge, demonstration of waste management concepts and solutions, public accessibility of information, site memorialisation, reinforcement of regional identity, generation of tourism revenue, and/or creation of recreational amenity.

- The municipality of Oskarshamn has considered a Science Centre or a Time Travel Museum looking at spans of hundreds or thousands of years in both historical and prospective terms.
- The idea of an on-site environmentally-oriented geoscience centre or "Experimenter Facility" was highlighted by Sweden's KSO.
- STOLA recommended a communications centre in the vicinity of the repository site, to serve as the point of reference for information regarding radioactivity, its applications and consequences. An inter-active science exhibit on radioactivity should be part of this centre.
- The Port Hope End Use Advisory Committee has put forward an idea to build an "interpretative centre" or museum. This would pass along history on the nuclear industry and "how we got to be what we are" in the local community: Port Hope was the site of a radium processing industry, then was stigmatised by legacy waste, and finally stepped forward to manage the waste on residents' own terms.

Creating a museum is similar to other heritage endeavours. Steps include: study, selection, and valorisation of the essential elements that should be transmitted over time beyond those directly involved in building or living with the property. Museums allow others to observe and appreciate the technical and social qualities of the past (and to enjoy while learning). In the radioactive waste management realm, local proposals for museums may allow visitors and future generations to understand the technical dimension of the waste management activity. Even when this technical aspect is not memorialised, the culture (knowledge, tastes, aspirations, ethical views or beliefs) of the host community and their active part in building the centre or site recreational amenities can be made apparent to future visitors.

3.3 Physical design features

The physical level of design (Table 4) is a familiar one for architects and engineers. They can seek to integrate the facility into its physical setting, to eliminate any threatening, repulsive character, and increase site and facility *amenity*.

Table 4. Physical design features that help to maximise the added value brought to a community by a radioactive waste management facility

Design feature	Characteristics	Value added	Possible strategies to achieve the desired feature
Integration	The installation respects the "genus locus" (spirit of the place), fits into the landscape and complements it.	The installation does not intrude on or disrupt people's living space and their attachment to the place.	Architects study and respect the "genus locus".
Amenity	The site includes features that enhance its attractiveness, convenience and usability.	People may actively go toward the site and draw satisfac-tion from using it.	Architects, artists and community consult on desirable landscaping and equipment.
Accessibility	A large proportion of the installation surface is open, fences and barriers are reduced to the essential.	People get a feeling of security and familiarity rather than a sense of threat.	Architects, planners and regulators seek to reconcile protection and openness.

Integration

"Integration" means that care is taken to make the facility and site blend into the natural or built landscape. The radioactive waste management installation should not be implanted without regard for the harmony of the place.

- Spain's Vandellós-I reactor was closed in 1990 and while awaiting a management facility, contaminated graphite is stored on-site in former reactor buildings that have been restructured and re-styled. The city of Vandellós is a beach resort and the existing building has been made more attractive in the local landscape through various means. In particular, the site is no longer intrusive to the view from an inland position: a special paint job makes the remaining building blend into the natural setting by matching the green of the forest line and the blue of the sea. Integration was improved by reducing the reactor building from 90 metres to 60 metres in height.
- In Sweden, implementer SKB has asked an architect to think about "industrial design with man in mind" for the future final repository for SNF. "What will it look like? A big square industrial structure?" The

architect answers that it's important to get to know the site where the buildings will stand, and the "genus locus" or spirit of the place. New buildings and industrial plants must be in harmony with the unique feeling each place has. "When we're finished using the site we want to be able to leave it the way we found it. It should be able to resume its original appearance". Security features may be integrated in the form of natural obstacles and differences of ground level. On the site investigated in Oskarshamn, the architect points out that nature is not pristine, but shaped by man over the centuries. He tries to capture the interplay between man and nature with the proposed placement of buildings, where "man has already made his mark on the landscape, taken the land in his possession and tilled it for centuries; in this way the final repository can be a continuation of the site's history, revitalising it and keeping it to the same course it has been following for millennia".

"Integration" is a physical design concept, but it also has meaning in socio-economic terms. The radioactive waste management facility and site should fit into and stimulate other community projects and initiatives.

- Port Hope's End Use Advisory Committee stipulates that repository planning should consider long-term and integrated planning for, or compatibility with, the entire neighbourhood.
- The Oskarshamn municipality points out that "To be effective the findings (on added value to be brought by a repository) must also be put in a broader perspective. All municipality activities are part of a larger picture and none can be treated in isolation". Considering a repository "forces discussion on prioritisation".

Amenity

"Amenity" is any feature that enhances attractiveness and increases the user's satisfaction. It will be achieved in all the ways a radioactive waste management facility or site can provide appealing resources for everyday use by the community. This can be related to multi-functionality.

- Port Hope's vision for parallel uses of the low level waste storage area targets pleasant use of the area now and in the future. In the near term, the area can be used for sports. A more far-sighted use as a garden aims to preserve green acreage and its enjoyment for centuries to come.
- SKB's industrial architect points out that designing a final repository is "like designing a small city, with restaurant, offices, overnight accommodation and everything".

