Radioactive Waste Management
2015

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

Adding Value through Design and Process – 2015 Edition

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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The mission of the NEA is:

- to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes;
- to provide authoritative assessments and to forge common understandings on key issues, as input to government decisions on nuclear energy policy and to broader OECD policy analyses in areas such as energy and sustainable development.

Specific areas of competence of the NEA include the safety and regulation of nuclear activities, radioactive waste management, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information.

The NEA Data Bank provides nuclear data and computer program services for participating countries. 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.

Cover photos: Visitors in the Aspö Hard Rock Laboratory (HRL) tunnel in Oskarshamn (Curt-Robert Lindqvist, SKB), Sweden; Deep geological repository site in Oskarshamn (SKB), Sweden.

Foreword

The Forum on Stakeholder Confidence (FSC) was created under a mandate from the Nuclear Energy Agency (NEA) Radioactive Waste Management Committee (RWMC) to facilitate the sharing of international experience in addressing the societal dimension of radioactive waste management. It explores means of ensuring an effective dialogue among 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 a role to play in the radioactive waste management process.

Traditionally, the benefits to be drawn locally from a radioactive waste management facility have been discussed primarily in terms of hosting fees and socio-economic development packages (for example, guaranteeing employment or infrastructure). These benefits and land use compensations are meant to offset real and perceived impacts, and they continue to be a major topic of discussion in facility siting contexts today. The first edition of this report, *Fostering a Durable Relationship between a Waste Management Facility and its Host Community: Adding Value through Design and Process* (NEA, 2007a), broke new ground by investigating the features of waste facilities and sites that could provide added value by focusing on cultural and amenity value in both the short and long term, thus helping to build a sustainable relationship with the host community and the region.

Sustainability and value added, in the sense of cultural, amenity and other intangible values, are still a relatively unexplored topic in radioactive waste management stakeholder discussions. Yet they have high symbolic and practical value in bringing national and local actors together.

This 2015 update of *Fostering a Durable Relationship between a Waste Management Facility and its Host Community: Adding Value through Design and Process* will be beneficial in designing paths forward for local and regional communities, as well as for national radioactive waste management programmes. New findings are cited in many areas, and particular attention is given to the importance of understanding and memory. In the framework of the FSC, the term "understandability" means that people understand the facility and its functions – or that they have the means to learn about them. It also describes a situation whereby the installation can be linked to existing knowledge and potentially relate to everyday life. Understandability is reinforced by achieving aesthetic quality and reinforcing memory – meaning that both physical and cultural markers identify the site and tell its story – so that people are able to grasp and remember what is there over very long timescales.

1. *Italicised* words are defined in Annex 2 (Glossary of terms).

Acknowledgements

The NEA Forum on Stakeholder Confidence Core Group and the FSC Chair oversaw the 2015 update of the previous report with the assistance of the Institut Symlog. Numerous stakeholders from inside and outside the FSC, including local communities, provided input to the initial 2007 study, and Annex 1 acknowledges the continued contribution of these stakeholders.

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List of abbreviations and acronyms

AkEnd	Arbeitskreis Auswahlverfahren Endlagerstandorte/German Independent Working Group on Site Selection Procedures for Final Repositories (1999-2002)
Andra	Agence nationale pour la gestion des déchets radioactifs/ French National Agency for Radioactive Waste Management
COVRA	Central Organisation for Radioactive Waste
CSM	Centre de stockage de la Manche
FSC	Forum on Stakeholder Confidence
MONA	Mols Overleg Nucleair Afval Categorie A
NAPA	National Academy of Public Administration (United States)
NEA	Nuclear Energy Agency
OECD	Organisation for Economic Co-operation and Development
ONDRAF/NIRAS	Belgian Agency for Radioactive Waste and Enriched Fissile Materials
SCK•CEN	Belgian Nuclear Research Centre
SKB	Swedish Nuclear Fuel and Waste Management Company
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization
WIPP	Waste Isolation Pilot Plant (United States)

Executive summary

Any long-term radioactive waste management project is likely to take many years to complete. It will require a physical site, first of all, and will have an impact on the surrounding community over the entire period of the project. The societal durability of an agreed solution – i.e. its sustainability over the long term of the project – is essential to guarantee success, and thus short-term fixes to facilite the project and the ultimate installation of the facility will be insufficient.

The sustainability of such a project cannot be ensured solely through financial compensation and development opportunities. While these economic factors are important, radioactive waste management projects also offer opportunities to improve well-being, consolidate knowledge, fulfil value ideals, further define community identity and image, and build social relationships. Such opportunities can be seized when planning and developing a facility. The ultimate goals should be to define how a facility and its site can be better integrated into the community, how it can be made attractive for the long term and how it can add value and improve a community's prospects for quality of life across generations.

Provisions for adding value to the local community may be relatively inexpensive, as straightforward as adding a coat of paint (as was done at the Vandellós site in Spain), or as complex and expensive 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, facility design elements that could contribute to building a durable relationship between the facility and its host community are identified in this report, based on an analysis of input from stakeholders and of experiences from the Forum on Stakeholder Confidence (FSC) experience. These design elements include functional, cultural and physical features.

Among the functional features, multifunctionality or polyvalence may be singled out, meaning that the facility and its site are conceived, from the very beginning, to serve multiple uses. Other important functional features include adaptability and flexibility, which allow the facility to evolve and to adapt to new, yet unknown uses. Among the cultural features, distinctiveness would underline the attractiveness or uniqueness of the facility, its potential to become a local landmark, thereby providing a positive reputation to the community and attracting visitors. Other cultural features include understandability, whereby the installation can be tied to existing knowledge and related to everyday life, both through its aesthetic quality and through its ability to reinforce memory, meaning that both physical and cultural markers identify the site and tell its story so that people fully 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 also provided in the report.

Finally, the very process of working out the desired features of a radioactive waste management facility and site can by itself bring added value to the community. This has been the conclusion of local stakeholders who have taken an active role in site investigations, or who have participated, with implementers, in formal partnerships. Social capital – consisting of networks, norms and trust – can be constructed in this way, preparing the community to face other decisions and issues. Local stakeholders may also focus on community identity, image and profile. Even when communities are not favourable to the idea of hosting a radioactive waste management facility, they can use the opportunity provided by siting assessments to develop quality-of-life indicators and reflect on the direction they want to take in coming years.

Another benefit that may be accrued by the host community is that of enhancing the educational level of the population because of the influx of highly skilled workers. Furthermore, when host communities demand training and participate in monitoring site developments and operations, they ultimately build their capacity for vigilance and oversight. As a consequence, their understanding and confidence in safety is enhanced. These added–value aspects of facility planning and implementation can also be beneficial to the entire community.

Adding cultural and amenity value is specific to each context, and while it may be possible to formulate general principles, no universal guidelines can be provided. Each project must be adapted to the context of its national programme and must fit into a community development plan, according to criteria that are defined with the relevant stakeholders. Regional interests should also be taken into account. The examples provided in this report show that, overall, it is possible to add cultural and amenity value and to build facilities that favour a sustainable relationship with the community.

Sustainability and value added, in the sense of cultural, amenity and other intangible values, are still a relatively unexplored topic in radioactive waste management stakeholder discussions. However, they have high symbolic and practical value in bringing national and local actors together. This study, with input from a wide range of contexts, will be beneficial in designing paths forward for both local and regional communities, as well as for national radioactive waste management programmes.

1. Introduction

The duration and complexity of radioactive waste management projects represent a particular challenge to society. Planning, siting, constructing, operating and, finally, decommissioning a radioactive waste management facility is not a simple linear affair and may take decades to accomplish. It implies many different types of assessments, evaluations and decisions, and involves different types of actors. All these decisions cannot be taken at once. In the future, the type of administrative assessments that will be required, the level of technical knowledge available and the political climate will evolve from decade to decade. There will be a renewal of actors as new ones, 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*[1] agree that any chosen radioactive waste management solution must first deliver an agreed level of safety for the public and the environment, and then meet requirements for fairness (including fulfilling the "producer pays principle"). Finally, it must address other aspects of individual and social acceptability.[2] All these dimensions benefit from early study and planning in a participative manner, and the desired positive gains on each level reinforce each other.

