

Information and Memory for Future Decision-Making – Radioactive Waste and Beyond

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Workshop: Information and memory for future decision making – radioactive waste and beyond

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Preface

These proceedings document a workshop on the the issue of records, knowledge and memory (RK&M) preservation over centuries and millennia, which is a topic of increasing concern in Sweden as well as in other countries. The participants were mostly from Sweden and represented governmental agencies, universities, local communities, regulators, industry, policy makers, civil society organizations and the press. It was the first time in Sweden that such a wide group of experts could address the issue of preserving RK&M in order to enable future society to make knowledgeable decisions concerning environmental legacies inherited from the past.

The workshop benefitted from the expertise and active involvement of all participants and the relevance of so wide a set of viewpoints and experiences. The international participants provided an overview of thinking and progress from outside Sweden. The resulting chart of principles and practical goals as well as the workshop proceedings provide an important foundation for developing new avenues for cooperation and strengthening and extending current practices in RK&M preservation. This should advance both the field of radioactive waste management and the management of other long-term legacies in the context of sustainable development for the benefit of future generations.

WORKSHOP OVERVIEW

Claudio Pescatore, *Affiliated Researcher, UNESCO Chair on Heritage Futures, Linnaeus University and Independent Consultant*

According to the Swedish Geological Survey, “there are about 80,000 potentially or confirmed contaminated areas in Sweden. Approximately 1,300 of these are assessed to entail very great risks to human health or the environment and probably require measures.”¹ When they will be remediated, the polluted soils will be disposed of in a number of deposits that will be constructed all over the country. How then to ensure that future generations will remember that these places must be considered to be off-limits for housing, playgrounds, etc. for centuries to come? Will all of those deposits function as planned? Besides contaminated areas, will an inventory be preserved concerning other types of environmental, long-term legacies? Will oversight be maintained of these legacies? By whom, and by which means? Is it possible today to work towards robust strategies for informing the future publics while knowing that responsibilities, funding, priorities, and values will not be the same as today’s? How do the current, responsible bodies envisage preparing for the future information challenge? How does society plan for the future in other sectors, such as cultural heritage? The workshop raised and provided ground for discussion of these and other related questions on preserving information and memory for the well-being of future generations.

It was the first time in Sweden that such a varied group of participants, from Sweden and beyond, – representing governmental agencies, universities, local communities, regulators, industry, policy makers from various sectors, civil society organizations and the press – got together to address the issue of preserving information and memory for future use and decision making. The workshop lasted three days. Its success rests on the expertise and active involvement of all participants and the relevance of so wide a set of viewpoints and experiences.

After the welcome address, the first day set the scene both nationally and internationally (Chapter 1). The next day (Chapter 2), the audience divided into groups of roughly 20 people each and participated in face-to-face discussions of four themes covering, respectively: Sustainable Development and Information-and-memory Preservation; Law and Regulation and Long-term Responsibilities on Preservation of Memory in Society; The Role of Actors vis-à-vis the Future; The Significance of Cross-sectoral Collaboration in Managing Societal Challenges.

During the first two days there was wide agreement that the current approach to information-and-memory management is based on dealing with the future in the image of the present and that this does not constitute a robust long-term strategy; that, although we may want to forget, we have to remember and cannot postpone taking action; that it is important to take all long-term legacies into account at the same time, not just radioactive waste, or toxic waste, or other; that, currently, the state of knowledge and reflection is most advanced in the field

¹ Swedish Geological Survey, see page on contaminated areas at <https://www.sgu.se/en/physical-planning/contaminated-areas/> (last consulted August 2019).

of radioactive waste management. This field can show the way. The present proceedings include summaries of the first-day talks and of the second-day discussions.

The third day of the workshop included the plenary discussion of a chart of guiding principles and practical goals on informing policy, regulation and practical work on preserving records, knowledge and memory of environmental legacies and heritage across generations. By and large the workshop supported the main points of the chart. In the following days, the organizing committee implemented the feedback received at the workshop and updated the chart. The present proceedings (Chapter 3) include the updated chart, which consists of three guiding principles and four practical goals. The three guiding principles are as follows:

- Enabling future members of society to make knowledgeable decisions to suit their needs is part of responsible, ethically sound management of environmental and other impacts of the legacies we leave behind.
- The relevant institutions ought to plan for continuing oversight. This is also in line with a prudent approach for protecting health and safety.
- Any strategy for the preservation of Records, Knowledge and Memory (RK&M) should integrate the possibility of a future disruption of the foreseen methods of transmission. The intention should be to regain oversight, in case oversight was lost.

The workshop ended with final perspectives provided by a science journalist, an academic with expertise in industrial heritage and a second academic expert on ethics and radioactive waste disposal (Chapter 4).

The workshop, its vision document and the chart of guiding principles and practical goals are meant to start a broad-based reflection as well as practical action, in Sweden and elsewhere, on how to aid future generations maintain or regain awareness of some of the most relevant environmental legacies that they will inherit. The texts in the workshop proceedings provide suggestions on moving forward: from amending the sustainable development goals as described in the Agenda 2030, to drafting comprehensive law and regulations, to creating a centralized Authority for legacy management, to making use of local knowledge in the host communities, to relying on international agreement and instruments, to creating synergies amongst disciplines as varied as hazardous materials management and heritage management.

Reflection on how to move forward is timely in Sweden, in that the Swedish government (May 2019) is in the process of deciding about a repository for final disposal of spent nuclear fuel to last 100,000 years and the question is on the table on how to pass on information – what, by whom and to whom – about the final repository. A similar, deep underground repository for the indefinite isolation of mercury-tainted and other processing waste is slated to be operating shortly and an underground repository for short-lived low- and intermediate-level radioactive waste is already in operation. Nuclear waste, whose literature on RK&M preservation is fairly large and recent, can act as a useful trigger for better understanding the wider questions at hand as well as suggest possible strategies and tools. The workshop took advantage of international thinking - and proposed toolbox - from a recent, OECD/NEA international project on RK&M dealing more specifically with radioactive waste.²

² The OECD/NEA RK&M project is documented on the web page: <https://www.oecd-nea.org/rwm/rkm/>

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CHAPTER 1 – SETTING THE SCENE NATIONALLY AND INTERNATIONALLY

1.1 Welcome address

Mats Djurberg, *Secretary-General, Swedish National Commission for UNESCO*

History matters. What happened in the past matters today, and what happens today will matter in the future. How do we make sure that we really learn from the past and also send the right messages forward for the coming generations? This is one of the main tasks of UNESCO, the United Nations Educational, Scientific and Cultural Organization.

In 2007 the UNESCO Member States signed a joint declaration on the Responsibilities of the Present Generations Towards Future Generations. This declaration emphasizes that “The present generations have the responsibility of ensuring that the needs and interests of present and future generations are fully safeguarded.” But how can this be done? Today you are all here to discuss one important aspect of this, namely how we manage, explain and communicate the risks and proper management of nuclear and other wastes to future generations. One insight is that culture and, specifically cultural heritage, can be incredibly powerful. Another insight is that we must make sure that the messages that are incorporated in our cultural heritage are preserved and made available.

On cultural heritage, I would like to mention the UNESCO’s world heritage sites as well as the UNESCO’s Memory of the World program that targets documentary heritage. One of the Swedish Memories of the World is located just a few kilometers away from here, at the Film Institute which has the Ingmar Bergman archive and at the Royal Library, which is home to the collections of Astrid Lindgren and Dag Hammarskjöld.

The purpose of Memory of the World program is to ensure that a snapshot of an era or an event is preserved because it can teach us something important. These lessons are not necessarily beautiful or pleasant. Other examples of memories of the world are Anne Frank’s diary, Peru’s Archive of Terror, documents related to the construction of the Berlin wall and the Auschwitz trials. Indeed, many of the most shameful moments of humankind have been selected by UNESCO to be preserved, digitalized and shared as widely as possible.

It is very encouraging that so many different stakeholders are present in this room: government agencies, business representatives, research institutions, NGOs, local municipalities etc. Memory preservation is a complex challenge and we need to ensure that we have not just the best brains working on it but also a great variety of both brains and perspectives. We are much more likely to find a good solution if the people involved come from different backgrounds and different walks of life.

I am particularly pleased to see that the first Swedish UNESCO Chair in cultural policy, Professor Cornelius Holtorf, is behind the making of this conference, and I am looking forward to be part of it. My wish is that we can bridge the gaps across sectors and create a deeper, common understanding and better cooperation for the future in the field of long-term memory. Finally, I would like to thank the Swedish National Council for Nuclear Waste, the Linnaeus University, the Swedish National Archives and the Swedish Radiation Safety Authority who are the workshop co-hosts. They have done a remarkable job to make this event a reality.

1.2 “Information and Memory for Future Decision Making – Radioactive waste and beyond”. The Vision Document to the workshop

Claudio Pescatore, *Affiliated Researcher, UNESCO Chair on Heritage Futures, Linnaeus University and Independent Consultant*

Legacies such as radioactive and hazardous waste deposits will last centuries to millennia and it is the duty of the current generation to promote and implement provisions that maximize the chances that records, knowledge, and memory (RK&M) remain accessible and usable, or that they can be retrieved or reconstructed.

The current approach to legacy and, more generally, heritage management, is *create the legacy, maintain memory till the next generation, leave it to the future generations to do the same*. Amongst all possible futures, the choice is thus made in favor of a future in which benevolence continues without interruption and in which the relevant institutions and individuals have the knowledge, the records and the financial means to continue to intervene. This is not the most likely future, and any well-meant RK&M preservation intentions of today are most likely to go unfulfilled in the future, the more so as time progresses.

The sustainable development (SD) literature is very much axed on maintaining equality of chances across generations and on not depleting resources, or on compensating for their depletion. Avoiding creating legacies is emphasized. Were the SD principles applied across the board, there would be little need for RK&M preservation. As a result, the SD literature does not emphasize RK&M preservation across generations. Yet environmental and other legacies have been and are being created, and future generations will be faced with the need to make informed decisions about them.

It turns out that preparing the future as if it was a continuation of the present means and intentions across all time scales – the “rolling present” approach – is the reference approach in legacy management and RK&M preservation. “Future” is not a professional skill in heritage management either, and it becomes necessary to rethink and improve upon the current, rolling-present approach. It is proposed to research and conceive a multi-faceted approach that incorporates different tools and mechanisms encompassing technical, administrative and societal provisions. The new approach should be constructed on two modes of transmission: one based on the presence of direct intermediaries between generations, and one based on the absence of intermediaries. Details are presented in the vision document for this workshop, which is available from the Workshop Web Site¹ and from the Linnaeus Portal².

The vision document also identifies a set of questions and, most importantly, it proposes a draft chart of basic principles and goals towards preserving RK&M across generations. The set of questions and the draft chart are the bases for the discussions at this workshop.