Accessibility

"Accessibility" means that the site and facility are not barricaded, but are open and welcoming. People can go toward the installation without feeling unreasonable fear. Accessibility appears to be closely linked with feelings of safety. Safety is more than just a technical concept – it also has everyday meaning in the community.

- SKB's industrial architect says "this is a facility you want to show off, not hide deep in the woods". The access road must not give the impression that it is taking employees and visitors "to the site of some suspicious enterprise. Rather, the final repository should radiate openness, insight and transparency."

Certainly each and every area of a radioactive waste management facility cannot be made open to the public. Areas restricted for the necessities of safety and security need not benefit from the same degree of functional, cultural, and physical design input, for they are not aiming to add direct value to the community. Still, the radioactive waste management facility and site should be considered in a holistic manner, in order to maximise the added value that it is possible to achieve at reasonable cost.

Meeting radiological safety demands – the primary condition set by the stakeholders consulted for this study – is linked to how accessibility is managed. While technical features will provide the agreed level of protection, physical design elements will help create the feeling of security. A facility that is carefully designed and monitored for public safety is demystified if it offers parallel uses for the community. In particular, if a site that is licensed to operate can be freely visited, walked through, or enjoyed for other uses, it clearly must be safe. It no longer seems to impose restraints on the user, nor shuts people out in an alarming way. It accomplishes its goal of protection without emphasising danger. This style of safety differs from the traditional implementation found in many contexts. Radioactive waste management projects today often push safety away from a militaristic concept, towards an implementation that is more socially welcoming.

- The Vandellós waste store can be visited without extensive personal protection, and a confident feeling is produced by the ability to peer into the storage area through portholes.
- In a similar manner, the underground offshore facility of the Swedish Final Repository (SFR) for Radioactive Operational (L/IL) Waste can be visited essentially in street clothing.

- The Port Hope community determined early that the Long Term Low Level Radioactive Waste Management Facility should be completely accessible, thereby communicating assurance that it is completely safe. Since January 2005, the End Use Advisory Committee has developed framing principles for deciding how the facility should be designed. Those directly related to accessibility and safety are: “First and foremost, ensure the safety of the population; assure them of the site’s safety; Make the site open and accessible; Ensure public oversight through accessibility”.

Although the cultural approach cannot in and of itself provide a demonstrable and technically-based safety assurance, building a facility that is a positive, sustainable and accessible community feature could add an additional layer of defence-in-depth, one beyond those contemplated by technologists today. It would also provide an identity to those in local communities as guardians rather than outsiders.

Accessible installations serving multiple functions can be achieved only with the careful cooperation of the regulator and willingness to adapt or rethink regulations that were created in a different context. It is difficult to predict the future demand for safety as both knowledge and living conditions will evolve. Flexibility (on the functional level of design) may prove its value here as well.

4. VALUE ADDED BY THE PROCESS OF PLANNING AND IMPLEMENTING THE FACILITY

This section discusses benefits that may be gained from the very process of planning and implementing radioactive waste management projects that target sustainability and quality of life. These benefits – local utility, capacity building, local image refinement – should be understood as added value in and of themselves. The added value is found principally on the cultural level, with economic value present as well.

4.1 Local utility

As part of its basic function a radioactive waste management facility should serve the local community. "Local utility" means that the radioactive waste management facility provides jobs and stability to the community. Services may be provided as well.

- In Belgium, the STOLA local partnership stipulated that a low- and intermediate-level waste repository should be accompanied by a digital network, delivering free internet access to residents.

Local durable employment creates ties and bonds and memory – cultural benefits – as well as prosperity. Many communities point out the need to gain stable, durable employment with a radioactive waste management facility, and not just service jobs associated with a temporary influx of workers, or the creation of a small number of expert positions. Moreover, there may be special demands imparted by the long-term nature of radioactive waste management. How can high socio-economic potential and quality of life be favoured by the very presence of the radioactive waste management programme in the host community?

- UK implementer Nirex stresses the need for suitable long-term projects that would help support the sustainability of the radioactive waste management facility host community.[12] NuLeAF, the Nuclear

12. Nirex's response to CoRWM's second consultation document – *How should the UK manage radioactive waste?* (Ref. 472433) Didcot: UK Nirex Ltd.

Legacy Advisory Forum of the UK local government association, drafted a policy statement recommending benefit packages "with an emphasis on contributing to the sustainable development of the affected area and the well-being of local communities and their descendents".[13]

- The multi-stakeholder research programme Cowam-España has investigated the role of financial support to host communities in ensuring sustainable development. Moving beyond the concept of short-term compensation or incentives, future instruments should enable local and regional development, help the community assume responsibility for waste generated for the benefit of society at large, and also serve to create and maintain local knowledge and competence to monitor management over the coming decades and generations.

Local utility lessons may be drawn from other parts of the nuclear fuel cycle or other industries in which there is experience with declining industrial activity and decommissioning.