Traditionally, local benefits to be drawn from a radioactive waste management facility have been discussed primarily in terms of hosting fees and socio-economic development packages (guaranteeing employment, infrastructure, etc.) (NEA, 2010a; Kojo and Richardson, 2012; Kojo and Richardson, 2014; Bergmans, 2010). These benefits and land-use compensations are meant to offset real and perceived impacts and they continue to be a major topic of discussion in facility siting contexts (Kojo and Richardson, 2013). There is also recognition that a radioactive waste management facility might best be envisioned within a territorial development plan (Réaud, Schieber and Schneider, 2013; NEA, 2011).

Sustainability and value added, in the sense of cultural, amenity and other types of intangible value, are still a relatively unexplored topic in radioactive waste management stakeholder discussions. Yet it has high symbolic (NEA, 2010b) and practical (NEA, 2010a) value in bringing national and local actors together.

1. *Italicised* words are defined in Annex 2 (Glossary of terms).
2. A similar hierarchy of concerns was expressed by stakeholders from Switzerland who gave input to this study.

This report looks into features and approaches that may improve the ability of 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. Cultural and amenity value refers to agreeable additions to the *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; and through fostering community improvements in areas like education, image definition or problem-solving capacity.

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*;[3] although its findings may be useful in these areas. It is recognised that as decades pass, the importance of monetary compensation may decrease, while the importance of good relations and durable added value will likely increase.

It is also important to discuss design considerations from the start of a radioactive waste management installation project in order to maximise its value added – that is, to maximise its contribution to potential sustainability and well-being in the community once safety considerations have been addressed. Relevant design features relate to functional, cultural or physical aspects.

Added cultural and amenity value brings direct gains to the quality of life; it can foster socio-economic gains by making the site location more attractive to visitors or future residents. In the best case scenario, added cultural and amenity value will trigger a virtuous circle, bringing benefits, encouraging an ongoing relationship with the facility, strengthening the community, and ensuring that in future years the installation can face challenges and continue to contribute to community life.

The desired cultural and amenity *added value* when designing and negotiating the construction of a radioactive waste management facility is a key aspect. 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 ensuring that the facility is understood and remembered over time by residents.

3. Compensation and incentives can be an area for innovation as well, as shown in Sweden. Before the host site for a potential spent nuclear fuel repository was designated, an agreement was signed between the two competing candidate communities and the waste management organisation. The agreement foresaw that the bulk of a healthy investment programme would also benefit the community not chosen as the final candidate in the siting process. In this way, both communities could look forward to the outcome and obtain significant, durable compensation for their multi-year engagement in the siting effort.

Different cultural and national contexts may have varying approaches to these issues. This report is offered as an input into site- and community-specific discussions regarding 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 does not exist.

Partnering is an approach that can bring added value in a radioactive waste management context. The 2010 Forum on Stakeholder Confidence (FSC) study on partnering (NEA, 2010a) observes that a variety of partnering arrangements (e.g. non-governmental organisations, local government associations, units within or around local and regional governments) have been or are being set up in an increasing number of countries. Several examples cited in this report arise from partnership arrangements. Involving local actors in designing the facility and the community benefits is likely to result in solutions that will add value to the host community and region. In all cases, social capital is augmented as members of the community develop new skills and increase their knowledge about their shared interests and ideals. Implementers and other institutional players also improve their skills as responsive actors in the governance of radioactive waste and as responsible neighbours concerned with the well-being of the community. Institutions that oversee these arrangements, such as the national or regional governments, also gain from this approach because the national policies are fulfilled in a constructive manner. An additional added value is that partnerships provide a mechanism for addressing new issues in a non-adversarial manner as they may arise; for instance, unforeseen national developments or changes in policy.

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, as other examples may provide specific solutions that have produced added value within a given national and local framework.

In 2015, many stakeholders still understand added value as an "umbrella term" covering different elements of institutional mitigation, compensation and incentives in the site selection process. Such important arrangements may be a major topic of discussion between local and institutional stakeholders. Several publications may be useful to those interested in community benefit approaches which complement an approach centred on cultural and amenity value (NEA, 2010a; Kojo and Richardson, 2012; Kojo and Richardson, 2013; Kojo and Richardson, 2014; Bergmans, 2010).

Section 2 of this report summarises the value 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 to fit into the community in a sustainable manner. Each design feature is illustrated with examples. Section 4 discusses the benefits that may be gained from the very process of planning radioactive waste management projects which target sustainability and quality of life. These benefits – capacity building and local

image refinement – should be understood as cultural added value in and of themselves.

Tables are drawn from FSC publications as recent as 2014 (as well as other NEA publications), a literature review, specific interviews and stakeholder responses to a questionnaire.

Numerous members of the FSC and other stakeholders, including local communities, provided input to the 2007 study (NEA, 2007a). They showed that stakeholders can identify long-term cultural and amenity value which could be added by a radioactive waste management facility, as well as the economic opportunities to be seized in their contexts.

Annex 1 acknowledges the continued contribution of the many stakeholders who gave detailed input to the 2007 version of this study; Annex 2 comprises a glossary of terms and identifies publicly accessible 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 are present in a host community for a very long time, a fruitful and positive relationship must be established with those residing there, in the beginning and over the long term. A sustainable relationship improves both the ongoing quality of life in the host community and future societal capacity to contribute to memory and oversight of the facility. This section defines what is meant 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" (UN/WCED, 1987). Because the physical environment is our primary resource base, the first pillar of sustainable development is ecology: resources should not be harvested faster than they can be regenerated, nor should waste be emitted without regard to its future fate.

The three other pillars of sustainable development are economic, social and ethical. Altogether, sustainable development targets not only material (ecological and economic) needs but also social, spiritual and cultural needs.

How can radioactive waste management contribute to sustainability? In the first place, there is high sustainability value for society in containing and isolating used nuclear fuel from people and the environment, especially through approaches which do not pass along obligations for institutional management to future generations. On a community level, to reply to this question, all four pillars of sustainable development 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 discussed (NEA, 2010a; Kojo and Richardson, 2012; Kotra, 2003; NEA, 2003; Bergmans, 2010). The National Academy of Public Administration (NAPA, 1997) explains the, perhaps, more intangible social and ethical 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" (NAPA, 1997: 10). In this way, "sustainability is also an opportunity" (NAPA, 1997: 10). Furthermore, if a community seizes value from a radioactive waste management facility, this value is like a capital whose benefits can accrue over time. In this report, some examples are given of how communities have drawn from radioactive waste management what is called cultural added value, made up in particular of future-oriented resources as described by NAPA.

From a classical sustainability perspective, societal management of radioactive waste should, in principle, not only avoid disrupting but also seek to contribute to improving the sustainability of the host environment. Translated into community terms, the waste management installation can contribute to opportunities to improve well-being, consolidation of knowledge, fulfilment of value ideals, elaborating community identity and image, and building desired social relationships. Planning for a facility could include consideration of these opportunities.

In this report, local community is a generic term for the group of personal actors potentially concerned by, or who may 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 bounded territory, share a government, participate in various other common institutions and often have a common cultural and historical heritage. A community does not need to be tied firmly to an administratively defined zone. It is understood to be defined on several overlapping factors that make up community identity: these are spatial or geographic, political, economic, cultural and emotional (Wylie, 2010). 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.

The Forum on Stakeholder Confidence (FSC) recognises that there is no single definition of community or of community well-being. The many dimensions of community identity all have implications. Moreover, community identity may become more sharply defined or evolve in the process of radioactive waste management facility development, or at least across the years involved in a siting process and a facility life cycle. Communities who are invited to define their vision of a desired future may wish to include consideration of economic health, environment, safety and security, spiritual aspects, social conditions and new opportunities for community members. 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. It is also less likely to be seen as 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 a 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 might 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.

Generally, institutions cannot commit to the final form of a radioactive waste management facility before a specific site is agreed. 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 undertaken early in the decision-making process can provide meaningful preparation. This approach is supported for example, by the United Nations Economic Commission for Europe (UNECE) Aarhus Convention.