Whilst legacy management – and specifically radioactive waste – are the original issues that were addressed by the group that supports the vision document, the proposed principles and

¹ <https://www.karnavfallsradet.se/en/workshop-information-and-memory-for-future-decision-making-radioactive-waste-and-beyond>

² C. Pescatore, “Information and Memory for Future Decision Making - Radioactive waste and beyond. A vision and discussion document on preserving information and memory over centuries and millennia in the context of sustainable development and the future human environment”, Linnaeus University, 2018. <http://lnu.diva-portal.org/smash/record.jsf?pid=diva2%3A1276461&dswid=7691>

goals apply more widely as well. Constructing and drawing synergies across a variety of disciplines and practices is one of the suggested goals.

A broad-based reflection is needed – both in Sweden and elsewhere – on how to aid future generations maintain or regain awareness of some of the most relevant environmental legacies that they will inherit. The current workshop and its vision document are meant to foster that reflection.

1.3 Cultural Heritage, Nuclear Waste and the Future

Cornelius Holtorf, *Professor of Archaeology and Chairholder, UNESCO Chair on Heritage Futures, Linnaeus University, Kalmar, Sweden*

Anders Högberg, *Professor of Archaeology, UNESCO Chair on Heritage Futures, Linnaeus University, Kalmar, Sweden*

"Nuclear technology is like the music of Mozart – it belongs to us all."

James Acord

In the joint research we have been conducting since 2011, our overarching interest has been to investigate what we can learn about long-term preservation and memory if we consider nuclear waste as a particular kind of cultural heritage.

Arguably, nuclear waste is cultural heritage in the sense that it is part of the human legacy and evidence of 20th and 21st century Atomic Culture and indeed of the birth of the environmental movement that transformed global politics in recent decades. At the same time, nuclear waste and cultural heritage share a number of additional characteristics. Both realms demand safe conservation with the ultimate goal to increase human welfare; both are subject to regulations and require considerable expertise; both combine aspects of culture and society with aspects of nature and physics and they prominently feature tangible as well as intangible dimensions; both operate in time frames longer than what society commonly acknowledges, while having to accommodate values and meanings that are highly contextual and variable in time and space.

Our research is framed around the notion of heritage futures which is a novel term, first employed in the context of a major AHRC-funded research project on "Heritage Futures" in which we were involved 2015–2019 (heritage-futures.org). Heritage futures are concerned with the role of heritage in managing the relations between present and future societies, e.g. through anticipation or planning. Since 2017, our research is carried out in the context of a UNESCO Chair on Heritage Futures at Linnaeus University (lnu.se/en/unescochair). We are currently also working in a project "Memory across Generations" funded by VINNOVA (2019–2020).

The lessons we have learned from our work are relevant both for managing nuclear waste and for managing cultural heritage. They can be summarized as follows.

Looking at existing discussions about Records, Knowledge and Memory (RK&M) in the nuclear waste sector illustrates how long-term future planning can be conducted, systematically and thoroughly, in international collaboration and with a multidisciplinary approach. The high level of 'future literacy' evident in the nuclear waste management sector contrasts with the heritage sector that often claims to be working towards the preservation of cultural heritage for the benefit of future generations but in general fails to address the future impact of

heritage management. Moreover, in the heritage sector the risk of future harm, which is a common focus in nuclear waste management, is as important to consider as the risk of missed benefits.

Vice versa, there are implications for managing nuclear waste when we consider this material as a particular case of cultural heritage. Although remains of the past have been appreciated in various ways for thousands of years, cultural heritage in the current sense of the word, linked to cultural identity, museums, legislation and scholarly research is not much older than two centuries and part of the constitution of the modern nation-state. The history of cultural heritage illustrates how the values, meanings and indeed uses of heritage have kept changing even in modern times. It appears that every present has its own past and future. There is a proverb that expresses this insight very pointedly: *Nothing ages faster than the future, and nothing is more difficult to predict than the past.*

In the way we prepare and plan for the future, it is therefore sensible to assume that human futures, and indeed nuclear waste in the future, will be very different from what we currently consider them to be. There is therefore a strong need to learn how to manage continuous change and safe transformation rather than how to maintain continuity and guarantee safe conservation. It is today unclear what it may mean in practice to allow for, and facilitate, continuous development, change and renewal in the context of RK&M related to repositories of nuclear waste.

We need to accept that too many initiatives designed to ensure long-term preservation are failing. Our heritage institutions preserve more than we either have use for ourselves or can be confident that they will be beneficial in the future. Retrospectively, when we look at past intentions and past hopes of preservation they quickly appear to be dated. It emerges very often that ‘the future isn’t what it used to be’. This applies also to the nuclear waste sector where past approaches to RK&M have already been superseded by new ones that are distinctly different. This “messiness of memory” (as Carina Green put it during the workshop, see below) is not surprising to heritage researchers but rather to be expected. We need to explore in much more detail how to work in a long-time perspective through the messiness we encounter in relation to both cultural heritage and nuclear waste.

Further reading

Holtorf, C. and A. Högberg, eds (forthcoming late 2019) *Cultural Heritage and the Future*. London and New York: Routledge. Incl. contributions by Abe Van Luik, Roger Nelson, Marcos Buser.

Holtorf, C. and A. Högberg (2018) Archaeology and the Future. In: C. Smith (ed.) *Encyclopedia of Global Archaeology*. Cham: Springer. Available online: https://doi.org/10.1007/978-3-319-51726-1_2792-1

Holtorf, C. and A. Högberg (2014) Communicating with future generations: what are the benefits of preserving for future generations? Nuclear power and beyond. *European Journal of Post-Classical Archaeologies* 4, 315-330. Open access: http://www.postclassical.it/PCA_vol.4_files/PCA%204_Holtorf-Hogberg-1.pdf

Holtorf, C. and A. Högberg (2014) Open lecture: Future Archaeologies of Nuclear Waste – Experiences and Results. Linnaeus University, Kalmar, 1:15 hrs. Available at: https://play.lnu.se/media/t/0_k7f7iw9i

Palm, Jonas and Lothar Jordan, How to Make Information on Nuclear Waste Sustainable? A Case for the Participation of the UNESCO Memory of the World Programme, in forthcoming book “The UNESCO Memory of the World Programme: Key Aspects and Recent Developments”, Editors: Ray Edmondson, Lothar Jordan and Anca Claudia Prodan, Series Title: Heritage Studies

Schröder, Jantine (2019) *Preservation of Records, Knowledge and Memory (RK&M) Across Generations: Final Report of the RK&M Initiative*. Paris: OECD, Nuclear Energy Agency. [Details to be confirmed soon]

UNESCO Chair on Heritage Futures, see:
<https://lnu.se/en/unescochair>

Heritage Futures Research Project, see:
<https://heritage-futures.org>

1.4 Social Memory: Narrating the past through time and space

Carina Green, *Researcher, Swedish University of Agricultural Sciences*

This paper presents a broad perspective on the phenomenon of memory as it is generally understood in research coming from a social science and humanities position. Memory is a social construction, tightly connected to the present and also to specific cultural and societal contexts. Thus, memory is displayed differently in different human societies throughout time and space.

The messiness of social memory

Memory, as discussed here, is something more than a simple account of things that happened before. Memory is indeed a “messy” business, where past events are constantly re-told, re-interpreted, re-invoked, and re-enacted. Our societies are full of visualizations of narrated memories. Typical examples of this are all the statues in our cities, often demonstrating (male) regents in commemoration of won war battles. There are other visualizations too, of course. Memory is inscribed in buildings, artifacts, walls, parks, etc. (Nora 1989). ‘Things’ are containers of memory. They tell stories, but materiality also create stories and evoke narratives of the past.

It is important to note that there is always a certain amount of power involved in memory processes. The narrative of the past that is re-told, for instance, in books and through teaching are the words of leading elites and are born out of normative viewpoints in society. The past in visual form is displayed to send a message, at times to glorify kings and admirals, to consolidate and confirm certain political agendas, and to form collective identities among people in a certain area (Olick et al 2014). We can also ask ourselves what is *not* part of these narratives. Which past events are consciously or unconsciously forgotten, and why? Whose stories are not re-told? Relationality is in this sense important for memory production. Memory always has a sender and a recipient, whether these are individuals, actor groups or nation states. There are preconceived notions, agendas, past experiences, and particular characteristics of that interaction that shape what is being remembered and in what way it is presented.

Further, memory must be understood as dynamical. What is being remembered, and how, is a process that is constantly changing. Memory is a reflection and manifestation of how the present understands the past and of how the present needs to narrate the past. It is thus

tightly linked to the present itself, and constructed to make sense and meaning of contemporary experiences and happenings. As such, memories are signs of *our* times (Kenny 1999:437). This, of course, does not mean that memory is simply made up or false, but that it is re-told and used in ways that is needed by present-day societies, groups and individuals. Contrasting historical narratives can be told at the same time, at times leading to conflict and animosity among people and countries.

Examples of memory constructions in diverse cultural settings

A contemporary example of the “constructedness” of memory is found within environmental circles. Under the concept of “re-wilding” massive restoration projects are being launched to restore ecological habitats to its natural “wild” state, preferable untouched by humans. Within social science and the humanities, the ideology behind the actual idea of re-wilding has been scrutinized (e. g. Jorgensen 2015). Is it really relevant to set pristine environmental baselines (comp. Hilding-Rydevik et al 2018)? And if so, why would this be more “natural” than a landscape with humans in it? What is really wild? *When* was it wild? The point here is that the re-wilded areas envisioned by supporters of this idea are constructed memories of the past as they visualize it. In the world we live in, with declining biodiversity and the climate change threat, it makes meaning for some to see a past that seemed stable and more ecologically robust. It is a narrative that enacts upon an idea of a past with untouched landscapes in natural balance. There is no doubt that human activities affect the environment, and often to a scale that is detrimental, but the way that the past is remembered and narrated within re-wilding circles tells us more about the present than it does about the past.

Memory, like all other social phenomena, is formed in specific cultural contexts, and differs in time and space. Each culture and each society remembers different things and treats narrations of the past differently, depending on ontological assumptions or perception of time. For instance, in the traditional Maori culture in Aotearoa/New Zealand the divisions between life and non-life, human and non-human are set a bit different from what we are used to (Green 2018). Mountain, for instance, are the manifestation of forefathers and are seen as having personalities and agency. Water contains life-force, just like people or animals. This means that as a human being you interact with these entities in other ways than we normally would. It also means that what is counted as worth remembering and narrating differs from our society. Not only people have voices and stories to tell. The mountains’ and the rivers’ story will be important to bring into narrations of the past, and will make sense to people in the present.