- In the far north of Canada where uranium is mined, the traditional aboriginal culture is still dominant locally. It is important to organise sustainable modern economic activity in harmony with ongoing traditional activities. A miner gets more community respect and satisfaction from being a skilled and experienced trapper. Cogema has recognised that miners should enjoy working conditions (time schedules, geographic placement) such that they can still devote themselves meaningfully to traditional skills. Local utility here implies provision of resources enabling people to preserve their environment and perpetuate their traditional culture despite modern economic pressures. Furthermore the uranium industry has committed to the long-term goal of offsetting diminishing mineral resources by the creation of other economic opportunities. Specialised academic and technical training allow greater numbers of northern people to move up into the mining management ranks. As their economic and educational level rises, the work force is becoming more flexible and competent. Successful northern-owned as well as joint-owned service industries have taken root.

13. NuLeAF Steering Group, *Implementing policy on the long-term management of radioactive wastes*, Draft Outline Policy Statement, 6 April 2006.

- An existing European regulation[14] relative to mining in general stipulates that host compensation funds must not all be ear-marked for short-term needs, but must be directed in part to generating economic and cultural resources that will sustain the community over the long term.

In essence, a waste management facility will eventually reach the end of its operational life and be decommissioned one day. While the active period of construction and operation may generate palpable economic benefits for the host region, this is less likely during surveillance and decommissioning phases. Sustainability implies addressing the entire life cycle of a facility and site. Where diminishing economic returns are to be expected, the creation of added cultural (and amenity) value is all the more important.

4.2 Capacity-building

If the decision-making process is fair, inclusive and equitable, communities may draw cultural value from the very process of deliberating about hosting a radioactive waste management facility or site. This added value may lie in enhanced capacity to address *quality of life* issues, and increased *social capital*.

At first sight it is not easy to measure or quantify the cultural or amenity value that a facility could add to the community. Local democratic institutions however may assemble important information when deliberating on what it would mean to integrate a radioactive waste management facility into the community. They may gain a more complete view of community goals and resources. In particular, quality of life is a primary concern of communities when contemplating an industrial facility.

- A pertinent (counter) example is found in Clark County, Nevada (USA). Clark County includes the Las Vegas "Strip" and has expressed opposition to the federal high-level waste repository project. To support their argument that Yucca Mountain could adversely affect the fast-growing Las Vegas community, they have developed detailed economic, fiscal, social, environmental and public health and safety indicators. In so doing, Clark County has enhanced its self-knowledge and understanding of the elements that are important to residents and community identity. Clark County has accrued "cohesive integration of community resources and (…) a system for long-term monitoring of impacts through community

14. Regulation CE 1407/2002 of the European Council 23 July 2002.

indicator tracking and evaluation". This results in improved decision making capability and adaptability that will benefit the community whether or not the repository is authorised one day for construction.

A constructive local multi-stakeholder discussion of how radioactive waste is to be managed creates social capital that may remain available to the community. Where there is municipal leadership and motivation to join in this discussion, skills, knowledge, networks and trust are created. These constitute a cultural fund on which the community may draw in other circumstances (not least importantly, in the later phases of radioactive waste management).

- The Belgian LLWM partnerships draw upon the accumulated experience of the diverse participants. They have created social capital in the form of inter-stakeholder networks, shared knowledge, and mutual trust. Significantly, the Belgian communities want to realise their investment by using the committee structure to address other unrelated local topics. They have maintained the existing structures to face new steps in the radioactive waste management siting process (Dessel was designated in July 2006). STOLA was replaced by STORA, a new association acting as Dessel's "eyes and ears". Mol proposes a permanent participatory body to defend its role as neighbour to the repository, and also to assure the dialogue on high-level radioactive waste management when that comes onto the federal agenda.

Europe's Cowam-2 project focusing notably on long-term governance of radioactive waste management concludes that alongside socio-economic and legal provisions, community capacity to monitor their facility must be maintained over the generations. "Sustainability funds", intended to improve quality of life over the decades, are being suggested by partnership initiatives in Belgium. In Spain, such funds should be used to enhance community capacity to play a future guardianship role.

- Cowam-España suggests that radioactive waste management stake-holders including local and regional authorities should focus on devising mechanisms for social learning, economic development and environmental protection over the long term; these would be supported by grant funds. Spain's planned National Interim storage facility could serve in this connection as a tool for research, training and social learning. (Note that experience is already accumulating in Spain in the decommissioning area: in the context of dismantling Vandellós-I, a multi-stakeholder Municipal Monitoring Commission

oversaw work progress, safety, waste management, environmental surveillance, and contracted personnel issues.[15])

Waste management facilities and sites diminish the green acres available to a community and their resource capital must be replenished in another way. The resource most obviously associated with radioactive waste management is knowledge. Integrated waste facility projects can generate added value on the intellectual and cultural plane, increasing the ability of future generations to take decisions.