Just as the environmental impact assessment (EIA)[1] has proved to be a good umbrella process for discussing stakeholders' concerns, the added cultural and amenity added value theme can be a driver for sustainability dialogues, facilitating more productive exchanges on compensation as well as other long-term provisions.

1. Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, *Official Journal of the European Union* (OJ) L 175/40 (5 July 1985).

3. Value added by facility design features

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 once safety considerations have been addressed. 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, in practice, they are often tightly linked.

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

Below, Table 1 summarises the design features found by the Forum on Stakeholder Confidence (FSC) that may help a 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
Multifunctionality or polyvalence	Distinctiveness	Integration
Adaptability	Aesthetic quality	Amenity
Flexibility	Understandability	Accessibility
	Memory	

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. Although, radiation protection and safety necessitate cautious engineering in order to isolate the waste, careful functional design can add value, by allowing parallel uses of some areas of

the site that are of direct interest to residents and visitors. Table 2 summarises design features and characteristics found by the FSC that relate to facility function, as well as the value that may be added to the community, and 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
Multifunctionality or polyvalence	The installation serves several functions at the same time: it fulfils its mission of safely managing radioactive waste while supporting other uses like education or recreation.	The project provides opportunities for a wider range of persons to come into contact with the installation and to bring it into their lives, and it 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 an acceptable cost or at no cost at all.	Near-term multifunctionality of the installation is supported.	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 an acceptable cost.	Longer-term multifunctionality is supported, including complete transformation of structure or use.	Designers anticipate that new functions will be introduced by future users; they ensure robustness and avoid building in features that narrowly restrict potential uses.

For safety purposes, not every square metre of a radioactive waste management facility can be put to multiple uses. The desirability of multifunctionality and the ways to achieve it should be decided in each context, by the stakeholders involved.

Multifunctionality

Industrial facilities are often mono-functional, dedicated to serve their engineering purpose only. In contrast, FSC workshops in national and local contexts[1] have highlighted the desirability of integrating radioactive waste management facilities into people's way of life and vision for growth. Adding value through multifunctionality will make the facility more attractive because it would make a more positive contribution to the local quality of life.

Multifunctionality means that the radioactive waste management facility or site can have multiple uses over the years. These functions can provide value to the community immediately or in the future. They can 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. Multifunctional facilities and sites (for example, scientific, cultural and recreational facilities built within site confines) might be 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.

Examples are provided of multifunctionality with added cultural and amenity value, as well as traditional economic value.

Modern exhibit or theatre spaces can be transformed according to need (walls and seats are modular and mobile).

Canada:

> The Port Hope End Use Advisory Committee developed a vision for multifunctional 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.

1. www.oecd-nea.org/rwm/fsc/workshops/.

France:

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. At CSM, an additional source of attraction has been the creation of three herbaria presenting plants growing inside the repository site. "They will include a very short description of the repository (ultra-summary record), thus being the first marker of the repository. One of them will be kept at the repository; the others will be kept by scientific institutions together with historical herbaria" (NEA, 2015).

In Nord-Pas-de-Calais, 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.

Netherlands:

In the south-west, the waste treatment and interim storage facility operated by the Dutch Central Organisation for Radioactive Waste (COVRA) provides a conservation service for fine art. Museums in the region have endured shortage of storage capacity for the artefacts that are not on exhibit. This represents generally some 90% of their collection. Looking for suitable storage space, the museums and COVRA found each other. The conditioned COVRA storage buildings for low- and intermediate-level waste have enough unused space to store the museum artefacts. This space is available as a result of the robust construction of the storage building, and it cannot be used for the radioactive waste itself. The climate conditions are favourable because there are only gradual temperature changes and humidity in the air is under 60%. In 2009, the storage space was offered free of charge to the museums in a 100-year contract. Such a long-term contract is unique even for museums. The National Museum of the Netherlands (the Rijksmuseum) for instance, where works by Rembrandt can be seen, only has a 40-year contract with a storage depot (Codée and Verhoef, 2015).

Added scientific value can also be generated through multiple uses of polyvalent radioactive waste management facilities. Including underground installations which 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 the US Department of Energy's Waste Isolation Pilot Plant (WIPP). The European Institute for Reference Materials and Measurements (IRMM) operates a laboratory for ultra-sensitive radioactivity measurements inside the 225-metre-deep HADES underground laboratory (Belgium).

France:

> In Saudron, a technological exhibition facility displays prototypes of innovative engineering equipment that was developed in order to further the radioactive waste management research at France's underground laboratory. This equipment can inspire other designers and be adapted to other contexts (NEA, 2010c).

Italy:

> Similar plans are being drawn in Italy for the construction of a low-level waste surface management facility for which a site search is being conducted.

Spain:

> Laboratory facilities at El Cabril Centralised Low and Intermediate Level Waste Disposal Facility and WIPP are available for use by universities and administrations. This up-to-date infrastructure serves for research and for regional environmental analysis or monitoring.
>
> The country is building a centralised storage facility, complemented by a technological centre. Its main laboratory will be a research laboratory for spent fuel and high-level waste. It will also include a low-level waste laboratory. (The previous basic design of these two nuclear laboratories is revised for their integration in the centralised storage facility, to facilitate radioactive material transfer and to build and license a single nuclear facility). Other laboratories foreseen in the technological centre will allow research on materials behaviour, chemistry and environment, robotics and industrial pilot plants.

United Kingdom:

> Elected officials in Sellafield have called attention to opportunities which could be generated for the local community by the continued scientific research associated with monitoring and retrievability at waste management sites.

The link between scientific culture and everyday culture can be made in multipurpose, interactive facilities. This represents added value for the users of these facilities, and over time, it can help improve the educational capital of society as a whole.

Belgium:

> The HADES underground laboratory has an exhibition area for scientists and for the public (at least 18 years of age). The exhibition offers well-organised information about research and development activities dealing with the possibility of disposing of radioactive waste in deep clay layers.
>
> Isotopolis is a unique visitors' centre about the management of radioactive waste located at Belgoprocess (the subsidiary company of the Belgian Agency for Radioactive Waste and Enriched Fissile Materials (ONDRAF/NIRAS) operating the agency's facilities for processing, conditioning and interim storage) at the municipality of Dessel. The information centre provides clear,

easily understandable information for anyone interested in radioactive waste. Isotopolis also has a strong scientific focus and is an excellent and visually attractive learning tool, especially for students between the ages of 15 and 18.

Next to the future surface repository in Dessel, ONDRAF/NIRAS plans to build a new communications centre – that will replace Isotopolis. The centre should become the local reference point par excellence for radioactive waste management and its broader context. A theme park will provide appealing information in an attractive setting, targeting a broad and diverse audience including schools, families, clubs and companies. A visit to the centre can be combined with a visit to the repository itself. Besides the tourist programme, the communications centre will also house diverse functions for residents. Multifunctional rooms, a theatre, event meadow, exposition space, etc. will be used intensively by the local community. Moreover, all of this – the repository and associated facilities – is surrounded by beautiful nature.

Sweden:

The Association of Swedish Municipalities with Nuclear Facilities' (KSO) Secretariat gave ideas for cultural added value installations. In an environmentally oriented biogeoscience 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 the iron-work industry of Forsmark. The geoscientific 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 geoscientific trail with stations explaining bedrock types, fossils, etc.

The Swedish Nuclear Fuel and Waste Management Company's (SKB) Äspö Hard Rock Laboratory includes a demonstration component, providing knowledge to scientists through research and to the public through a hands-on museum experience.

Radiation protection and safety needs push engineering solutions towards isolating the waste. Is it really possible to create a multifunctional 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, for the business centre that is part of Spain's centralised storage facility and for museums and visitors' centres at other repositories. In principle, the concept can be extended to any installation, and a wider variety of uses can be imagined.

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 multifunctionality. 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.

On the scale of an entire construction, 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.

A facility which is built to be adaptable is also more easily dismantled at the end of its lifetime. Indeed, 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.