And what about memory and our perception of time? We often take it for granted that time goes from point A to point B, and so on. A linear trajectory that also entails progression in terms of new technology and faster, bigger and better solutions to the endless needs of our society. But a linear time perception is rather culture-specific in time and space. For instance, in Australia, indigenous communities will typically perceive time as a circular motion. Things that happened in the past is more of a parallel reality that can be directly interacted with through ceremonies, for instance. Now and then exists simultaneously. Consequently, and in contrast to our own society, history is not important in the same way. And the idea of preserving and protecting cultural heritage for generations to come is to a certain degree an unfamiliar idea (Green & Turtinen 2016). In a society dominated by a circular time-perspective, memory is understood and used very differently compared to our European societies. Narratives of the past is not so much a recount of old events or lost ways of being

or behaving as they are records of how the world continuously is coming into being, what part humans play and what rules should guide our lives.

Conclusions

Memory is not an objective and neutral account of past events. It is a narrative of a vision of the past that is dependent on relational aspects, power structures, and political agendas. Memory can thus be seen as constructed in specific cultural and societal contexts. It is indeed a “messy” social phenomenon and when analyzing the process of narrating memory we can learn just as much about our present-day situation as we do about the past. We cannot know what ontological assumptions or time perception people in our part of the world will have in the distant future. The only thing we can be sure of is that they will narrate history and construct their memory in such a way that it make sense and meaning in their present.

References

- Green, C. (2018) "Att kombinera olika perspektiv. Maoriskt inflytande på den nyzeeländska naturvården" in *Biodiverse* Nr 2 2018. <http://www.biodiverse.se/articles/att-kombinera-olika-perspektiv-maoriskt-inflytande-pa-den-nyzeelandska-naturvarden/>
- C. Green & J. Turtinen (2016) "Indigenous peoples and World Heritage sites – contested management regimes in Australia, New Zealand and Sweden". In *Sámi Customary Rights in Modern Landscapes*. L. Elenius, C. Allard, C. Sandström (eds). Routledge, New York.
- Hilding-Rydevik, T., Moen, J., Green, C. (2018). "Baselines and the Shifting Baseline Syndrome – Exploring Frames of Reference in Nature Conservation" in *Issues and concepts in historical ecology*. Crumley, C. L., Lennartsson, T. and Westin, A. (red). Cambridge University Press.
- Jørgensen, D. 2015. Rethinking rewilding. *Geoforum* 65:482-488.
- Kenny, M. G. (1999). A place for Memory: the interface between individual and collective history. *Comparative Studies in society and History* 41(3), 420-437.
- Nora, P. (1989). Between Memory and History: Les Lieux de Memoire. *Representations* (26), 7-24.
- Olick, J.K, Vinitzky-Seroussi, V. and Levy, D. (2014). Response to our critics. *Memory Studies* 7(1), 108 –138.

1.5 Local perspective on memory in the context of managing future waste legacies

Anna Bergsten, Östhammars Kommun (municipality)

Bodil Liedberg-Jönsson, Oskarshamn Kommun (municipality)

The municipalities of Östhammar and Oskarshamn have been involved in questions concerning nuclear waste since the 1980's and, through the years, have acquired a great knowledge about nuclear waste issues. In addition, the municipalities have acted as well-functioning arenas for an open and transparent dialogue with the public.

In Sweden, the final decision about licensing a final repository for spent nuclear fuel is taken by the government. However, the municipalities where the waste will be stored or handled have a veto right according to the Swedish environmental law. The license application was first reviewed by the Swedish Radiation Safety Authority and the Land and Environmental Court. In January 2018, both authorities handed over the application and their statements about it to the government who are currently handling the application.

In their statement to the government the Land and Environmental Court point out that conservation of memory and information was found to be of great importance during the hearings under the environmental law and that further investigations are needed before deciding on what measures to be taken for memory and information preservation. Considering the character of the question, the court stated that a trial period for the formulation of the final provisions may be a way forward.

In the Land and Environmental Courts hearing about the licensing for the repository for spent nuclear fuel, the Östhammar municipality stated that the question of preserving memory and information after closure should be kept updated and alive throughout the operational phase of the repository. SKB (the Swedish applicant and implementer) should at regular intervals report to the regulators on the development of techniques and strategies.

Spent nuclear fuel is not the only type of waste that needs to be remembered by coming generations. All over Sweden there exist more than 80 000 sites that are polluted by heavy metals and/or toxic organic compounds. These sites need to be remediated and the polluted material needs to be taken care of and stored in a safe way. In many cases the polluted material will be stored in specifically designated landfills. Heavy metals and persistent organic compounds will not degrade over time and the landfills will remain hazardous and a threat to coming generations. We must not allow them to be forgotten, which may very well become the case if we fail to find robust solutions for memory preservation.

It is of great importance for the municipalities that they are involved in the whole process and contribute local knowledge towards feasible solutions for memory preservation of each long-lived waste landfill or deep repository.

1.6 A memory governance system for storage sites and repositories for radioactive waste: Challenges and possibilities

Johan Swahn, *Swedish NGO Office for Nuclear Waste Review, MKG*

The nuclear era with an activity at a scale large enough to leave a radioactive waste legacy started in the mid 1940s. It remains to be seen if nuclear energy can compete with renewable systems in middle of this century, and thus if nuclear reactors are still operating. It also remains to be seen, on the same time-scale, if the entrenched attachment in some countries to nuclear weapons will continue, requiring operating nuclear weapon production facilities. It is certainly possible, and even desirable, that the nuclear era will end in the second half of this century.

Independently of how long the nuclear era lasts, there will be a considerable resulting radioactive waste legacy stretching for hundreds of thousands of years – more than 5000 generations – into the future. It is important to find a governance system, both on national and international levels, to allow a thoughtful and qualified transfer of knowledge into both the near-term and long-term future about repositories and other storage sites for radioactive waste left behind from the nuclear era.

Remembering the negative waste legacy of the Anthropocene is actually a broader challenge, involving also waste from other industrial processes. However, as radioactive waste management is so well regulated, it is well suited as a sector for efforts to start to develop a memory governance system. Some efforts have been made to put focus on this issue,³ but much more needs to be done. Countries that appear to be closer to implementing repositories for the most long-lived radioactive waste, such as Sweden, Finland and France, still only have rudimentary plans for transferring knowledge about radioactive waste sites to the future. This needs to change.

In this document a discussion from an environmental NGO perspective raises some points on memory governance that can hopefully contribute to the efforts in the field. An important point is that a memory governance is needed irrespective of the chosen path forward for radioactive waste management. The importance of starting early to develop memory governance is also stressed. In addition, an emphasis is put the importance of taking into account scenarios for intentional intrusion into repositories. Finally, some relevant concepts for discussion are presented (rolling stewardship, the dual approach and societal verification).

There is a need for providing information to the future irrespective of the chosen short-term and long-term route for radioactive waste management (RWM)

A memory governance system for transferring knowledge about the waste from the nuclear era is important, either we rapidly start to build repositories for radioactive waste or we hesitate and instead plan for long term “intermediate” storage of the wastes.

It is clear that there are controversies in ongoing decision-making efforts to implement various concepts of geological disposal of spent fuel and other high-level radioactive waste. This is partly based both on a warranted mistrust of long-term techno-scientific safety assessments for geologic repositories at 300–500 m depth in granite, clay, salt or tuft. A well-known

³ There was a focus in the U.S. in the 1990s on the issue of markers to warn future generations of the risks for intrusion into the WIPP final repository for transuranic radioactive waste containing plutonium (<https://wipp.energy.gov/closure-institutional-control.asp>). The OECD/NEA has had a project since 2011 on record-keeping and memory for repositories for radioactive waste (<https://www.oecd-nea.org/rwm/rkm/>).

example is the scientific controversy regarding the long-term integrity of the copper canisters in the Swedish-Finnish method for disposal of spent nuclear fuel.

Opposition to rapidly implementing repository systems for radioactive waste at relatively shallow depths is based on an understanding that such repositories present both an environmental threat and a societal threat to thousands of future generations. The content of the repositories can be released as a result of an incorrect safety assessments or can be accessed by humans unintentionally or intentionally causing health problems and environmental damage.

An alternative to moving ahead and building repositories is to plan for and implement long-term and safe storage systems. These could be operated for hundreds of years until perhaps, sometime in the future, a possibly safe more permanent final management solution can be found. This approach can often allow future decisions for repository implementation to be taken in a decision-making context where nuclear energy is no longer an important part of the energy system. This means that powerful interests in operating (or planned) nuclear power plants has less influence on decisions in a distorting way, possibly allowing a broader choice of ways of moving forward.

In summary, a radioactive waste memory governance is necessary irrespective of the plans for how to proceed with radioactive waste management. This allows both proponents and opponents of rapid implementation of waste repositories to work on the issue. Perhaps even in the same fora.

The development of a memory governance system should start now

Moving ahead to construct possible repositories will in many countries take several generations. Even if implementors in a few countries will be able to get a repository operations license within ten years, almost all of currently existing spent fuel and other high-level waste will by default spend over three generations in interim storage. Interim on- or near-surface storage will for the coming hundred years in many countries become the standard.

We cannot wait until the closure of future repositories, towards the end of this century. The creation of a memory governance system to transfer information to the coming 3 to 4 generations should start now. We see that transfer even to the next generation is already a challenge today.

There needs to be more discussion of intentional intrusion scenarios

There is an international “understanding” documented in IAEA and OECD/NEA texts that present generations do not have to take into account the intentional actions of future generations. This “understanding” has come from discussions between implementors and some regulatory authorities. The main reason could be that it is difficult to put figures regarding this problem into a techno-scientific safety case. But it could also be an understanding that the issue is difficult to deal with and could become problematic to discuss seriously in licensing processes for repositories.

But intentional intrusion into a geologic repository at 300–500 m depth is likely more probable, and can give more dire consequences for health and the environment, than those from the expected deterioration of the repository itself.

There are many possible human threats to the safety of the repository over the long time-scales involved. These have to be taken into account. It is possible that a future society

understands the risks of intrusion, but it is also certainly possible that knowledge about radioactivity will be lower in the future, or even lost.

Learning from archaeological history we know that it is impossible to prevent inquisitive humans from enter the challenging unknown. Myths about treasure or theological content can arise around a repository. We should not underestimate the risk of the repositories becoming a resource base for metals (copper or steel).

There is also a long-term threat from the spent fuel repositories becoming “plutonium mines”.⁴ This threat remains for at least a hundred thousand years. The plutonium in a repository is usable in nuclear explosive devices, the sophistication depending on the technological level of the society. The radioactive waste in itself can also be used in “dirty weapons”.

It is understood that there has to be safeguards and security control for geologic repositories, and storage systems, for as long as there is an existing international safeguard regime. This is important for discussions of memory governance.

The concept of “Rolling Stewardship”

The concept of “Rolling Stewardship” has been proposed by Gordon Edwards of the Canadian Coalition for Nuclear Responsibility as an alternative to the “abandonment” of radioactive waste in repositories after closure.⁵ The main point behind the concept is that we should not plan now to abandon these wastes, but that they should be stored in such a way to allow for the monitoring, retrieval, repair, and repackaging of the waste if and when that is considered necessary.