- Belgian local partnership STOLA laid out a requirement for knowledge resources. The repository must integrate a nuclear information clearinghouse and a science museum, such that the knowledge associated with the nuclear industry and radioactive waste management can be made accessible to those who wish to manage and reduce risks. Two "layers" of cultural value are thus provided: knowledge is disseminated (for any use the visiting public may wish to make of it), and, knowledge is kept available for the specific needs of societal risk management.
- Oskarshamn (Sweden) has good economic development status. However, the local educational level is lower than in Sweden's regions that are experiencing the most economic expansion. The municipality has never considered the radioactive waste management project as primarily a source of economic compensations. Safety has been the primary concern, and in the past few years the working groups have considered added value for the community. A rising educational level is seen to be one potential benefit. In Oskarshamn, it is recognised that taking decisions whose benefits may be "soft" and not immediately observable, requires boldness and vision (the example of the once-rejected, now lauded Eiffel Tower was quoted).
- Nye County, Nevada (USA) comprises the nation's candidate site for deep geologic disposal of spent nuclear fuel and high-level nuclear waste, Yucca Mountain. The county has a cooperative agreement with the US Department of Energy (DOE) to collect data and perform research vital to the repository research and development project, for example regarding ground water movements. Nye County has over a dozen recognised expert earth scientists, and subcontracts some tasks to universities. The studies not only serve the YMP, but also increase

15. J. Castellnou (2005), "Dismantling of the Vandellós-I Nuclear Power Plant", paper presented at the Workshop of the OECD/NEA Forum on Stakeholder Confidence, L'Hospitalet de l'Infant, 21-25 November 2005 (proceedings in preparation).

the knowledge base regarding ground water resources for future regional development. Should the repository be built, it is anticipated that the influx of scientists with a high educational demand for their families will produce added value for the entire community through reinforcement of the rural school system. (Of interest is the Nye County Comprehensive Community Protection Plan[16] which outlines the measures required to protect the health, safety and economic well-being of Nye County residents as repository hosts. Alongside many detailed measures to create a sustainable long-term partnership with the DOE, the Plan outlines requirements for ongoing institutional oversight by the county.)

- Carlsbad, New Mexico (USA), where the WIPP repository is sited, has already begun to draw the cultural benefits of hosting a highly-educated workforce. The local community stakeholders point out that the workers from the national laboratories and contractors are involved in all aspects within the local community. Their involvement enhances and improves the culture within the community.

4.3 Image refinement

In the 60s, the siting of nuclear facilities conferred upon host communities a strong positive sign of being part of the future but there was no active local role in the siting process. The welcoming attitude linked to technological enthusiasm eroded in the 1970s and siting became viewed as imposing a burden on an unwilling host. Now, in several countries, the process has been turned around. Whether they volunteer or are approached by implementers, whether they address a waste legacy or envision integrating a new radioactive waste management activity, many communities are taking an active role. They increasingly expect a projected facility to fit their concept of safety and amenity, and are willing to work hard to achieve that. In this process, communities are looking not only to protect their *community identity* and *image*, but to create a positive community *brand or profile* with the radioactive waste management facility as a visible component. If the town or region must be identified in the public mind with a radioactive waste management facility, this ought to be a true article of local pride. Such an objective leads to creativity: communities imagine cultural elements that will define the project as an asset in an overall development vision.

- The Municipality of Oskarshamn (Sweden) decided early on to "stretch" the implementer to gain assurance that the repository project

16. Consult www.nyecounty.net/.

proposal is the best from multiple perspectives. Oskarshamn has the ambition to engage in a partnership with the industry and not be seen as a "target for decisions taken elsewhere". Alongside checking technical aspects, they have formed working groups to reflect on maximising benefits should the repository be sited. The implementer SKB thus is funding several studies conducted by national experts to develop the basis for siting decisions not only on technical criteria but also on added-value activities.

A repository may not be compatible with a local image. In the Municipality of Storuman in Sweden there was a significant opposition feeling that the image of "Europe's last wilderness" was not compatible with representations of a nuclear waste repository.[17] For an industrial community, in contrast, a repository may have the potential to enhance the local image.

- Oskarshamn is taking an active part in a social science project looking at ways to integrate a repository with the community identity and image. "We are not accepting a waste dump; we are accepting a high technology facility for the purpose of protecting our environment and our coming generations. This should enhance and sharpen our local 'brand' profile already expressed by our motto "Oskarshamn – the municipality with energy".

- Port Hope area municipal councils decided to take an active role when federal efforts failed to find a new host for legacy low-level radioactive wastes. Elected officials approached the federal government with local solutions based on local values and desires. They then entered into a legal agreement for the long-term management at three sites. In this way the communities transformed liabilities into assets. Valuable cultural changes occurred through this search for a solution to a long-standing environmental problem. The communities have developed their identity and image as problem-solvers. Once stigmatised as a contaminated community, Port Hope has gone on to develop a new image as a tourist destination and "a great place to live, work and play".

In many countries, the communities that have gone furthest in considering a radioactive waste management facility project are those which already count a nuclear installation within their territory. These may be called communities with "industry awareness". This should not be seen primarily as a sign of economic

17. Tourist Entrepreneur Stig Stand, Storuman 1994, quoted in the Oskarshamn questionnaire response to this study.

dependency, and certainly not as a willingness to sacrifice safety.[18] Instead, it should be recognised that host communities have already integrated the industrial activity and cognitive understanding into their local culture. This has been referred to in the past simply as "familiarity" but in fact it may be called an existing cultural basis for facility development. In these communities solid support to engage is often found among the public. Where others see radioactive waste management facilities as threats these communities see the potential of something to be proud of, an advanced facility that solves a national environmental problem relating to an energy source that is also familiar to the community. Developing joint solutions consists of building on and adding to that existing cultural basis.