Belgium:

> The architecture of the Belgian communications centre on radioactive waste management was adapted to the ongoing process of participation. ONDRAF/NIRAS develops the activity programme for this centre in close co-operation with the local partnerships Stora and *Mols Overleg Nucleair Afval Categorie A* (MONA). The architects opted for a flexible and adaptable design concept, so that the construction could be adapted to the needs that emerge during the process. Under a massive concrete table (which symbolises the participation process), smaller structures can be built to fill in the (changing) needs of the various stakeholders. While the plans for the structure underneath the table evolve during the participation process, the overall architecture and look remain intact.

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.

United Kingdom:

> At the Dounreay nuclear power plant in Scotland, setting decontamination priorities and radiological target levels required a multi-year process. Stakeholders worked 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 represent a heavy and costly task. A stakeholder proposed that the famous domed reactor building might be made into a national monument, but the cost associated with its maintenance under that formal regime was found to be too high, as would be the cost of

transformation. Many local stakeholders with family employment ties are sentimentally attached to the landmarks of the no-longer operating site, but after the remains of the fast breeder reactor it houses are completely dismantled and removed, the golf ball sphere is presently scheduled for demolition in 2025.

An adaptable and flexible facility can provide enjoyment during its operation and also allow 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, multipurpose facility can contribute to the latter, as it is likely to last for generations of social use and enjoyment.

3.2 Cultural design features

The 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 carry forward and realise ideals.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) has defined culture 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".[2] 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 were found by the FSC to provide opportunities for 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.

2. UNESCO Universal Declaration on Cultural Diversity, adopted on 2 November 2001, http://unesdoc.unesco.org/images/0012/001271/127162e.pdf.

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 unique.	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, etc.
Aesthetic quality	The installation is nice to look at and to experience.	People may draw enjoyment from the presence of the installation rather than avoiding it or rejecting it.	Architects, artists and community stakeholders consult each other on desirable look, layout and landscaping.
Understandability	The installation and its functions are understandable.	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 radioactive waste management project. Information and education programmes.
Memory	The facility and site are marked so that people 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. The community's choices and achievements are recorded. The potential for lasting oversight is enhanced.	Durable markers such as interactive museums or art installations can be built.

Distinctiveness and aesthetic quality

Attention should be given to making the facility 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 has the potential to become an icon, lending a positive reputation and drawing visitors to the locality.

Austria:

> 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.

Sweden:

> The Oskarshamn municipality felt that a future spent nuclear fuel and high-level waste facility could be a showcase for Swedish innovation and design. They called for a national architectural competition to be held.

The visual impact of industrial installations can be designed to support pleasant and desirable interactions with the community.

Hungary:

> In Bátaapáti, the design of surface buildings, wood and stone materials used for construction, and the orderly maintenance of the numerous environmental stations, are all intended to suggest that the radioactive waste repository adapts itself to the land in an environmentally friendly manner (NEA, 2009).

Netherlands:

> In the south-west, the COVRA HABOG high-level waste treatment and interim storage installation has been designed in tight collaboration with artist William Verstraeten, who proposed to integrate the building into a multi-year conceptual art project. The building itself is now a piece of art, a statement by itself as well as a landmark included in regional architectural tours by universities. The art concept, with its specific storytelling about waste management, is elaborated inside and outside the building (see the section on understandability below). With "Metamorphosis 2003-2103", COVRA offered to the local community the largest work of art in the region together with the storage facility for radioactive waste. The inclusion of art in the activities of COVRA shows pride in the work performed. At the same time, COVRA points out that art creates opportunities for communication (Codée and Verhoef, 2015).

Sweden:

> At Forsmark, the architectural firm selected to design the surface installations for a future repository told the FSC in 2011, that the skyline of the facility should be integrated in the surrounding landscape and not dominating. The proposed design emphasises flat roofs. In this way it will be less noticed from the sea perspective (NEA, 2012). Aesthetic quality means that the installation is nice to look at and to experience. In sum, if an installation is aesthetically pleasing one would be happy to pose for a photograph with the site in the background. There are different ways to achieve this: through tradition or through innovation.
>
> The Äspö surface buildings 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.

Another example of pleasant interactions with the community can be found in Artist Cécile Massart's work. She has visited waste facilities throughout the world and captured their particular beauty and identity in graphic works (photos, engravings and videos).

Understandability

Understandability means that people understand 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, allowing members of the community to relate to the facility. Moreover, understandability allows community stakeholders to play a sought-after role in lasting oversight of the facility. In turn, their participation in oversight and monitoring enhances understandability.

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

Belgium:

> In their final report, community members of the Stora (formerly Stola) and MONA integrative local partnerships (Dessel and Mol) spelled out their requirements for accepting a facility: the repository project for low-level waste must integrate technical and social aspects. Moreover, it must bring positive value to the community. The partnerships set requirements to foster understanding of the facility and site, now and over the years. Next to the repository there will be a communications centre, telling the full story of radioactive waste management. Via a special circuit, visitors will also be able to take a look at the full process, from temporary storage to final disposal. The opportunity to visit the site shows the visitor that the disposal facility is safe. The whole story that will be told, is written in close co-operation with the partnerships Stora and MONA.

France:

> The CSM can be toured throughout the year and draws both tourists and regional inhabitants.
>
> Cogema (now Areva) demonstrated that it is possible to place cameras even in the "hot" areas of waste management facilities, allowing people to look in and help them form an image of what waste management 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.
>
> At the proposed repository site at Bure, visitors can take an elevator down several levels into the earth, learn about the clay geology and experience a mock repository tunnel constructed at full scale. Four times per year, the Meuse/Haute-Marne Underground Research Laboratory at 500 metres underground is opened to visits by the general public. The nearby

Technological Exhibition Facility allows visitors to examine sample containers, the machines that handle them and the innovative equipment designed to drill tunnels. Some 40 000 individuals pass through the visitors' centre each year (NEA, 2010c).

The Local Information and Oversight Committee for the French Meuse/Haute-Marne laboratory project runs a well-stocked public reading room in the village of Bure. Regional residents and visitors can peruse documents collected from many sources, on both technical and socio-economic aspects of waste management in France and internationally. A nice-looking stone wash house, of a design traditional to the region, was restored for this purpose using funds made available by the French National Radioactive Waste Management Agency (Andra) (NEA, 2010c).

Hungary:

Several thousands of persons visited the exploration site and shafts before commissioning of the low- and intermediate-level waste repository at Bátaapáti. Once these could no longer be accessed, a visitors' centre absorbed the tourism demand. Visitors learn how the waste management and control process work and why the facility was sited at Bátaapáti (NEA, 2009).

Netherlands:

The COVRA HABOG installation was described above as a significant aesthetic contribution to its region. As conceptual art, it is also a major example of a creative approach to increasing understandability of high-level radioactive waste and the function of the treatment and interim storage installation. To tell a story about the activities inside the facility, a formula is painted in monumental letters of aqua green on each of the three outside walls: Einstein's famous equation $E=mc^2$, as well as $m=E/c^2$ and Planck's formula, $E=h\upsilon$. These equations refer to the metamorphosis from mass to energy, providing an insight into the radioactive character of the waste. Overall, the building is an orange object. This colour was chosen for its potential to suggest the metamorphosis of something dangerous (red) into a safe situation (green). The decrease over time in heat production of the high-level waste will be portrayed in the gradual change of the colour painted on the outside of the building. Every 20 years, when the building needs to be repainted, this will be done in a colour that is slightly lighter than the existing one. After about 100 years, the colour will be white instead of orange. The gradually fading colour tells a story, helping to explain radioactive decay. Inside the building there are many more relations between the art concept and features of waste management. With HABOG, COVRA explicitly tried to address the question of how to explain the long-term aspect of radioactive waste management in a way people can relate to. "The answer is surprisingly simple. Show people that we have a very long history of preserving things, often things that are far more difficult to store than immobilised waste. Ask people how long we should preserve our cultural heritage such as the paintings of Rembrandt or Van Gogh. The answer is generally: 'forever'. The link between the long-term preservation of art and the management of radioactive waste helps people to visualize and trust the concept of long-term management". (Moreover, a direct link was established

with the skilled conservation of cultural heritage; see the section in this report on multifunctionality). "Telling stories to present and future generations to pass on knowledge and memory is a demanding craft. To make the story last it has to be a thing of beauty and it needs vivid descriptions that appeal to emotions. Boring, complex or difficult to understand metaphors can turn an imaginative journey into a lifeless plot. Emotions are subconscious and they will leave a trace long after the words have been forgotten. Art and cultural heritage give such stories and provide compelling metaphors for radioactive waste" (Codée and Verhoef, 2015).