Rolling Stewardship requires that some institutional body should be in charge of knowing the facts, assessing the needs, and taking action. Thus, society has to grant authority and resources to a body of people, without a conflict of interest, with the necessary resources and authority to carry out these tasks on behalf of society at large, just as we have fire departments and police departments and such.

The importance of culture in keeping memory should not be underestimated. Radioactive waste is not very interesting and something that people want to remember. It is a challenge to keep interest alive.

Rolling Stewardship is not the same as talking about a rolling present. The concept of Rolling Stewardship is proactive and aims at continual improvement of the situation.

The concept of a “Dual Approach”

The concept of a “dual approach” to the safety of geologic repository, as proposed by the waste expert Marcos Buser, implies that the importance of protecting humankind and nature from the content of repositories or storage systems needs to be complemented. It is equally important to protect the repository or storage system from what can be called “anthropogenic

⁴ See for example Johan Swahn, *The Long-Term Nuclear Explosives Predicament: The Final Disposal of Militarily Usable Fissile Material in Nuclear Waste From Nuclear Power and From the Elimination of Nuclear Weapons*, Ph.D. Thesis, Chalmers University of Technology, 1992, (http://www.mkg.se/uploads/The_Long-Term_Nuclear_Explosives_Predicament_-_Johan_Swahn_Chalmers_University_of-Technology_1992.pdf).

⁵ See Gordon Edwards, *Nuclear Waste: Abandonment versus Rolling Stewardship*, (http://www.ccnr.org/Rolling_Stewardship.pdf).

hazards".⁶ The risk that humans destroy the integrity of a repository and thus compromising the safety case is large during the very long time-scales involved. Once the repository is compromised the radioactive waste can be uncontrolled for very long time-scales.

In this context it could be important that any repositories that are perhaps finally implemented are as inaccessible as possible. One way of doing this is to place the radioactive waste at as large depths as possible, for example in deep boreholes.⁷ The deeper the repository the higher technological level is necessary to compromise the repository.

The concept of "Societal Verification"

The concept of "societal verification" was developed as part of efforts in the 1990s to understand how a nuclear-weapons-free world could be verified. An important part of the work was done in the Pugwash movement where Joseph Rotblat played a vital role.⁸ There are many parts of that discussion that has relevance also for discussions of how to keep memory of radioactive waste.

The concept includes citizen reporting and whistle blowing and building up governance to allow citizen involvement in surveillance that can be used also for repositories in an international regime.

In this context it would be appropriate to make sure that there is ease of access to the area above repositories, for example as natural reserves or parks. And why not place national archival activities, i.e., research facilities, on top of repositories?

⁶ See Marcos Buser, Nuclear Waste: How to Handle our Legacy to Future Generations: The dual approach, Lecture held at the the international congress "Human rights, future generations & crimes in the nuclear age", University of Basel, 14-17th September 2017 (http://www.mkg.se/uploads/Marcos_Buser_Nuclear_Waste_-_How_to_Handle_our_Legacy_to%20Future_Generations_-_The_dual_approach_Marcos_Buser_2017.pdf).

⁷ See for example Guido Bracke et al., About the Possibility of Disposal of HLRW in Deep Boreholes in Germany, *Geosciences* 2017, 7, 58

(<https://pdfs.semanticscholar.org/047f/fe325940926e7c12dfbac41688bfccbf8999.pdf>).

⁸ See Joseph Rotblat, *Societal Verification*, 1993 (<http://www.lasg.org/inspections/rotblat-verification.htm>).

1.7 Role of the national archives in Sweden, especially with reference to future legacies

M. Gerber, *National Archives of Sweden*

According to the legislation and government instruction, the National Archives (RA) is a governmental authority that has the special responsibility for governmental archiving and for archival care. Another important assignment is to receive, for long-time preservation, primarily public records from the other governmental agencies as well as records from other types of organizations.

Not all public records will be transferred to RA for long-time preservation. At the agencies there is an appraisal process, governed by RA, where a selection of the records is made for preservation. In the meanwhile, the agencies' archives must be preserved, kept organized and cared for so they fulfil: the right to access public documents, the need for information for the justice and the public administration, and the needs of research. Minor selections of private archives may also be preserved by RA.

Information about radioactive waste are not especially addressed by RA but they may well be preserved as part of public record or as important private records. RA provides also input to the present Committee on Archives (Ku 2017:02). The Committee has stated that important information is created also outside the governmental sector, for example information on nuclear power and the environment, and that the RA should have a clearer responsibility and an expanded assignment concerning that.

The Swedish Radiation Safety Authority (SSM) has issued regulations regarding archives at licensed nuclear facilities (SSMFS 2008:38). There, it is stated that, eventually, all records should be transferred to RA. It is good that measures are taken to preserve these records. According to RA, however, the correct formal procedure is that SSM should require the needed information/records transferred to them, first. They will then become public records, and may be transferred later from SSM to RA.

Concerning the preservation of digital records RA has no time limit set. There are, however, a number of conditions to keep in mind. For instance, even if the information to be preserved is rather voluminous, it should still be available for access at all times, including with high access frequency. The information may also have complex technology. Therefore, a strategy involving mediation between generations has been considered as the main solution. That strategy, among archives called "Migration Strategy", involves coping the data carriers in time due to physical ageing and converting the formats in time, due to new technical generations. With the introduction of the OAIS-standard, Open Archival Information System, ISO 14721:2012, focus has been set to see the preserved records as an information package, consisting of both data and metadata. To be able to better understand the content and the context of the records during long time metadata was categorized. A number of metadata standards has been developed.

The idea that special situations or considerations may require other preservation strategies has sometimes been discussed in RA. In the standards concerning Trusted Digital Repositories, ISO 16363 etc, a stated main presumption is economical resources, which may lack one day due to finance and politics. In such situations an idea could be to make copies of strategic information on a more stable data carrier, for example film, which still may be in digital form.

For a much longer time perspective and for a narrower selection of information solutions like HD-Rosetta have been mentioned, with a data part digital and a metadata part analogue.

1.8 The OECD-NEA RK&M Initiative

Stephan Hotzel, *GRS and Chair of the RK&M initiative*

Profile of the initiative

Geological repositories for radioactive waste are designed to be safe over the periods of time that are necessary to protect mankind and the environment against the effects of ionising radiation. This introduces the issue of maintaining some information and a degree of awareness of these facilities in the future, a challenge that has been discussed repeatedly over the past 50 years. Against the background of increasing demands for international reflection and progress towards viable and shared strategies in this field, the Radioactive Waste Management Committee (RWMC) of the OECD-NEA launched an initiative on the “Preservation of Records, Knowledge and Memory (RK&M) Across Generations”, hereafter “RK&M Initiative”, that ran from March 2011 to April 2018. Twenty-one organisations from 14 countries, representing implementing agencies, regulators, policy makers, R&D institutions, and international and archiving agencies, plus the IAEA, contributed to the work.

Evolutions in thinking

There is a fairly rich literature on the RK&M preservation topic from the 1970s onwards. A literature review early in the project revealed that while several insights from these reports remain valid and relevant today, a comprehensive compilation and discussion of the diverse aspects of RK&M preservation was missing. Furthermore, it had to be noted that most sources deal with either RK&M preservation for short-term, primarily operational purposes, or RK&M preservation aimed at notifying society in a very distant future, sometimes with very bold ideas. Few documents attempt to cover both areas of interest, or to bridge them, or address explicitly the intermediate timescales of a few centuries after closure of a repository. The RK&M Initiative filled these gaps by focussing on both,

- to develop a theoretically founded, broad-based understanding of the issue at stake and
- to develop a practice-oriented toolbox of concrete RK&M preservation for all relevant timescales.

In the past, RK&M preservation efforts were mainly directed at avoiding inadvertent human intrusion through messages and methods focusing on danger and promoting aversion. Although deterring potential intruders remains a valid goal, it was found that this should rather be achieved by supporting an informed and alert attitude towards the required levels of safety, security and societal accordance. More generally, supporting informed decision-making in the future – including the decision to access the repository and the waste it contains – was identified as an integral part of responsible radioactive waste management. This is in line with recent recommendations issued by the International Commission on Radiological Protection (ICRP), as well as with a prudent approach to safety and a conscious attitude to ethics.

Project outcomes

The scope of the RK&M Initiative is encapsulated in how, through RK&M preservation, it may be possible to reduce the likelihood of inadvertent human intrusion, and to support the

capacities of future members of society to make their own informed decisions regarding a radioactive waste repository after closure. These aims were addressed in 3 defined time frames, related to the anticipated level of human oversight:

- short term – until closure of the facility, with full oversight;
- medium term – after closure, for as long as oversight is exercised; and
- long term – after closure, when oversight is lost.

The project also took into account two parallel strategies: mediated transmission, in which the message/record is passed on from one generation to another, and non-mediated transmission, in which the message/record is developed to be delivered directly and in its original format from the present time to the future receiver.

The two purposes of RK&M preservation – preventing future generations from unnecessary interference with the repository and supporting future decision making – imply two different tasks. The first requires maintaining awareness of the repository, whereas the second requires preserving detailed knowledge of the repository. Clearly, different levels of detail and complexity are needed.

The project has concluded that there is no single mechanism or technique that, by itself, is likely to achieve the preservation of RK&M over all timescales. Rather, an integrated set of technical, administrative and societal mechanisms is needed, using both mediated and non-mediated transmission, which increases the survivability of a recognisable message. The RK&M Initiative refers to this philosophy as a “systemic strategy of RK&M preservation”.

The project has created a toolbox that consists of a set of 9 “approaches”, comprised of a set of 35 “mechanisms”. Each of these is described in a comprehensive, structured, and standardised format, highlighting its individual characteristics, such as the target timescale, the transmission mode, the level of detail, the geographical scope, the type of media used, and the actors involved. The interconnectedness of the RK&M preservation approaches and mechanisms as well as the diversity of their characteristics would be important elements of any systemic strategy.

Output

The RK&M Initiative was concluded with five final deliverables: the overarching results, including the toolbox, being reported in the “Final report of the RK&M Initiative”. Two other reports go into detail of the specific RK&M preservation mechanisms that have been developed by the initiative: The Key Information File (KIF) concept, and the Set of Essential Records (SER) concept. Finally, the RK&M “Reference Bibliography” and the “Catalogue of Legislation, Regulation and Guidance Governing the Preservation of RK&M for Radioactive Waste Repositories” are reference and supporting products, containing publications and regulation created over the past decades up until 2018. The project’s website, where all deliverables are (or will be soon) downloadable as PDF reports, is www.oecd-nea.org/rwm/rkm.