18. J. Hetherington, "Community Involvement: Stakeholder Learning in the UK and Canada" in *Public Confidence in the Management of Radioactive Waste: The Canadian Context*. Workshop Proceedings, Ottawa, Canada, 14-18 October 2002. OECD, Paris.

5. CONCLUSIONS

Any long-term radioactive waste management project is likely to last decades to centuries. It requires a physical site and will impact in a great variety of ways on the surrounding community over that whole period. Short-term fixes to facilitate a project and installation are not good enough. The societal durability of an agreed solution and its sustainability over the long term are essential to success.

The greatest challenge, both technical and societal, may be to create a local, operating facility that can fulfil its mission over the generations. Alongside scientific knowledge and technical competency, and resources for implementing an agreed approach, there must be a continued willingness to live with and maintain the facility. Moreover, radioactive waste management projects must support the sustainable development of the host community and its long-term capacity to go on hosting the facility. In these goals, how may a facility and its site be better integrated with the community? How may the facility and site be made attractive for the long term? Ultimately, how may they improve a community's prospects for quality of life across the generations?

Communities do not gain added value and sustainability solely through financial compensation and development opportunities. Whilst those economic means are important, radioactive waste management projects also offer opportunities to improve well-being, consolidate knowledge, fulfil value ideals, elaborate community identity and image, and live out desired social relationships. Planning for and implementing a facility should seize these opportunities.

Today individual communities and radioactive waste management partnerships (grouping community and technical stakeholders) are reflecting on how to build a long-term, sustainable relationship with a facility sited in their territory. Different countries and regions are likely to have different socio-political realities and therefore best practices for one region may not be best for another. Still, it should be possible to extend and structure this reflection through exchanging ideas on the international level.

A number of basic elements for designing a facility that would favour building a sustainable relationship between a facility and a local community were identified, based on the analysis of numerous stakeholders' input and FSC experience. The design elements include functional, cultural, and physical features. Amongst the functional features, multi-functionality or polyvalence may be singled out, meaning that the facility is built to serve multiple uses. Other important functional features include adaptability and flexibility. Amongst the cultural features, distinctiveness may be mentioned, indicating that the radioactive waste management facility or site is attractive and like no other, but has the potential to become an icon, lending a positive reputation and drawing visitors. Other cultural features include aesthetic quality and understandability, whereby the installation can be tied in with existing knowledge and related to everyday life. "Memorialisation" means that both physical and cultural markers identify the site and tell its story, so that people will grasp and remember what is there. Finally, physical design features include integration, amenity, and accessibility, which can help the facility and site correspond to the local definition of a safe, unthreatening environment.

The report also examined the added value that may reside in the very decision-making and implementation process. Implementing any radioactive waste management facility should benefit the community in terms of prosperity, but moreover in the best of cases increased stability and cohesiveness are gained. These represent cultural added value. Other cultural benefits that may be accrued are an enhanced educational level in the host community related to the influx of highly skilled workers. Not least important, when host communities demand training and participate in monitoring site development and operations, they are building their capacity to act as guardians and therefore ensure another layer of defence-in-depth.

The very process of working out the desired features of a radioactive waste management facility and site can bring added value to the community. This has been the conclusion of local stakeholders who take an active role in site investigations, or who participate with implementers in formal partnerships. Social capital – networks, norms and trust – is built up, equipping the community to face other decisions and issues. Local stakeholders may also focus their work on community identity, image and profile. Even when not favourable to hosting a radioactive waste management facility, communities can use the opportunity to develop quality-of-life indicators and reflect on the direction they want to take in coming years.

While this paper reported good practice, it could not provide universal recipes. Added cultural and amenity value is specific to each context. It is important that the stakeholders concerned work out what kind of solution is

desired and appropriate for their own setting. Radioactive waste management stakeholders are encouraged to investigate the experience of other industries in similar settings and with comparable challenges. They may learn in this way from specific solutions that have produced added value within a given local framework.

Examples gathered in this report show that there is a practicable path towards building facilities that favour a sustainable relationship with the community. Still, sustainability and value-added themes are clearly a new topic in radioactive waste management stakeholder discussions. It is hoped that this study report, with input from a wide range of contexts, may be beneficial to both communities and national radioactive waste management programmes.

Appendix 1

STAKEHOLDER ACKNOWLEDGEMENTS

This study benefited from direct input by 32 different stakeholder sources representing 20 localities or radioactive waste management programmes. Some stakeholders filled out a questionnaire or gave written comments, whilst others granted a telephone interview (from end 2005 to mid 2006). We invited all FSC participants to provide input, and we sought out the opinion of some stakeholders from outside the FSC. Our aim was to obtain a variety of views, not a fully representative sample. Alongside this input, we relied on the FSC stakeholder workshops and topical sessions held through November 2006 and also conducted desk and internet research.

We are grateful for the participation and input by many stakeholders and experts:

- Harald Åhagen (Oskarshamn, Sweden).
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- David Swanson (Nye County, Nevada).