Understandability can be enhanced if community members are directly involved in details of the site function. Communities may wish to develop their understanding through training, which also equips them to participate in monitoring and oversight of the facility life cycle over the years. Enhancing local understanding, familiarity and control through this participation are essential components of the safety concept.

Belgium:

Individual budgets are granted to the partnerships Stora and MONA, which ensure them a high degree of autonomy. It gives them the ability to hire their own experts and order independent studies regarding the safety case. The participating residents also organise visits to similar repository projects in other countries, invite experts to give lectures, etc. Moreover, the partnerships have their own communication channels (website, newsletter, magazine, social media, etc.) to inform the local community.

World-renowned institutions like the Belgian Nuclear Research Centre (SCK•CEN) and the Flemish Institute for Technological Research (VITO) are located next to the Belgian repository site in Dessel. This makes it an area with unique nuclear expertise. For the sake of employment, but also for the sake of safety, it is imperative to keep that expertise within the region. ONRAF/NIRAS draws special attention to maintaining and, even, expanding this local base of knowledge. In addition, the organisation will start an education programme on radioactive waste management, in association with the local university, Thomas More.

Hungary:

Members of the "information associations" have obtained training to support their active participation in the technical monitoring of nuclear facilities. At the low- and intermediate-level facility in Püspökszilágy and repository in Bátaapáti, as well as the interim spent fuel storage facility in Paks, trained municipal groups perform various measurements including regular randomised control of incoming waste packages, comparing resulting data with the expected values recorded in the drum's passport. Local groups will be trained to perform this monitoring at the site of the future high-level waste repository near Boda (NEA, 2009).

Spain:

> Former Mayor J. Castellnou of Vandellòs i l'Hospitalet de l'Infant, the Vandellòs nuclear plant host community, told the FSC (Castellnou Barceló, 2006) 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.

Monitoring emerges as a particularly important aspect of understandability, as it allows the community to form an extensive idea of how the presence of the facility impacts the context (this is mentioned again in this report under the heading of capacity building). The FSC has published a detailed study on local demand for monitoring (NEA, 2013). Local stakeholders see a role for themselves in this oversight, which has clear relevance for ensuring durable quality of life in their community, as well as maintaining and refining understanding of the continuing presence of the facility. Communities are of the opinion that environmental, socio-economic and epidemiological impacts should be measured and followed up, as well as physical repository processes, institutional processes and checking the activities of each player.

Belgium:

> ONDRAF/NIRAS, together with the partnerships Stora and MONA, started a project to monitor the health of people living in the area surrounding the future surface disposal facility. The project aims at mapping the environmental health by means of human biomonitoring. More specifically, it will measure the presence of environmental pollutants in 300 children born in and around Dessel with a long-term follow-up. In addition, other health data will be gathered with a view to health prevention in the region. Every ten years, a new group of new-borns will be recruited to participate.

France:

> The French local information committees tasked with oversight of repository projects, monitoring is a key issue principally in regard to health and environmental concerns. The Local Information Commission of Soulaines-Dhuys obtained an epidemiological study of cancer rates by the French Institute for Public Health Surveillance (Institut de veille sanitaire) and undertook biomonitoring projects. French host communities are also asking for monitoring to measure impacts on socio-economic variables like property values or economic development. They have stated that monitoring should be launched before a given facility starts its operation in order to record the baseline situation (NEA, 2010c).

Another aspect of understandability is ensuring that the community and interested parties have facilitated access to knowledge materials concerning the waste management project and installation. Translation and interpretation of technical materials, as well as discussion opportunities, enhance this access.

France:

> The Bure Local Information and Oversight Committee has used part of its funding to engage external expertise on major technical documents submitted by the waste management agency Andra concerning the projected deep geological repository (NEA, 2010c).
>
> The French National Association of Liaison Committee (ANCCLI), actively offers white papers and frequent training/discussion seminars to its membership. A special series of seminars has taken place in connection with the 2013 national public debate consultation on the proposed emplacement and design of the future deep repository. These day-long meetings were arranged jointly with the French Institute for Radiation Protection and Nuclear Safety (IRSN) which, as the national regulatory authority's technical support organisation, plays a public expert role.

Hungary:

> Official local committees tasked with information and control call upon independent experts from the Hungarian Academy of Sciences to interpret research documents and help disseminate technical information in a broadly understandable manner (NEA, 2009).

Spain:

> A regional university professor was given the role of translating the relevant technical concepts into non-technical language that local people on the Vandellòs dismantling monitoring commission could understand. This increased members' grasp of the issues they were to monitor (NEA, 2007b). 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 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.

Belgium:

> ONDRAF/NIRAS seeks to communicate openly about its disposal project in Dessel. A footpath and special footbridge were designed to take visitors from the communications centre to the nuclear area, where they can have a look at the waste management process. They will be able to have a glimpse into the storage building, the monolith production facility and have a view on the disposal modules. This openness creates a sense of security and ensures the visitor that nothing is hidden.

France:

> 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.

Hungary:

In the National Radioactive Waste Repository at Bátaapáti, visitors can see through fences to see outdoor processes such as waste transportation to the site and into the disposal areas (NEA, 2009).

The themes of understandability are closely linked to issues of memory.

Spain:

At Vandellòs, visitors can look at the stored graphite waste through peep-holes.

Memory

Sustaining a long-term relationship with a radioactive waste management facility implies that the memory of the site is preserved, which 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. The NEA initiative "Preserving Records, Knowledge and Memory across Generations" has delved deeply into the reasons and the means for maintaining this memory.[3]

Belgium:

At the request of the local partnerships Stora and MONA, ONDRAF/NIRAS created a local fund, as a means to realise additional socio-economic added value projects. A fund has been set up to last for many years. It allows future generations to anticipate on changing needs in society. The nature of projects and activities financed by this local fund may vary: they may have a social, economic or cultural character or be aimed at the environment, health, welfare, etc. The local fund is not only a manner to create persistent added value for the society, it also plays an important role in keeping the memory alive. Each initiative, supported by the local fund, creates an opportunity to bring the origin of the funds to attention, namely the repository for radioactive waste.

3. www.oecd-nea.org/rwm/rkm/.

France:

> Andra has observed that without memory preservation, closed down industrial sites may become lost or unreadable in as little as 20-30 years. A living history should be composed by ongoing collection of records based on local experience, communal archives, such as photos and written material. In parallel with research on archiving systems and materials, Andra considers that active memory must rely on ongoing interactions with the local public. The local information committees (Commissions locales d'information, CLI) must be supported to play their fundamental role over time.

United Kingdom:

> The UK National Nuclear Archive is expected to be built at Wick, one of the member communities of the Dounreay Site Stakeholders Group. The archive will hold information in diverse quantitative and qualitative forms concerning all 19 nuclear sites in the United Kingdom. Local communities want to know what kind of nuclear and non-nuclear material is stored in their locality. They also want to know about the social history of their community relationship with their site (including occupational health information). Much reflection is given on how to ensure durable quality of information and knowledge transmission in the archive, especially in light of the fact that different operators and different sites have not always maintained adequate records from the beginning. The Highland Council is partnering on this project by providing the land, and its own North Highland archive will be housed in the same installation (including clan history and genealogical records which are frequently accessed by persons who no longer live in northern Scotland). The national archive helps the history of nuclear facilities, Dounreay in particular, to be integrated into larger community history.

For decades, technologists have reflected on the need to preserve site memory by constructing durable markers. While 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 the industrial experience to date.

Artist C. Massart reminded the participants at the FSC Belgian Workshop (18-21 November 2003) 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. This way, it is also possible to create new relationships, a new contemporary dialogue around waste management (Massart, 2004). 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 suggested that 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".