The Final report constitutes a general guide to the RK&M preservation topic, without value judgements but with the toolbox compiling what can be done. None of the reports is prescriptive. Rather, these publications are meant to provide a basis for the necessary discussions and eventual decisions on the implementation of RK&M preservation strategies in a national context.

Outlook

As of May 2019, a follow-up initiative, “Information, Data, Knowledge Management (IDKM)”, has been launched by the NEA Radioactive Waste Management Committee with a scoping, kick-off meeting being foreseen for late 2019. Amongst others, it is planned to continue international harmonisation and co-operation in the field of RK&M preservation, gradually shifting the focus towards implementation and exchange of experiences.

1.9 Information and knowledge preservation over generations in the Swedish regulatory context for radioactive waste and other long-lived waste

Carl-Henrik Pettersson, *Swedish Radiation Safety Authority (SSM)*

The internationally-agreed strategy for long-term management of radioactive waste is to isolate and contain such materials, in order to prevent or control the release and dispersion of radioactive substances. The aim is to ensure that the hazard is kept away from the biosphere for as long as possible. A consequence of isolating and concentrating the waste, rather than diluting and dispersing it, is that inadvertent disturbance may occur as a result of future human actions, which in turn may result in exposures to radioactive materials and/or their release to the environment. This means that the acceptance of a repository for radioactive waste, or indeed any other long-term storage arrangement, also involves the acceptance of a certain risk of potentially high doses in connection with future inadvertent human intrusion. Such risks, however, can be reduced through repository design, site selection and RK&M preservation.

Information and knowledge preservation

In the governmental ordinance specifying general instructions for SSM (SFS 2008:452) it is stated that the Authority shall contribute towards the development of national competence for the needs of today and tomorrow within the Authority’s area of operation. This includes activities concerning the disposal of nuclear material and nuclear waste.

The regulatory framework in Sweden supporting RK&M preservation is composed of regulations formulated by the Swedish Radiation Safety Authority (SSM) and the National Archives. SSM’s regulations are mainly concerned with the handling and preservation of records for as long as a licensed nuclear activity is conducted at the facility. A general advice on the application of the regulation SSMFS 2008:37, relating to the final management of spent nuclear fuel and nuclear waste, states that:

[...] consideration should also be given to the possibility to reduce the probability and consequences of inadvertent future human impact on the repository, for instance inadvertent intrusion. Increased repository depth and avoidance of sites with extractable mineral assets may, for instance, be considered to reduce the probability of unintentional human intrusion. Preservation of knowledge about the repository could reduce the risk of future human impact. A strategy for preservation of information should be produced so that measures can be undertaken before closure of the repository. Examples of information that should be taken into consideration include information about the location of the repository, its content of radioactive substances and its design.

This is consistent with the first paragraph in Article 17⁹ of the IAEA Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

SSM has also issued regulations and guidelines regarding requirements for proper filing, archiving and long-term preservation of records from licensed nuclear facilities (SSMFS 2008:38). This regulation gives general guidelines regarding document selection and for how long certain documents should be saved in the archives. Furthermore, SSMFS 2008:38 refers to regulations published in the statutes of the Swedish National Archives (Riksarkivet, RA). RA's regulations mainly concern the proper handling of documents, on paper and electronic media, as well as the construction and maintenance of archives for ensuring the longevity of records.

Hence, there are some existing relevant guidelines and regulations in Sweden relating to *what* kind of information should be passed on to future generations, i.e. the location, content and design of a repository, and *where* this information should be preserved, i.e. archived. This kind of information is consistent with one of the NEA's RK&M project deliverables, the so-called *key information file* (KIF), which provides a very condensed record of a repository and the activities that occurred at the facility, addressed to a non-expert audience. The intention is that such information should support preservation of the memory of the repository and the hazard it represents and thereby reduce the possibility that inadvertent intrusion might occur. There are other repository records that have other purposes, i.e. not only dedicated to preserving the memory of the repository's existence. An example of this is the *set of essential records* (SER), another deliverable from the RK&M project, the intent of which is to provide future generations with the tools and information needed to undertake their own safety assessment or, depending on decisions made at that time, to safely retrieve deposited material. Such information is therefore addressed to a technical audience.

Since the implementing organisation responsible for geological disposal has produced the underlying information, they should also be responsible for creating the repository records, for instance KIF and SER. If specific regulatory requirements are developed in this area, the responsible authority will need to review the information for compliance with regulatory requirements.

Transfer of Responsibilities after Repository Closure

For as long as the site of a long-term waste management facility is under institutional control, a successive transfer of information and knowledge across generations can, at least potentially, persist. After closure of a repository, even if there is no licensed operator for the facility, the institutional control will continue, but there might be a transfer of responsibilities. This handover of responsibilities imposes a risk of losing information and knowledge. Considering the amount of information and knowledge, this handover of responsibilities is a challenge, which needs to be addressed. As a ratified party to IAEA Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, Sweden is obliged to "*reaffirm that the ultimate responsibility for ensuring the safety of spent fuel and radioactive waste management rests with the State*". Clarification of the process for

⁹ Article 17. Institutional measures after closure

Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:

- (1) records of the location, design and inventory of that facility required by the regulatory body are preserved;
- (2) active or passive institutional controls such as monitoring or access restrictions are carried out, if required;
- (3) if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.

any transfer of responsibility at final closure is important for the continued planning of responsibilities of information and knowledge preservations in the longer term. An important step in this process, addressed in the recent government official report on potential updating of the Law on Nuclear Activities, is to clarify post-closure responsibility and its relationship to licensee responsibilities, (see below)

When the post-closure responsibility is determined, another question is *who* should be responsible. It's not *per se* necessary that the regulating authority to the previous licensing body should shoulder the long-term responsibility. One example how it's assured that post-closure responsibilities are met for sites containing long-lived hazardous wastes is the establishment of the Office of Legacy Management (LM)¹⁰ in U.S. Department of Energy. LM were establishment in 2003 to meet a growing concern that even after remediating and closure of sites contaminated with radioactive and hazardous waste, many of these sites would still pose a risk to human health and the environment. LM's mission statement is: "*Fulfill the Department of Energy's post-closure responsibilities and ensure the future protection of human health and the environment.*" To achieve this mission, the LM have several guiding functions including:

- *Protects human health and the environment through effective and efficient long-term surveillance and maintenance.*
- *Preserves, protects, and makes accessible legacy records and information.*

Thus, there are experiences with the post-closure responsibilities at sites contaminated with radioactive waste. What are the good practices to keep in mind?

The broader Swedish regulatory context

The focus of this text has been on the regulatory framework for the preservation of records, knowledge and memory regarding repositories for radioactive waste. However, RK&M preservation over generations is similarly important at other disposal sites containing, for example, non-radioactive, long-lived hazardous wastes or potential injection sites for carbon dioxide storage. For example, a Swedish government official report regarding geological repositories for long-lived hazardous non-radioactive wastes, predominantly mercury and mercury-tainted waste, states that such a facility should be designed and localised with the aim of decreasing the possibility of future inadvertent human intrusion. In addition, the documentation regarding the facility's location, design and inventory needs to be preserved. Such guidance is very similar to that given in SSM's regulations for the final management of spent nuclear fuel and nuclear waste, highlighted earlier.

Thus, a range of different actors, such as policy makers, regulators, implementers, environmental groups, local communities, researchers etc., have a common interest that would benefit from a holistic and systematic approach to RK&M preservation. Preparation of regulations that support RK&M preservation therefore needs to be coordinated between many actors working in different fields of safety and environmental protection. Consideration also needs to be given to on which level specific regulations relating to RK&M preservation could be developed with regard to frame law, supplementary ordinances and administrative provisions that would define the regulatory guidance (frame law). The first step towards a holistic and systematic approach would be to identify the key actors in developing regulatory

¹⁰ U.S. Department of Energy, Office of Legacy Management: <https://www.energy.gov/lm/office-legacy-management>

guidance on RK&M preservation regarding disposal sites containing long-lived hazardous wastes. What other waste categories need to have a long-term preservation strategy of records and knowledge for future generations, i.e., what other waste categories falls under the ethical principle of avoiding an undue burden on future generations?

Conclusions

Regulatory guidance regarding obligations in relation to the preservation of records, knowledge and memory relating to a geological disposal facility should encompass *what* measures needs to be taken, *when* then should be taken and *who* should implement them for the period of indirect oversight. An important step in this process, addressed in the recent government official report on potential updating of the Law on Nuclear Activities (SOU 2019:16), is to clarify post-closure responsibility and its relationship to licensee responsibilities. The RK&M project has highlighted a multidisciplinary and participatory process as a key factor for RK&M preservation. The creation of a regulatory framework to support RK&M preservation is no exception to this. Several questions have been raised in the text that will need to be addressed through such a participatory process in continued work relating to the definition and implementation of a national legal framework to support long-term RK&M preservation. One recurring practical question is how to identify and involve different actors in this implementation process, considering similar concerns for long-term safety and environmental protection related to other forms of waste disposal.

Selected references

SSMFS 2008:37, The Swedish Radiation Safety Authority's Regulations and General Advice Concerning the Protection of Human Health and the Environment in Connection with the Final Management of Spent Nuclear Fuel and Nuclear Waste.

AEA (1997). The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. GOV/INF/821-GC(41)/INF/12. International Atomic Energy Agency, IAEA, Vienna.

OECD/NEA: "Preservation of Records, Knowledge and Memory (RK&M) Across Generations: Final Report of the RK&M Initiative", OECD Nuclear Energy Agency, Paris, in press.

1.10 Recent perspectives on legislation in Sweden – Proposal for a new Nuclear Technology Act

Gábor Szendrő, *Ministry of Environment (Inquiry Chair)*

On 1st of April 2019, an Inquiry authorized by the Swedish Government delivered a report (SOU 2019:16) on a new Nuclear Technology Act. A summary of the key proposals is presented below.

The responsibilities of licence holders and operators are clarified

The inquiry proposes clarification of the operator's long-term responsibility for the decommissioning of nuclear facilities and the management and disposal of spent nuclear fuel and nuclear waste, and the licence holder's responsibility for the safety of nuclear facilities and activities. The proposal also clarifies that delegation of licensee responsibility is not allowed.

A formal stepwise licensing process is introduced

The inquiry proposes that a stepwise process for the licensing of nuclear operations or facilities is to be introduced in the new act, which until now had its legal basis in the licence conditions stipulated by the licensing authority (the Government). The licence conditions usually state that the licensee is not allowed to begin construction, commence test operation, or commercially operate the nuclear facility or begin decommissioning activities until the regulatory authority has given its approval.

Subsidiary responsibility and ultimate responsibility of the State

The inquiry proposes that the State's subsidiary responsibility for nuclear activities, which ensues from international commitments, should be laid down in the act. Moreover, the inquiry proposes introduction of provisions clarifying that the long-term responsibility for a geological repository for spent nuclear fuel or radioactive waste, once it has been sealed, shall rest with the State (ultimate responsibility of the State). Furthermore, the Inquiry proposes a license obligation for sealing of a repository.