We thank those who granted an interview, or who took the time to write detailed, thoughtful responses to the study questionnaire. A finding is that sustainability and value-added themes are a new topic in stakeholder discussions. Not all dialogues today include these themes, sometimes because stakeholders perceive that other outstanding concerns (safety foremost among these) must be taken care of first. Where added cultural and amenity value are discussed, it is often in close relation with more familiar local development items. Front runners, however, show that structured field studies can identify potential added value in addition to economic opportunities. Tangible and intangible effects on community "identity, image and profile", can also be assessed. Working groups can provide meaningful proposals to be submitted to implementers, regulators, and municipal authorities, and many stakeholders expressed satisfaction with this type of process.

Special thanks are offered to the local stakeholder representatives and experts who participated in the June 2006 topical session entitled *"Forming a Sustainable Relationship to a Waste Facility":* Roland Palmqvist (Mayor of Kävlinge and President of GMF; Peter Wretlund (Mayor of Oskarshamn); Ursula Rüetter-Fishbacher (Social Researcher) , Prof. Erik van Hove (Univ. of Antwerp, retired) and to the specialists who granted interviews: Pascal Gontier (Ecological Architect, Paris), Cécile Massart (Art Professor and Artist, Brussels, Belgium), as well as to FSC members: Yves Le Bars (Cemagref, France), Steve Chandler (UK Environment Agency), Elizabeth Gray (Scottish Executive), Elizabeth Atherton (Nirex, United Kingdom), Hideki Sakuma (Nagra, Switzerland), Auguste Zurkinden (HSK, Switzerland), and Michael Aebersold (BFE, Switzerland).

Various observations inspired the FSC to think about how to build a sustainable, long-term relationship between a radioactive waste management facility and the community:

- Professor M. O'Connor pointed out the importance of the relationship between the community and "the waste" itself.[1]
- Professor E. van Hove emphasised that the facility should not be seen solely as a waste-management instrument; an attractive, multi-functional facility has more chances to become a positive part of community life, contributing to enjoyment and local pride.[2]

1. O'Connor, M. (2003) "*Building relationships with the wastes*", in NEA (2003b) (see Appendix 3 for references).
2. Van Hove, E. (2004) "*Valorisation of a repository in an added-value project*". In NEA (2004a).

- Artist C. Massart showed how a waste facility can become an art object and how it is important to preserve the memory of disposal, not just for safety reasons, but also because radioactive waste has unique societal significance.[3]
- The Sellafield enquiry of 1997 mentioned as one community objection to radioactive waste management surface buildings that they would impact negatively upon the amenity of the host region.

This study was discussed at FSC meetings in 2005 and 2006. The report was written by Claire Mays (Symlog) and Claudio Pescatore (NEA) with valuable guidance from the FSC and from Prof. Erik van Hove.

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3. Massart, C. (2004) "*How Plural Interests, Values and Knowledge Could be Translated into a Concrete Radwaste Disposal Project Design: An Artist's Vision*", in NEA (2004a).

Appendix 2

GLOSSARY OF TERMS

In this glossary some basic terms encountered during the study (italicised in the main body of the report) are defined and discussed. The FSC publications from which some citations have been drawn are listed at the end of the annex.

Added value

The increase in worth of a product or service provided by features and benefits over and above those representing the "core product".

Amenity

Feature of real property that although not essential to use, enhances its attractiveness and increases the user's satisfaction. It is a positive enhancement to living environment conditions, providing convenience, comfort, satisfaction or appeal.

Natural amenities include a pleasant or desirable location, scenic surrounding area, etc. Human-made amenities include recreational and other facilities for collective use.

Bribery

An offer of money, goods or services in order to persuade a second party to perform an action in the interests of the party offering the bribe, or to sway the second party's opinion or decision.

Persons objecting strongly to the presence of radioactive waste may view compensations or other socio-economic benefits as "the wages of risk", or bribery to persuade a community to accept a management facility which they view as inherently unsafe.

Community identity

Internal view that members have of their community.

Community image

View the outside world has of the community.

Community profile or brand

Strong points and values for which the community wants to be known.

Communities look to gain a positive identity and develop meaningful facilities or projects in their area. Working out desired cultural value can be part of a process of clarifying community identity. Cultural value can be used to enhance the community profile or brand and to shape the image of the community.

Identity, image and "branding" are becoming more important with the circulation of people and goods in the global economy. Countries, regions and communities are all concerned with their image. A successful image must be rooted in a corresponding identity – it is virtually impossible to create a positive public image if that is not the deep identity experienced by the community. Constructing identity and image requires long-term effort and commitment.

Compensation

Repayment for any necessary expenditures or losses associated with the siting and operating of a facility. Sometimes conceptualised as "equity offsets".

Compensation and incentives may be financial or non-financial and can be provided at one time only or on a continuous basis during the siting, construction, or operation of the facility (NEA, 2004b).