During the "Constructing Memory International Conference and Debate on the Preservation of Records, Knowledge and Memory of Radioactive Waste across Generations" (NEA, 2015), which took place in September 2014, C. Massart presented her latest work on creating "laboratories" that would be placed in the area of the disposal site. Her vision for those is to "fulfil the function of markers and living research platforms at once. Through such laboratories, each generation would try 'to visualise' the radioactive waste sites, thus creating an international community of guardians, weaving a link from one generation to the next. The idea is to bring together people with a variety of backgrounds (musicians, archaeologists, writers, economists, artists, farmers, poets, among others) who would reflect about the transmission of memory from an ethical, economic or artistic perspective" (Massart, 2015).

The concept of memory is present in the UNESCO World Heritage Convention (UNESCO, 1972), which aims at listing monuments, groups of buildings and sites (in the World Heritage List) to be placed under the protection of the UNESCO World Heritage Committee, 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.

Markers are being considered in some contexts of national repository programme in order to reduce the possibility of human intrusion. Over the years these markers would, inevitably, become part of the local heritage. However, their significance will likely evolve and warning messages may be ignored, as it has largely happened in the case of the Japanese tsunami stones (NEA, 2014a). Future populations' awareness of such markers, their understanding of the meaning of the markers and their motivation to maintain them appear more likely to persist if the facility is a positive part of daily community life for the several decades of its operation than if it is something kept apart, isolated and forgotten (Pescatore and Mays, 2008).

France:

> The CSM is planning to build a stela "indicating the main characteristics of the repository, potentially linked to an art work, will be erected at the repository" (NEA, 2015).

Local stakeholders express interest in preserving memory of waste management installations (NEA, 2010a; NEA, 2013). 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 memory 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 memory, reinforcement of regional identity, generation of tourism revenue and/or creation of recreational amenity.

In particular cases, when mines were closed they were transformed into mining museums, offering a new tourism industry while memorialising the activity that meant so much to the region and shaped it.

Belgium:

> Stora 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 interactive science exhibit on radioactivity should be part of this centre. The partnerships are involved in the entire development process: volunteers join the table to discuss the architecture of the building and work out the content of the exhibition.

Canada:

> The Port Hope End Use Advisory Committee put forward the idea of 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 affected by legacy waste and finally stepped forward to manage the waste on residents' own terms.

Hungary:

> In the natural surroundings of the visitors' centre in Bátaapáti, visitors can drink from a spring that local legend calls the "mother's fountain". Inside the museum, waste generation, packaging and disposal, facility operations, environmental monitoring, and historical interrelations between the geological environment and local society, are presented in the centre of the show area. These exhibits are encircled by presentations of local flora and fauna. The centre acts as both a cultural destination and a venue for scientific lectures (NEA, 2009).

Sweden:

> The municipality of Östhammar considered the establishment of 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 the Association of Swedish Municipalities with Nuclear Facilities.

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 is a familiar one for architects and engineers. The factors found by the FSC (Table 4) suggest that they can seek to integrate the facility into its physical setting, 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 "genius loci" (spirit of the place), fits into the landscape and complements it.	The installation enhances people's living space and their attachment to the place.	Architects study and respect the "genius loci".
Amenity	The site includes features that enhance its attractiveness, convenience and usability.	People may actively go towards the site and draw enjoyment from viewing and using it.	Architects, artists and the community consult each other 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 can be implanted with respect and regard for the harmony of the place.

Belgium:

> Before laying the first brick for the Belgian surface disposal project, ONDRAF/NIRAS consulted landscape architects to work out a "visual quality plan" for the whole site. The undeveloped and hardly accessible area is to be transformed into an attractive and valuable nature park. The plan is the basis for cohesion and visual quality through the whole area. Every building will be integrated naturally into the landscape, so that it ensures as minimal disruption as possible. The plan describes the materialisation of the buildings and disposal modules, the maintenance of the surrounding nature, etc. The area and its nature will be open for tourists and residents through a network of paths.

Spain:

> Vandellòs-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 restyled. The city of Vandellòs 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 to 60 metres in height.

Sweden:

> The nuclear fuel and waste management company SKB asked an architect to think about "industrial design with man in mind" for the future final repository for spent nuclear fuel. "What will it look like? A big square industrial structure?" The architect answered that it is important to get to know the site where the buildings will stand and the "genius loci" or spirit of the place. New buildings and industrial plants must be in harmony with the unique feeling each place has. "When we are 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. The architect points out that in the areas investigated for siting facilities, 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.

Canada:

> 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.

Sweden:

> The Oskarshamn municipality pointed out that "to be effective, the findings (on 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 multifunctionality.

Belgium:

> The communications centre combines a tourist and informative programme with functionalities for the local community. The centre is surrounded by a beautiful nature park, ideal for walking and cycling. There will be a cafe/restaurant with accompanying playground. A number of features for the local community are also integrated into the building: multifunctional rooms, conference rooms, a theatre, an exposition space, etc. This creates a connection between the community and the disposal site, and it creates a vibrant place for tourists and locals.

Canada:

> 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.

Czech Republic:

> Local stakeholders have suggested that a repository should bring with it local amenities such as playgrounds and support for leisure activities (Kojo and Richardson, 2014).

Sweden:

> The industrial architect hired by SKB pointed out that designing a final repository is "like designing a small city, with restaurants, offices, overnight accommodation and everything".

Accessibility

Accessibility means that the site and facility, even with fencing to ensure security, are still open and welcoming. People can go towards 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.

Belgium:

> From 2015, the HADES underground research laboratory will have its own access, outside the SCK•CEN compound, hence becoming more easily accessible for the public.

Hungary:

> The main guideline adopted for designing the low- and intermediate-level waste repository at Bátaapáti is openness. Visitors have to see clearly how well-managed the site is. The Public Limited Company for Radioactive Waste Management (PURAM) proposed screens through which people can see all outdoor management processes such as waste container arrivals and handling. At the same time, local people wish for the installation design to convey that it is safe and that the protective barrier guarantees that no unauthorised persons will enter (NEA, 2009).

Sweden:

> The industrial architect selected by SKB replied to the 2007 survey that "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". Later, at the 2011 FSC National Workshop and Community Visit held in Sweden, the proposed design showed the intention to make the surface installations almost invisible from the sea perspective. (In the summertime, thousands of tourists come to the area to stroll in the surrounding nature, enjoy the coast and swim in the sea). However, discussion revealed that another option could be to present an attractive landmark to those approaching from the sea. A resolution must be found between the desire to avoid calling attention to a facility and the need to demonstrate that a facility is a safe addition to a community, as well as a lasting asset (NEA, 2012).

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.

Canada:

> 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; and ensure public oversight through accessibility".

Spain:

> The Vandellòs waste storage site can be visited without extensive personal protection, and a confident feeling is produced by the ability to peer into the storage area through portholes.

Sweden:

> In a similar manner, the underground offshore facility of the Swedish Final Repository for Radioactive Operational (low- and-intermediate level) Waste can be visited essentially in street clothing.

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.

Accessible installations serving multiple functions can be achieved only with the careful co-operation of the regulator. 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.

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.

Belgium:

> In order to minimise road transport, the Belgian Agency for Radioactive Waste and Enriched Fissile Materials (ONDRAF/NIRAS) built a quay for the supply of raw materials. Local enterprises can also take advantage of this newly created quay.

Local durable employment creates ties, 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?

Canada:

> The Canadian Nuclear Waste Management Organization's (NWMO) description of its siting process for a geological repository of used nuclear fuel (NWMO, 2010) highlights the organisation's commitment to fostering well-being in the community and surrounding area through the implementation of the project.

Spain:

> The multi-stakeholder research programme Cowam-Spain 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 (NEA, 2006b).

United Kingdom:

> In their reply to a national consultation, then UK waste management company Nirex stressed the need for suitable long-term projects that would help support the sustainability of the radioactive waste management facility host community. The Nuclear Legacy Advisory Forum (NuLeAF) 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 descendants" (NuleAf, 2006).

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.

Canada:

> In the far north, where uranium is mined, the traditional aboriginal culture is still dominant locally. It is important to organise sustainable modern economic activities in harmony with ongoing traditional activities. A miner gets more community respect and satisfaction from being a skilled and experienced trapper. France's Cogema (now Areva) recognised that miners should enjoy working conditions (time schedules, geographic placement) allowing them to devote themselves meaningfully to traditional skills. In this case, local utility implies the 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 trainings 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 (NEA, 2003).