Permanently closed nuclear power reactors

The inquiry proposes introduction of an obligation requiring the licence holder to notify the authorities when a decision has been made to permanently shut down a nuclear power reactor. A formal notification should also be made when all nuclear fuel (nuclear material under safeguards) has been removed from the permanently shut down nuclear power reactor.

Nuclear waste

The inquiry proposes harmonisation of the concept of nuclear waste with the definition of radioactive waste contained in the Radiation Protection Act. Thus, nuclear waste becomes a subset of what is defined as radioactive waste.

Research and development responsibility for waste management

The inquiry proposes that the obligation to set up a comprehensive research and development programme as needed for the safe management and disposal of spent nuclear fuel and radioactive waste should only cover parts of the planned system for which a licence has not been granted.

1.11 Panel Discussion – Main Points

The Panel discussion was facilitated by Pelle Zettersten from the Swedish Radiation Safety Authority (SSM). The panelists consisted of:

Claudio Pescatore	– Researcher at Linnaeus University and independent consultant
Cornelius Holtorf	– Prof. in Archaeology at Linnaeus University
Anders Högberg	– Prof. in Archaeology at Linnaeus University
Carina Green	– Swedish Biodiversity Centre, a part of the Swedish University of agricultural Sciences
Anna Bergsten	– Östhammar municipality
Bodil Liedberg-Jönsson	– Oskarshamn municipality
Johan Swahn	– Swedish NGO office for nuclear waste review (MKG)
Magnus Geber	– Swedish National Archives
Stephan Hotzel	– Scientist at GRS, Global research for safety, Germany, and Chair of the OECD/NEA Initiative on Records, knowledge and Memory across Generations
Carl-Henrik Pettersson	– Swedish Radiation Safety Authority (SSM)
Gabor Szendrő	– Ministry of the Environment

One of the issues that were discussed was what information from the past is possible to understand. The role of archives, both national and in the municipalities, was highlighted, as well as time capsules as a complementary methodology for a robust information transfer strategy.

The long period of time for safe final disposal was highlighted. Different parts of the world have different ways to perceive time, which can affect how one looks at heritage.

Linked to the time aspect, the idea of a rolling stewardship was raised. Would this be a more sustainable solution for radioactive waste management than the current final disposal strategy?

Another issue that was discussed was the ultimate responsibility for the nuclear waste. In Sweden the responsibility until the closure of the repository lies with the waste company (SKB), owned by the nuclear power companies.

The importance of taking a broader perspective was emphasized. When it comes to RK&M preservation, we should remind society to think broader than radioactive waste and include other categories legacy wastes. There is still a need to continue international cooperation.

One point made by the audience was that the nuclear power companies should have attended this conference as the entities responsible for producing the waste. On the other hand, SKB, which is a subsidiary of the nuclear power companies was present.

Finally, it was pointed out that the main conclusions from the RK&M-report of the OECD/NEA are now in the hands of the readers. It's time to draw practical conclusions and make a strategy.

CHAPTER 2 – SUMMARIES OF DISCUSSIONS OF FOUR THEMES

2.1 Theme 1: Sustainable development and information-and-memory preservation

Claudio Pescatore and Johan Swahn, Facilitators

The discussion of this theme by two separate groups followed very closely the questions that had been proposed. The discussion is thus reported in a Q&A format.

1. *Do we agree that making an effort to enable future generations to make their own informed decisions can be a principle for sustainable development? Is this principle already supported in sustainable development literature?*
 - That future generations are given the means – as much as possible – to make their own informed decisions is part of the logic of sustainable development.
 - It turns out that UN Sustainable Developments goals described in Agenda 2030 are lacking in terms of future perspectives .
 - Goal 16 is now being revised. It could be checked if we could help.
- *Can we cite accepted ethical principles that support this long-term information duty principle?*
 - The Aarhus Convention¹¹ does support this duty of information principle in its Art 1.
 - It is not clear that countries are progressing in this area.
 - In Latin America there is an equivalent to the Aarhus Convention.
 - The International Council of Archives has compatible wording in their mandate.
 - Euratom talks of no undue burden to future generations. The same wording is present in the Joint Convention.
- *If it has not, why has this principle not been generally recognized as a principle for sustainable development up to now?*
 - It is not clear why. It is a fact that the rolling present approach is the default approach.
 - There is need of research into why this principle is not recognized more strongly.
 - When it comes to radioactive waste, there is still discussion and even promotion, in some circles, that it may be best to abandon and forget repositories instead of remembering them.
 - There also is risk minimisation to be considered as an ethical principle. Informing the future brings risks (of intrusion), which is a dilemma.

¹¹ Convention on access to information, public participation in decision-making and access to justice in environmental matters, Aarhus, 1998:

<http://www.unece.org/fileadmin/DAM/env/pp/documents/cep43e.pdf>

- In research and in implementation we should be aware of the issue on not wanting to flip the past into the future. We should not think of a future in our image.

2. *Should this principle be formalised in legislation?*

- Yes, but at high level rather than being too specific. A generic formulation may be “we want to maintain the sustainability of informed decisions”.
- It is best if an international legal instrument demands it.
- Perhaps the issue of memory keeping may be connected to the precautionary principle? The latter is mentioned in many environmental legislations.
- The issue of memory keeping is consubstantial to the “concentrate and contain” strategy. In other words, having opted for the “concentrate and contain” strategy, formulating a RK&M preservation strategy for future generations becomes a must.
- In any event we should not wait for legislation, we should take the lead now.

3. *In the specific case of environmental safety and (physical) security legacies:*

- *Do we agree with the recommendation to maintain oversight of any long-term legacy for as long as practicable?*
 - There is strong agreement with this position. We should try not to forget.
 - One way of maintaining oversight is a system of “Rolling Stewardship”. Another way is working with “living legacies”.
 - It is important to start the process early; informing the present of dangers is needed to allow creation of memory.
- *What are examples of environmental safety legacies?*
 - Radioactive waste storage/repositories
 - Environmental remediation areas
 - Chemo-toxic storage/repositories
 - Carbon segregation and storage
 - Sites collecting hazardous waste
 - Sunken ships with toxic waste in the ocean
 - Plastics in Nature
 - Pesticides in soils
 - CO₂; NO_x; SO_x
- *What are examples of (physical) security legacies?*
 - Plutonium stocks in spent fuel that may be used for nuclear weapons for a hundred thousand years.
 - Radioactive and toxic and bio-toxic materials that may be used for malevolent purposes.

4. *Is it a shared view that any strategy for the preservation of oversight (records, knowledge and memory, RK&M) should integrate the possibility of discontinuities in the future?*

- There is agreement that there should be a two-legged approach addressing continuity and discontinuity in society.
 - A philosophy meeting in Goteborg a few years ago came to the same conclusions.
- Geological repositories provide a way to deal with discontinuities in society.
- Monitoring is part of oversight; monitoring is also a way to keep up confidence and memory; monitoring will take place under a variety of frameworks, both from within and from outside the radioactive waste area.
- A “Rolling Stewardship” approach can reinforce memory keeping.
- Oversight ought to be a national task rather than an international one.

- *Who will bear costs?*
 - When it comes to memory preservation, the reliability of the current “rolling present” approach has decreasing value with time. Other complementary approaches need to be employed if reliability of oversight is to be kept high.
 - We need to know/define the minimum expectations of what is being offered, e.g., in the collection of records.
 - Varying levels of oversight may be used/foreseen depending on the time scales.

2.2 Theme 2: Law and Regulation and long-term responsibilities on preservation of memory in society

Carl-Henrik Pettersson and Annika Bratt, Facilitators

This text is a summary of the major points made during the discussions of Theme 2 categorized into four groups. Namely:

- The broader Swedish regulatory context
- Updating law, ordinances or regulation
- Responsibilities for providing oversight
- Centralizing the post-closure responsibilities

The broader Swedish regulatory context

There was broad agreement that, as far as RK&M preservation is concerned, the regulatory framework should encompass all types of long-lived hazardous wastes, which includes but goes beyond radioactive waste. Of essence is the longevity of the hazard and the need to protect the biosphere.

- An inventory or chart is needed of the different types of long-lived wastes and their volumes.
- Different disposal sites or methods may need different RK&M preservation strategies.

Updating law, ordinances or regulation

The general opinion was that the current regulatory framework needs to be updated regarding RK&M preservation. The opinion differed, however, regarding the extent or depth of the changes.

- Legislation should be at a high level. More practical requirements concerning oversight should be addressed within ordinances and regulation.
- It will take time to update the law. We should expect general advice.
 - If the reflection concerning other waste is less advanced than for radioactive waste should the latter not be taken as an example and show the way?

It was emphasized that we should learn from the previous work in formulating regulations, i.e. USA (WIPP). Regulations should allow for the multidimensionality of the RK&M preservation. For instance, the existing laws in Sweden demand that the accessible surface on top of the geological repository area should be fully restored. On the other hand, parts of the accessible surface area could be left as a marker, which, one day, might even become or be developed as cultural heritage. This in line with the idea of integrating different approaches for RK&M preservation

Responsibilities for providing oversight

The importance of clarifying the responsibilities was emphasized. The implementer needs to develop and prepare for the period of indirect oversight. This needs to be coordinated with the regulating body. This could be done in a stepwise process until the closure of the facility.

- Guided by regulations
- Guided through the R&D process

The local community has an important role when it comes to taking decisions and it needs to be involved in the process of preparing for the period of indirect oversight.

Centralizing the post-closure responsibilities

Different views were expressed:

- There were both pro and contrary opinions concerning whether to centralize the responsibility for waste from past legacies. Also, it appears that not all share the same image of what it means to centralize the post-closure responsibilities.
- All in one institution makes it more efficient but also more vulnerable. A combination of both?
- One central organization for RK&M preservation would underline the importance of the issue.
- Does it have to be a new organization or could it be part of several existing ones? How would they and should they co-ordinate?
- Could there be an international component? Could it not include other wastes than nuclear?
- Need to have information at several places.
- Naturvårdsverket (the Swedish Environmental Protection Agency) have the responsibility for the coordination of investigations and measures for contaminated soil in Sweden involving the regional level. Should EPA be more involved in the radioactive waste question?

2.3 Theme 3: Role of actors vis-à-vis the future

Sofie Tunbrant and Erik Setzman, Facilitators

The discussion went beyond the questions that were proposed for discussion.

Overarching conclusions regarding the role of actors were as follows:

- It is desirable to have one Authority with overall coordinating responsibility. Namely, an “oversight or legacy waste management authority”. This coordinating actor has to be “independent”.
- A structured system, a strategy and long-term independent, sustainable funding are of the essence.