There is consensus today that potential host communities should actively define the right siting "package" including not only financial but also other accompanying measures.[1]

In some contexts, land-use compensation schemes have been decided by national actors and detailed formulae for calculating sums due are used or even set out in the law. In Spain, unusually, communities hosting nuclear power

1. See Kotra, J. (2003) "*How to Address Social Concerns? Round Table Discussions during Session II of the FSC Workshop in Canada*", in NEA (2003).

plants are compensated primarily in relation to the volume of (spent) nuclear fuel currently stored on local territory.

In questionnaire responses regarding dialogue among technical and societal partners, some stakeholders stated that compensation "is not discussed": "the word has never been used"; "points concerning compensation have not yet been raised". This suggests that local development, sustainability and quality of life issues are recognised to be prospective, not one-to-one compensation issues.

Culture

"The set of distinctive spiritual, material, intellectual and emotional features of society or a social group, encompassing, in addition to art and literature, lifestyles, ways of living together, value systems, traditions and beliefs".[2]

Incentive

A benefit to motivate local communities to accept a facility.

Integrative local partnerships

Committee structures in which technical and community stakeholders come together to work out an integrated radioactive waste management project (setting physical and safety characteristics, socio-economic and cultural/amenity requirements).

The recommendations to Government by UK CoRWM include a chapter on implementing a radioactive waste management strategy. This committee has high regard for the integrative local partnership approach. One of the advantages of the partnership approach is that it achieves an environment in which host communities can engage with an implementing body without feeling victimised by a national process over which they ultimately have little control. CoRWM therefore believes that a partnership approach should be developed in order to achieve community involvement. Partnerships should be based on an open and equal relationship between the potential host community and the implementing body. (…) International research shows that it is important that the host community has a sense of ownership of the facility that will be built and is therefore involved as early as practicable in the generic technical aspects

2. UNESCO Universal Declaration on Cultural Diversity, 2001, 2004. Online at http://unesdoc.unesco.org/ (consulted 19 September 2006).

of the design. (…) CoRWM therefore concludes that representatives of the potential host communities should be involved in determining both the broad technical aspects of the proposed facility as well as the socio-economic aspects aimed at ensuring the well being of the community".[3]

Stakeholders in several countries are turning to integrated projects, focusing on both technical and societal aspects of facilities. Technical partners and local partners alike treat these as interdependent and inseparable elements. Local stakeholders review or help build up the proponent's technical concept, satisfying themselves as to the level of protection that fits their demand; in parallel they work out expectations and requirements for radioactive waste management to function in the local context. The stakeholders envision living with the facility during its active period and beyond, considering simultaneous or end uses of the site. They mark out the development opportunities provided by hosting a facility. Beyond jobs, heightened economic activity, and "spin off" infrastructure development, local communities envision added cultural and amenity value, in the perspective of ensuring satisfactory quality of life for the present and future generations and ultimately a durable and sustainable relationship with the relevant facility.

NIRAS/ONDRAF, participating as implementer in the Belgian local partnerships, explains:

"The discussion bears on a mixture of technical criteria, traditional socio-economic aspects and added value. The essence is to develop an integrated disposal project, so the local community decides what it considers to be the necessary conditions (technical, environmental, aesthetic) for a disposal facility and they develop an accompanying local project that seeks to bring added value to the community. The outcome differs from community to community. The partnerships become the carriers of the site investigations and repository design and deal with all related issues such as safety, social, economic and ecological impact, urban planning."

Even where such integrative partnerships do not exist, cultural benefits accrue to the community taking an active part in defining desirable design features. A most positive outcome can be "consensus or agreement between parties with regard to the need to obtain support [for a concept or demand] from the national level, and to apply democratic rules in decision making", or the demonstration that "local participation works, giving added value to a democratic decision making process, making it possible to reach consensus

3. CoRWM (2006) *Managing our radioactive waste safely*. CoRWM's recommendations to Government. London: Committee on Radioactive Waste Management, July 31, pp. 136-137.

among members with quite different approaches to nuclear energy and radioactive waste management. Maybe this contributed to the upgrading of the level of public acceptance of the site [proposal]".

One challenge of working closely in a formal or informal technical and societal partnership, as pointed out by a stakeholder contributor, is "initially to find a functional working format and to understand each others' language".

Another challenge, according to a questionnaire response, is "maintaining the interaction between the partnership members and the local community (local organisations and the public in general)".

Partnerships call on the national or federal level to respect their work and take it into account in their decisions. The loose articulation between the partnership and this higher level of authority may be a source of "frustration" or weakness.

Local community

Generic term which refers to the group of personal actors that become involved in radioactive waste management facility siting deliberations.