European Union:

> An existing European regulation (Council Regulation (EC) No 1407/2002 of 23 July 2002 on state aid to the coal industry) 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 social resources that will sustain the local communities over the long term.

Every waste management facility will eventually reach the end of its operational life and pass into a post-operational phase when human intervention is no longer expected. While the active period of construction and operation may generate palpable economic benefits for the host region, this is less likely during later phases characterised by indirect oversight. Therefore, the present-day creation of added cultural and amenity value and present-day contributions to community resiliency, may provide a positive legacy that outlasts some benefits achieved by pure economic means. While such multi-generational value additions as infrastructure, health services and employment may be spontaneously targeted by the community (Réaud, Schieber and Schneider, 2009), the identification of amenity and cultural value needs special attention.

France:

> With this perspective in mind, the French National Agency for Radioactive Waste Management (Andra) has developed a number of activities on the site of the Manche Surface Repository (Centre de Stockage de la Manche, CSM). These include guided tours, exhibitions, collaboration with associations linked to the topic of memory and the foundation of a think tank (composed of retired Andra staff and other nuclear professionals, archivists, artists, local citizens and locally elected officials) tasked with finding ways to transfer the history and memory of the CSM to future generations (NEA, 2015). Through this think tank and efforts to remember and develop the local utility of the facility, an important sustainability effort has been made by Andra.

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, increased empowerment and *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 hosting an industrial facility.

United States:

> Through the process of developed detailed economic, fiscal, social, environmental and public health and safety indicators, Clark County in the state of Nevada 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 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 for construction one day.

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 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).

Belgium:

The Belgian low-level waste management 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). The conditions – imposed by the partnerships – were further concretised in a master plan (ONDRAF/NIRAS, 2010). This plan was the basis for further close co-operation between ONDRAF/NIRAS and the partnerships. In numerous working groups, volunteers contribute intensively to the shaping of all project components, both technical and social. The steering committee comprises representatives of both MONA and Stora and the mayors of Dessel and Mol. This work method ensures local support, a high degree of commitment and even a sense of pride.

Sweden:

When the Swedish Nuclear Fuel and Waste Management Company (SKB) applied, in March 2011, to build a final repository at Forsmark, this did not signify that the Östhammar community had given its green light for this construction within its territory. Instead, the municipality accepted (alongside the safety and land-use authorities and the government decision maker) to review the licensing application to build a repository. To address this expected five-year process, the municipality created an independent review organisation to decide whether or not to exercise its veto power at any time during the procedure, keeping in mind the best interest of the Östhammar citizens. The review organisation counts 40 persons and is made up of 3 committees (responsible for examining long-term safety issues or environmental/health issues, or for organising consultation). Five civil servants are employed on the issue. The municipality has access to the national Waste Fund (generated by a tax on each kWh) to support their knowledge building activities, and politicians are empowered to take decisions for which they thus become accountable.

In contexts where a siting process has not yet narrowed to the point of designating a particular locality, co-operative study and deliberation can be useful. Stakeholders in potential candidate communities can make contacts and form relationships with their peers and with national-level actors.

Belgium:

> For the long-term management of high-level and/or long-lived radioactive waste, ONDRAF/NIRAS recommends a global geological disposal solution, including a technical solution that fits into a decision-making process integrating the technical and societal aspects in its Waste Plan (ONDRAF/NIRAS, 2011). The development and implementation of this process is accompanied by a series of conditions arising from the societal consultation organised on the initiative of ONDRAF/NIRAS (such as the ONDRAF/NIRAS dialogues, the interdisciplinary conference and the citizens' conference [Fondation Roi Baudouin, 2010]) and from the legal consultation in the framework of the strategic environmental assessment (SEA) procedure. ONDRAF/NIRAS would prefer that the process progress in steps, be adaptable, participative and transparent, and ensures continuity. The participatory decision-making process will be independently monitored.

Czech Republic:

> A Working Group for Dialogue on the Site Selection Process for a Deep Geological Repository was established in 2010 as an advisory body of the Ministry of Industry and Trade. This group includes mayors, non-government organisations, parliamentarians, implementers, regulators, experts in sociology, law and geology and responsible ministries. Its objective is to define acceptable criteria for transparent site selection. The group is pluralistic, meaning that it can embrace vertical issues (relationships between national, regional and local actors, as well as the degree of fit with international requirements) and also horizontal issues (varying aspirations and priorities, and differing definitions of risk and benefit across stakeholder groups). The evolution of the working group from an informal to an institutionalised advisory body is rare in international terms. At the same time, however, this group views that it has not been able to deliver its full potential as a neutral platform to help build up relationships and prepare more active stages of repository development (NEA, 2014b). To empower its mandate the Working Group for Dialogue has been transformed into a Governmental Council for Energy and Raw Material Strategy to reach direct contact to the government.

The Cowam-2 project created thematic co-operative research groups at the European level. The group, which focused on long-term governance of radioactive waste management, concluded that alongside socio-economic and legal provisions, the community's capacity to monitor its facility must be maintained over the generations (Lavelle, Schieber and Schneider, 2013). Sustainability funds, intended to improve quality of life over the following decades, were designated by partnership initiatives in Belgium as a condition for hosting a repository. In Spain, stakeholders consider that such funds should be used to enhance the community's capacity to play a future oversight role.

Spain:

> The project Cowam-Spain suggested that radioactive waste management stakeholders, including local and regional authorities, should focus on devising mechanisms for social learning, economic development and environmental

protection over the long term, to be supported by grant funds. Experience has already been gained in Spain in the decommissioning area: in the context of dismantling Vandellòs-I, where a multi-stakeholder, the Municipal Monitoring Commission, oversaw work progress, safety, waste management, environmental surveillance and contracted personnel issues (Castellnou Barceló, 2006). Waste management facilities and sites diminish the green acres available to a community and their resource capital must be replenished in another way. Integrated waste facility projects can generate added value on the intellectual and cultural plane, increasing the ability of future generations to take decisions.

Sweden:

Oskarshamn has a good economic development status. However, the local educational level is lower than in Sweden's regions that are experiencing higher levels of economic expansion. The municipality never considered the radioactive waste management project as primarily a source of economic compensations. Safety was the primary concern; the working groups added deliberations and research on added value for the community in later stages of the candidacy. A rising educational level was seen to be one potential benefit. In Oskarshamn, it was 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).

United States:

Nye County in the state of Nevada 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 co-operative 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 Yucca Mountain Project (YMP), but also increase 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 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 in the state of New Mexico, where the Waste Isolation Pilot Plant (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 of the local community life. Their involvement enhances and improves the culture within the community.

4.3 Image refinement

In the 1960s, 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 this. 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.

A repository may not be compatible with a local image.

Canada:

The Councils of the Municipality of Port Hope 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".

Sweden:

In the Municipality of Storuman in Sweden there was a significant opposition feeling that their image of being Europe's last wilderness was not compatible with representations of a nuclear waste repository (Tourist Entrepreneur Stig Stand, Storuman 1994, quoted in the Oskarshamn questionnaire response to this study). For an industrial community, in contrast, a repository may have the potential to enhance the local image.

As a candidate, Oskarshamn took 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'. Engaging in such studies was part of the Oskarshamn ambition to engage in a

partnership with the industry and not be seen as a 'target for decisions taken elsewhere'".

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 primarily seen as a sign of economic dependency and certainly not as a willingness to sacrifice safety (Hetherington, 2003). 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.

5. Conclusions

Long-term radioactive waste management projects can last anywhere from decades to centuries and can have a considerable impact on the surrounding community. Such projects require more than short-term fixes to facilitate a project and installation at a physical site. Indeed, the societal durability of an agreed solution and its sustainability over the long term are essential to a project's success. 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 the sought-after qualities of a radioactive waste management installation, for both the physical building structures and for the benefits that the installation can bring to the community.