Regarding the coordinating authority, it was noted that, according to upcoming legislation in Sweden, it is expected that the responsibility for radioactive waste after closure of the repositories will be transferred to the State. The State could initiate work now, in view of the responsibility to come. The Government can decide what actors are involved.

A summary of ongoing or desired actors and roles is as follows:

- Municipalities – physical planning handles quite a lot of information (e.g. on land use), possible use of local archives and storytelling tradition, rituals and events.
- National Archives – documents are kept forever to allow “re-remembering”.
- Implementers/Waste Agencies – SKB starts to implement “SER thinking” (sorting documents to find a Set of Essential Records); evaluate possibilities to leave traces of the disposal facilities and actions that led to them.
- National Heritage Board or a specific regulator/authority for memory – remembering the era of nuclear power connects to remembering radioactive waste.
- International organisations – IAEA, UNESCO or perhaps something more long-lasting and persistent like the Catholic church tradition of rituals or other religions.
- NGOs – engage people and circulate information.
- Other actors than the institutional ones are also needed as complements or redundancy – Local history and heritage associations, private initiatives like Memory of Mankind, etc.

Bequeathing responsibilities on private companies was questioned due their possibly rather-limited duration. An open, democratic and transparent process including the host municipalities and involving the locals with participation of the public is essential in preparing for preservation of records knowledge and memory.

In discussion, the following points were also made

- Forgetting or ignorance is not only a historical problem.
- Metadata collection and documentation as well as correct labelling now are of great importance.
- Do we want to remember? Maybe not, but we need to. It is not possible to hide the existence of waste repositories and polluted land. Somebody will always discover them at one time.

- Besides repositories for radioactive waste, RK&M preservation should include environmental legacies from other forms of hazardous waste disposal, contaminated soil, as well as cultural heritage, which is what this workshop was intended to be about.
- The connection to the area of remediation may make it interesting for other municipalities to be a part of the process.
- There is a strong relationship between the preservation of RK&M for future generations and sustainable development.
- SKB should use the funds from the Nuclear Waste Fund for the work on RK&M preservation for repositories for radioactive waste. The financial law and ordinance need to be checked for possibilities or barriers to do that. How is this connected to the polluter pays principle? The latter stipulates that funds have to be set aside to take care of potential future consequences.
- The local municipality has great power, but financing is crucial. Work is already in progress on “what is the future” (Östhammar and Oskarshamn).
- The fact that we are sitting together today discussing these issues, shows that there is awareness among many different actors regarding the challenge of transferring information concerning environmental legacies.

2.4 Theme 4: The significance of cross-sectoral collaboration and partnership in managing societal challenges

Cornelius Holtorf and Anders Högberg, Facilitators

Many societal challenges are complex and require not only a wide range of competences but also involve many different stakeholders: from local communities to politicians to expert authorities and policy-makers to professional specialists in various fields.¹² Preserving records, knowledge and memory across generations is one such challenge requiring cross-sectoral collaboration and partnerships. In this session, we began to develop a shared knowledge base of cross-sectoral collaboration and partnerships that are suitable to meet societal challenges. We did so by discussing the participants’ varied experiences, which included lessons from collaborations and partnerships between different public, public-private and civil society collaborators. Participants were asked to contribute their knowledge of relevant experiences or existing studies or examples from which all could draw lessons and inspiration. Both groups started with a round-the-table on experiences of collaboration. Many examples were given. Although not all examples were cross-sectoral, many had proven to be effective for solving complex professional tasks and were very rewarding to those involved.

The discussion was then focused on two main issues:

- How can cross-sectoral collaborations be brought about?
- How do we manage the specific strengths and weaknesses of collaborations with different partners?

The main suggestions included:

- How can collaborations be brought about?

¹² The UN’s Sustainable Development Goals are a good example for complex issues and aspirations that need to be tackled in long-term collaboration across sectors and countries, see: <https://sustainabledevelopment.un.org/sdgs>

- a. provide opportunities for the right people to meet (even 'forced' collaborations can work)
 - b. invest time to get to know each other in various ways in order to develop trust
 - c. identify each other's needs, ambitions, and roles
 - d. establish common goals
 - e. practice transparency and openness
 - f. share power and ownership of the collaboration and its outcomes
 - g. 'co-produce' at all levels
- Which problems with collaboration must not be ignored?
 - a. limited resources
 - b. lack of mandate
 - c. very strong views, lack of flexibility
 - d. power relations are important and mutual dependencies must not be allowed to weaken the integrity of individual partners and thus jeopardize the collaboration as a whole
 - e. partnerships may become too tight and opinions too similar so that each other's roles and contributions suffer (maintain some distance)
 - f. perceived exclusivity by outsiders (keep loose edges)
 - g. ask whether the collaborations we enjoy the most, and which we therefore practice most, are also the collaborations we need the most

General advice was:

- a. whatever happens, always keep talking to your collaborators
- b. agree to a plan and timetable, and follow it
- c. don't become rivals and compete for the same resources
- d. good leadership is essential

The participants were then asked if they agreed with the following statements in relation to information and memory for future decision making regarding nuclear waste and beyond. Namely,

- a. *Synergies should be sought with other societal institutions and international bodies.*
- b. *There are important benefits to be gained from partnerships and collaborations between different players and sectors in society.*
- c. *Synergies and lessons to be learned should be sought wider than just the specific legacy of concern.*

All agreed in principle with the three statements, with the reservation that "partnerships" may involve closer collaboration than may be beneficial and that, therefore, this term should be removed.

CHAPTER 3 – THE UPDATED CHART OF GUIDING PRINCIPLES AND PRACTICAL GOALS TOWARDS PRESERVING RECORDS, KNOWLEDGE AND MEMORY FOR FUTURE GENERATIONS

All participants, in plenary, discussed and commented on the draft chart of guiding principles and practical goals that had been distributed ahead of the workshop. Claudio Pescatore acted as facilitator. By and large, the participants adhered to the proposed chart.

Soon after the workshop, the organizing committee implemented the feedback that was received and updated the original chart. Hereafter are the updated chart of guiding principles and practical goals towards preserving RK&M for future generations for long-lived legacies ranging from hazardous waste deposits to cultural heritage.

Preamble

As expressed in the 1997 UNESCO Declaration on the Responsibilities of the Present Generations Towards Future Generations, *“the present generations have the responsibility of ensuring that the needs and interests of present and future generations are fully safeguarded”*. That is why we are concerned with sustainable development and with the environmental and other impacts of the legacies we leave behind. Legacies vary broadly, from hazardous waste deposits to cultural heritage. Radioactive waste is an iconic example. By striving to maintain and provide access to records as well as to allow knowledge to persist or be reconstituted if lost, and by propagating the memory of these legacies we will fulfil our responsibility to enable future members of society to make knowledgeable decisions. Our responsibility extends over centuries and millennia, for as long as these legacies will last.

The present chart of guiding principles and practical goals is meant to provide a foundation for future work in the area of preservation of Records, Knowledge and Memory (RK&M) for the wellbeing of future generations.

Principles

- Enabling future members of society to make knowledgeable decisions is part of responsible, ethically sound management of environmental and other impacts of the legacies we leave behind.
- The relevant institutions should plan for continuing oversight. This is also in line with a prudent approach for protecting health and safety.
- Any strategy for the preservation of RK&M should integrate the possibility of a future disruption of the foreseen methods of transmission. The intention should be to regain oversight, in case oversight was lost.

Practical Goals

- Institutional and non-institutional players should determine and communicate their role in preserving RK&M and take relevant, coordinated actions. Law identifies roles and goals, and regulation guides practice.

- Preparing for future RK&M preservation is best addressed while a project leading to a legacy is being planned, designed, implemented and funded.
 - The long operational phase of some of these projects creates opportunities for the development of inclusive and workable RK&M strategies.
 - During the operational phase, the institutional stakeholders can facilitate the preparation and implementation of archives; administrative restrictions on land use; regular reporting by governments under one or more international mechanisms or agreements, etc.
 - Throughout the operational phase institutional stakeholders must prepare for any stage when their own roles will be reduced and responsibilities will be transferred to others. Responsibilities at the end of operations should be determined ahead of time.
- There is no single means of RK&M preservation over all timescales. All available communication channels should be explored and a number retained for a workable preservation strategy.
 - RK&M preservation approaches should include provisions for knowledge reconstruction and for providing information to future generations with and without requiring the involvement of intermediate generations.
 - Records will be used mostly by future members of society and attention should be given to the needs of these users in terms of facilitating readability and intelligibility, providing, in particular, relevant information on the context in which the legacy and the records were created.
 - The various components of the RK&M system should apply robust, simple and understandable techniques and support materials, and should not rely on technological provisions alone.
 - Common cause loss should be prevented. Robustness will be increased by regular reviews and updates.
 - Overall, a multi-faceted approach should be formulated for the RK&M preservation of each project whereby the various components of the RK&M system complement one another, provide for redundancy and maximize the chances of survival of a recognizable and comprehensible message.
- Collaborations with other bodies in various sectors in society, both nationally and internationally, provide important benefits.
 - Continuous knowledge exchange and synergies should be sought across disciplines and wider than just the specific legacy of concern.
 - Broader strategies and agreements are likely to survive beyond any operational phase and can thus contribute to RK&M preservation.
 - The robustness of national strategies will be increased if they incorporate an international component. A concerted methodology at the international level may be helpful.

CHAPTER 4 – PERSPECTIVES ON THE WORKSHOP

4.1 A journalist's perspective

Tobias Svanelid, *Journalist*

According to Claudio Pescatore, “We, as a species, don’t think about the future”. Perhaps then, we should search in the history for clues on moving forward in this nuclear age.

My own early memories of nuclear power and radioactive hazards are ambivalent. On the one hand I remember taking part as a four-year-old in the protests against nuclear power in Sweden in 1980. On the other hand, I remember having a lot of fun playing the iconic Swedish role-playing game MUTANT in 1985, wandering the radioactive wasteland of Sweden in the form of a mutated moose or lynx in a not so distant future.

My more recent involvement in the questions around nuclear waste disposal and risk communication stems from a radio show in 2017 where a catchy song told the audience about the ray cats and the atomic priesthood¹³. These fantastic solutions to the waste management dilemma still catch people’s attention and might be considered useful in communicating information about and memory of the topic at hand. The “Disneyfication” of nuclear waste might be another way of communicating risk and heritage, just like the heritage questions of the now-ruined Notre Dame need to take into account Disney’s and Hugo’s versions of the cathedral. Nuclear waste management might want to consider popular conceptions – be it ray cats or mutant moose.

We can approach memory cultures from different angles. Just as is the case with the cultural memories of Auschwitz and of Hiroshima – the first “we must never forget”, the second “we can never allow to happen again”. The cultural heritage of nuclear waste could also mean many different things.