"Local community" is understood in this report as a social group of any size whose members reside in a specific locality, share government, and often have a common cultural and historical heritage. Community is not tied firmly to a geographic area. AkEnd has proposed that the area that volunteers to host a radioactive waste management facility should be self-defining and calls it a "social, cultural and economic unit" with no clearly marked geographic borders.[4] Frequently today, extended local units, groupings of townships, or regions are brought to consider the location of a radioactive waste management facility or site in their territorial identity.[5]

Administrative character, location, mode of government, history and shared economic and cultural practices are complemented by further dimensions

4. AkEnd (2002) *Selection procedures for repository sites*, AkEnd. Available from Bundesamt für Strahlenschutz, Salzgitter, Germany (e-mail: info@bfs.de).
5. D. Ipsen told the FSC: "Regionality becomes more important as an arena of socio-economic development. (…E)economic and cultural globalisation (reinforces) regionality as a basis for success in the competition for resources and geographical status. (…) To involve people in the design of the future mainly means to give people an active role in local and regional development. In the context of (radioactive waste management), this means that the handling of nuclear waste will have to be better integrated in the general regional processes" (p. 69). ("Civil landscapes and changing modes of participation", in NEA, 2000.)

of "community". Each member's sense of belonging may be linked to a perception of the "spirit of the place", and by identifying with the group established there. Local community should be understood too as the extension of each member's personal sphere. The community is a network of personal relations. It is one space in which our lives take place, alongside other specialised spheres (for instance, the sphere of our employment, or the spheres delivering to us services and goods). By considering "local community" in a holistic manner, we may gain a better understanding of what is needed for a radioactive waste management facility to fit in, be welcomed, and be maintained there in a sustainable manner.

Quality of life

A state of physical, psychological, and social well-being.[6]

Physical well-being relies on working conditions, recreational opportunities and health care access. Psychological well-being depends on harmony between one's cultural identity and one's actual living conditions. Social well-being depends on the ability to share in cultural practices with one's peers. In the formal radioactive waste management decision process, quality of life may be addressed through social impact assessment (SIA), which more and more is applied in parallel with the required environmental impact assessment (EIA). Quality of life is also addressed when communities develop a vision of the cultural and amenity value they expect to draw from a radioactive waste management facility or site.

Safety

The condition of being protected against failure, damage, error, accidents, or harm.

Safety is a physical criterion addressed by the exact sciences. Safety is also a social construct.

Communities and societal groups may have their own requirements defining what is acceptably safe. These requirements may go beyond the level of protection set by national or international norms. Regarding a radioactive waste management facility, community requirements may imply technical features or mechanisms that might not be called strictly necessary from an

6. M. Simard (2002) "Urban Quality of Life and Industrial Project Management: The Case of Alcan Aluminium Smelter in Alma, Quebec, Canada" in *Public Confidence in the Management of Radioactive Waste: The Canadian Context*. Workshop Proceedings, Ottawa, Canada, 14-18 October 2002. OECD, Paris.

engineering or optimisation point of view. Conversely, a community may attach special cultural importance to design features that could challenge the desired level of safety. In each case, the regulator will provide expertise and feedback enabling the partners to reconcile all the requirements.

Regulators have begun to recognise that the community is a vital partner in monitoring and assuring safety over the long term, with precise knowledge of the site at all phases before, during and after facility development, and the high motivation to preserve local health and their way of life. It is in everyone's interest to adapt the radioactive waste management facility to the community and thereby improve its chances of being taken care of by the succeeding local generations as well as by technical people.

Safety is a rolling concept. In the past, terrorist attacks were formally excluded from safety analyses because their likelihood was considered unquantifiable; today, they are a major item of societal concern. It is difficult to predict the future demand for safety as both knowledge and living conditions will evolve.

Social capital

Features of social life – networks, norms, and trust – that enable persons to act together more effectively to pursue shared objectives.[7]

Spin-off

An economic venture underwritten or made possible in the context of a larger undertaking.

Many projects today are accompanied by appreciable spin-off projects funded by radioactive waste management implementers or other institutions. These might be described as "icing on the cake" – good things that come along with the facility but which are not an essential part of it. Instead, the report focuses explicitly on "the cake": how the conception and design of radioactive waste management facilities and their sites themselves may generate value for a community or for society as a whole. This is a new perspective on the "good neighbour" concept: traditionally project proponents make themselves agreeable by supporting demands coming from the community; here, the facility itself would be designed to facilitate the networks and activities that are important to community members, and contribute to them positively.

7 R. Putnam (1995) "*Bowling Alone: America's Declining Social Capital*", Journal of Democracy, vol. 6, no 1, p. 65-78.

Stakeholder

Any actor – institution, group or individual – with an interest or with a role to play in the process.[8]

UNECE Aarhus Convention

United Nations Economic Commission for Europe Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, adopted 24 June 1998 in Aarhus, Denmark.

An elaboration of Principle 10 of the Rio Declaration, the Aarhus Convention "links environmental rights and human rights. It acknowledges that we owe an obligation to future generations. It establishes that sustainable development can be achieved only through the involvement of all stakeholders. It links government accountability and environmental protection. It focuses on interactions between the public and public authorities in a democratic context".[9]

The Aarhus Clearinghouse for Environmental Democracy, a UNECE web-site [http://aarhusclearinghouse.unece.org/] points out that effective public involvement in environmental issues is made possible through adoption of laws, policy development, capacity-building, research, etc. Documents collected at and disseminated through the Clearinghouse website can lend insight on best practice in involving stakeholders in environmental decision making.

8. NEA (2000), See Deliberations of Working Group 3 on "*Stakeholders and the Public: Who Are They?*" in Stakeholder Confidence and Radioactive Waste Disposal. OECD, Paris.
9. www.unece.org/env/pp/welcome.html, consulted 7/27/2006.

Appendix 3

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