The greatest challenge, both technical and societal, is to create a local operating facility that can fulfil its mission over generations. Alongside scientific knowledge, technical competency and resources for implementing an agreed approach, there must be a continued willingness to maintain the facility. Moreover, radioactive waste management projects must support the sustainable development of the host community and its long-term capacity to continue hosting the facility. As part of these efforts, it is important to decide how a facility and its site can be better integrated into the community; how the facility and site can be made attractive for the long term, and ultimately, how it can improve a community's prospects for quality of life across generations.

Communities do not gain added value and sustainability solely through financial compensation and development opportunities. While these economic factors 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. Such opportunities can be seized when planning and implementing a facility.

Today, partnerships between host communities and radioactive waste management institutions (industry, policy bodies, etc.) are reflecting on how to build a long-term, sustainable relationship with a facility. 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. It should nonetheless be possible to extend and structure this reflection by exchanging ideas at the international level.

A number of basic elements for designing a radioactive waste management facility have been identified based on the analysis of input from stakeholders and on the experiences of the Forum on Stakeholder Confidence (FSC). These design elements include functional, cultural and physical features. Among the functional features, multifunctionality or polyvalence should be highlighted, meaning that the

facility is built to serve multiple uses. Other important functional features include adaptability and flexibility. Distinctiveness should be mentioned as one of the cultural features, whereby the radioactive waste management facility or site is attractive and unique, and has the potential to become a local landmark, lending to a positive reputation and drawing visitors. Other cultural features include understandability: the installation can be tied to existing knowledge and related to everyday life. Thanks to its aesthetic quality – meaning that both physical and cultural markers identify the site and tell its story – people 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.

This report examines the added value that may arise from the decision-making and implementation process. Implementing any radioactive waste management facility has the potential to benefit the community in terms of prosperity, but in the best of cases, increased stability and cohesiveness are also gained, which represent added cultural value. Other cultural benefits that may be accrued are an enhanced educational level in the host community because of 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, equipping the community to face other decisions and issues. Local stakeholders may also focus their work on community identity, image and profile. Even when communities are not favourable to hosting a radioactive waste management facility they can use the opportunity to develop quality-of-life indicators and reflect on the direction they want to take in the coming years.

While this publication highlights some experiences to date, it cannot provide universal guidelines. Added cultural and amenity value is specific to each context. As recognised by many, it is vital that the concerned stakeholders 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, as they may learn 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 when building facilities that favour a sustainable relationship with the community. Sustainability and value added themes nevertheless remain a new topic in radioactive waste management stakeholder discussions. While such potentially lasting value additions as infrastructure, health services and employment are quickly targeted by potential host communities, special attention must also be given to identifying cultural and amenity values, because of their major role in preserving knowledge and memory. This report, which has received input from a wide range of contexts, will be beneficial to both communities and national radioactive waste management programmes when fostering durable relationships.

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Annex 1. Stakeholder acknowledgements

The research and reflection at the basis of this report were first discussed at the Forum on Stakeholder Confidence (FSC) meetings in 2005 and 2006, and the first edition of the publication was issued in 2007. The theme "Increasing the Value of Waste Management Facilities to Local Communities" was then added to the forum's regular programme of work and case studies continued to be investigated. The 2014-2015 update of this publication includes examples gathered during the FSC national workshops and community visits. All Internet hyperlinks were verified in July/August 2014.

The field study conducted for the original publication benefited from direct input by 32 different stakeholder sources covering 20 localities or radioactive waste management programmes. FSC participants were invited to provide input, as were some stakeholders from outside the forum. The aim was to obtain a variety of views, not a fully representative sample. The following stakeholders filled out a questionnaire, gave written comments, or granted a telephone interview (from end 2005 to mid-2006):

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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 Martin O'Connor pointed out the importance of the relationship between the community and the waste itself (O'Connor, 2003).
- Professor Erik Van Hove emphasised that the facility should not be seen solely as a waste management instrument; an attractive, multifunctional facility has more chances to become a positive part of community life, contributing to enjoyment and local pride (Van Hove, 2004).
- Artist Cécile 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 (Massart, 2004).
- The Sellafield enquiry of 1997 mentioned as one disabling community objection to planned radioactive waste management surface buildings that they would impact negatively upon the amenity of the host region.

The 2007 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 Professor Erik Van Hove.

Annex 2. Glossary of terms

In this glossary, some basic terms encountered during the study (italicised in the main body of the report) are defined.

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.

Benefits which are part of an agreement to an affected community in recognition of their service or acceptance of inconvenience or disruption.

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 and/or operation of the facility (NEA, 2004b).

There is consensus today across governments, institutions, industry and civil society that potential host communities should actively define the right siting package, including not only financial but also other accompanying measures (NEA, 2010a; Kojo and Richardson, 2012; Kotra, 2003).

A distinction is made between an engagement package, enabling communities to participate fully in a siting process whatever its outcome, and a compensation-type benefits package, which becomes available when a community has been retained by a hosting decision (CoRWM, 2006).

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 plants are compensated primarily in relation to the volume of (spent) nuclear fuel currently stored on local territory (NEA, 2010a).

In the Forum on Stakeholder Confidence (FSC) 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.

However, the discussion of traditional compensation and benefits remains important in many contexts (Kojo and Richardson, 2012; Kojo and Richardson, 2014; Kojo and Richardson, 2013).

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".[1]

Incentive

A benefit to motivate local communities to host 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 the UK Committee on Radioactive Waste Management (CoRWM) in 2006 included 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 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" (CoRWM, 2006).

1. UNESCO Universal Declaration on Cultural Diversity, adopted on 2 November 2001, http://unesdoc.unesco.org/images/0012/001271/127162e.pdf.

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 valuewith 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.

The Belgian Agency for Radioactive Waste and Enriched Fissile Materials (ONDRAF/NIRAS), 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 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 other's 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

A generic term that 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 (Wylie, 2010). The German Independent Working Group on Site Selection Procedures for Final Repositories (AkEnd – Arbeitskreis Auswahlverfahren Endlagerstandorte) 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 (AkEnd, 2002). 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 (Ipsen, 2000).

Administrative character, location, mode of government, history and shared economic and cultural practices are complemented by further dimensions of community. Each member's sense of belonging may be linked to a perception of the "spirit of the place" and to an identifiation 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, what is gained isa 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 (Simard, 2002).

Measured, according to the OECD Better Life Index, notably through: employment status, health status, work/life balance, education and skills, social connections, civic engagement and governance, environmental quality, personal security (OECD, 2013).

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 a social impact assessment (SIA), which is applied more and more 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 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 may evolve.

Social capital

Features of social life – networks, norms and trust – that enable persons to act together more effectively to pursue shared objectives (Putnam, 1995).

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.

Stakeholder

Any actor – institution, group or individual – with an interest or with a role to play in the process (Webster, 2000).

UNECE Aarhus Convention

The United Nations Economic Commission for Europe Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, adopted on 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".[2]

The Aarhus Clearinghouse for Environmental Democracy[3] 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. In the area of nuclear power and radioactive waste management, significant stakeholder-led study of the application of the Aarhus Convention has been conducted, contributing to empowerment and capacity building for oversight (UNECE, 2013).

2. www.unece.org/env/pp/welcome.html.
3. aarhusclearinghouse.unece.org/.

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

In the field of long-term radioactive waste management, repository projects last from decades to centuries. Such projects will inevitably have an effect on the host community from the planning stage to the end of construction and beyond. The key to a long-lasting and positive relationship between a facility and its host community is ensuring that solutions are reached together throughout the entire process. The sustainability of radioactive waste management solutions can potentially be achieved through design and implementation of a facility that provides added cultural and amenity value, as well as economic opportunities, to the local community.

This edition of *Fostering a Durable Relationship between a Waste Management Facility and its Host Community: Adding Value through Design and Process* highlights new innovations in siting processes and in facility design – functional, cultural and physical – from different countries, which could be of added value to host communities and their sites in the short to long term. These new features are examined from the perspective of sustainability, with a focus on increasing the likelihood that people will both understand the facility and its functions, and remember over very long timescales what is located at the site.

This 2015 update by the NEA Forum on Stakeholder Confidence will be beneficial in designing paths forward for local or regional communities, as well as for national radioactive waste management programmes.

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