This is shown clearly in the very different approach of “the rolling stewardship”, presented during this workshop, where one may imagine future honorable guards patrolling nuclear waste disposal sites, and the idea of forgetting. But as compelling that latter idea may sound – drilling a hole in the ground, filling it with radioactive material and then forgetting about it – it is not likely to work, most of all because of the human curiosity that eventually will cross the forbidding boundaries with “Do not enter” signs.

No less fascinating is the idea brought forward in the planning of the US WIPP-site, where markers set up to warn about radioactive repositories had to be “aesthetically appealing” so they would face less risk of being destroyed in the future.

As a layman, this workshop has been a wake-up call. On one hand we learn about “the toolbox”, presented by Stephan Hotzel, that we could use for preserving memory and information. On the other hand, we realize that much of this is not yet operational, all the while nuclear power continues to produce radioactive waste.

There is a sense of urgency in that we need to act quickly to install the necessary means to ensure a safe and long-lasting solution to this problem, and start the work of record keeping, knowledge transformation and memory as soon as possible.

¹³ <https://sverigesradio.se/sida/avschnitt/947914?programid=407>

To succeed in this, I think one should work on raising the awareness of the general public. To many of us, radioactive waste has turned into a non-existing question. Many of us have been happy to forget about the legacy of nuclear power. The ones who have not, especially the environmental movement, have a crucial role in reinstating the awareness.

To engage in educational projects for the younger generations and to try to get media's attention to these questions could be crucial to get things up and running. Also, as this workshop has shown, I think, an approach where researchers from all fields could lend their support to the questions at hand. It has been truly promising to see so many archaeologists, anthropologists, linguists and even artists take part in the discussions.

“Only those who understands the past will have a future”, said Mats Djurberg, quoting Humboldt, and I would guess that recent years discussion about the human race creating its own geological era, the Anthropocene, have made us all aware of our impact on this planet, our place in history, and our responsibilities for it.

4.2 Concluding remarks by an academic

Anna Storm, *Stockholm University and the Royal Institute of Technology (KTH)*

In my concluding remarks, I would like to point to three potentially productive tensions, which I will bring with me from our discussions during this workshop.

The first tension concerns the message. Let us recall Jonas Palm's introduction where he showed a photo of the place in a park just outside Chicago where the remnants of the Chicago piles were buried. There, you find a stone with an inscription that says: “Do not dig” (see the picture on the frontpage of these proceedings). Two years ago, I visited also the place where the Chicago piles were originally built, on the grounds of the Chicago University campus. Here a memorialization process has taken place already since the late 1940s, and with significant additions in the 1960s. At this spot, you can read on a plaque: “On December 2, 1942, man achieved here the first self-sustaining chain reaction and thereby initiated the controlled release of nuclear energy.” The place is an important stop for the tours on campus introducing new students, and there is a continuous flow of people making photos of themselves in front of this plaque.

With the Chicago piles as an illustration, it is clear that there is an inherent ambiguity or tension in the message we are to pass on to the future. On the one hand, it says that the nuclear legacies are safe and controlled, and, on the other hand, it says that precaution is definitely needed.

A second tension concerns nuclear waste as exceptional or non-exceptional. What are the benefits and what are the drawbacks of considering radioactive waste as exceptional, or of considering it as a category among other hazardous waste? Wastes that need, what I like to think of as “eternal care”, or what I have elsewhere termed “post-industrial landscape scars”?

For example, as I have a background in working on the history of mining and of iron and steel industry, I was very surprised when I visited Sweden's final repository for short-lived radioactive waste, SFR, and found how a well-established mining terminology was completely absent in this underground facility. Could there be important competences outside the nuclear industry worth considering here? Which thus points us to the benefits of a non-exceptional perspective.

Still, exceptional and special features of nuclear waste have to be continuously highlighted, such as the non-sensory character of radiation, which makes radioactive leftovers different from other hazardous activities and their kinds of waste.

The third and final tension concerns heritage and waste. Spontaneously, heritage is most often understood to be something positive we choose to pass on from one generation to the next, while waste, spontaneously, is an unwanted leftover that we have to deal with in one way or the other.

One can note that on a national level, the main existing nuclear-related cultural heritage narrative focuses on early scientific progress and national industrial prowess, for example in technology museum exhibitions. In a physical sense a nuclear heritage is not very manifest though, but generally rather overlooked. Here in Sweden we have for example the place of the very first Swedish reactor R1 from the 1950s, located underground on the Royal Institute of Technology KTH campus, which is today used as an experimental stage including some brief historical information that you might see if you happen to get access to the cavern. And we have the unique small power plant R3 Ågesta from the 1960s, located in the Stockholm suburb of Farsta, which my colleagues and I have lately worked to try to preserve. However, just a couple of days ago, we got the message that preservation will not be considered further by the Swedish Ministry of Culture. And we have the commercial power plant Barsebäck which is currently under decommissioning without, to my knowledge, any heritage body involved.

On an international level, there are only two sites directly connected to nuclear topics, out of more than one thousand sites on the UNESCO World Heritage List. It is the bomb test site at the Bikini Atoll and the Hiroshima Peace Memorial. Hence, on this influential list, there is a sole focus on the catastrophic consequences of World War II atomic bombings, which makes it part of the subcategory of difficult heritage.

Nuclear waste is not yet generally considered as heritage, not even a difficult one, although it is unquestionable that it will stay with us for the future, and therefore needs our critical attention.

In sum, I have highlighted three tensions, first, in the ambiguity of the message we are to pass on to future generations, second, between exceptionality and non-exceptionality of nuclear waste issues, and, finally, between the logics of heritage and the logics of waste.

4.3 Concluding reflection on ethics

Carl-Reinhold Bråkenhielm, *Swedish national Council for Nuclear Waste and Professor Emeritus of Empirical Life Philosophy Studies at Uppsala University*

Five years ago, an important conference was arranged in Verdun, France, on “Radioactive Waste management and Constructing Memory for Future Generations”. One of the conclusions of the conference was the following:

There should be no intention to forgo, at any time, records, knowledge and memory (RK&M) of the repository and of the waste it contains. Enabling future members of society to make informed decisions is part of responsible, ethically sound and sustainable radioactive waste management.¹⁴

I think that this conclusion is correct and important. Nevertheless, there are a number of other answers to the question *why* “records, knowledge, and memory (RK&M) of the repository and of the waste it contains” should be established. Attention to all the questions about the mechanisms or techniques for the preservation of RK&M over centuries and millennia, must not be allowed to obscure the equally important question about *the basic reasons for RK&M measures*. What are these reasons?

First, there are *legal* reasons. There are international conventions such as The Aarhus Convention (1998) establishing a number of rights of the public (individuals and their associations) with regard to the environment. Among them is the right of “access to environmental information.” RK&M measures are not explicitly mentioned in the convention nor is the question if there are legal grounds to refuse such information. This needs to be clarified.

Secondly, there are purely *pragmatic and political* reasons for RK&M measures. The existence of such measures may affect the credibility of establishing and maintaining a repository for nuclear waste. Local communities in Sweden are concerned about RK&M initiatives for this very reason.

Thirdly, there are a number of ethical reasons to be considered in this context. RK&M initiatives may be important to establish intergenerational justice concerning information. The Aarhus convention emphasizes the importance of public participation, for example access to “a description of the site and the physical and technical characteristics of the proposed activity, including an estimate of the expected residues and emissions.”

Another ethical reason is that RK&M is necessary for the “rolling stewardship” of a repository. However, it should be noted that certain repository concepts for nuclear waste claim passive safety, i.e. continuing operation without the need for oversight after final closure.

Occasionally, it is also claimed that RK&M measures are required for minimizing risk of harming future generations. Future generations must be granted the ability for repairing or enhancing the safety of a repository. Needless to say, access to extensive information about the repository also makes voluntary intrusion for destructive purposes possible.

¹⁴ OECD/NEA, Radioactive Waste management and Constructing Memory for Future Generations, Proceedings of the International Conference and Debate, 15-17 September 2014, p. 31; available at: <https://www.oecd-nea.org/rwm/pubs/2015/7259-constructing-memory-2015.pdf>

Enabling self-determination for future generation is perhaps the most important ethical reason for RK&M measures. Such a right to self-determination might be deemed more important than the risk of dangerously misusing such information in the near or far future. Further ethical considerations are required to strengthen such a claim.

APPENDIX List of participants¹⁵

Jean-Noël Dumont	ANDRA (France)
Gordon Edwards	Canadian Coalition for Nuclear Responsibility (Canada)
Roger Edenmo	Country Administrative Board (Länsstyrelsen) in Uppsala
Ulrika Larson	Empirikon
Andrei Stepanov	European Humanities University (Lithuania)
Agneta Liljesköld	Folkkampanjen mot Kärnkraft-Kärnvapen
Lijana Gottby	Geological Survey of Sweden (SGU)
Stephan Hotzel	Gesellschaft für Anlagen- und Reaktorsicherheit gGmbH (Germany)
Rolf Lindahl	Greenpeace
Jan Haverkamp	Greenpeace
Marcos Buser	Institute for sustainable waste management INA Ltd (Zürich)
Martin Kunze	Independent artist (Austria)
Antonio Pereira	Independent expert
Tobias Svanelid	Journalist
Axel Andersson	Kritiklabbet
Cornelius Holtorf	Linnaeus University
Anders Högberg	Linnaeus University
Claudio Pescatore	Linnaeus University and independent expert
Laura Welcher	Long Now Foundation (United States)
Ola Wikander	Lund University
Miles Goldstick	Milkas (Miljörörelsens kärnavfallssektariat)
Kristina Börjevik Kovaniemi	Ministry of the Environment
Anna Sanell	Ministry of the Environment
Gabor Szendrő	Ministry of the Environment
Bodil Liedberg Jönsson	Municipality of Oskarshamn
Anna Bergsten	Municipality of Östhammar
Bertil Alm	Municipality of Östhammar
Marie Berggren	Municipality of Östhammar
Magnus Degerman	Municipality of Östhammar
Jonas Palm	National Archives of Sweden (Riksarkivet)
Magnus Geber	National Archives of Sweden (Riksarkivet)
Jenny Modig	National Archives of Sweden (Riksarkivet)
Joachim Stormvall	OSS (Opinionsgruppen för säker slutförvaring i Östhammar)
Tatiana Kasperski	Pompeu Fabra University (Spain)

¹⁵ Note, this is the list of participants Day 1.

Mikael Jensen	Retiree from Swedish Radiation Safety Authority (SSM)
Alexander Gill	Riksantikvarieämbetet
Anna Storm	Stockholm University
Jonas Fors	Swedish Environmental Protection Agency (Naturvårdsverket)
Tuija Hilding-Rydevik	Swedish National Council for Nuclear Waste (Kärnavfallsrådet)
Peter Andersson	Swedish National Council for Nuclear Waste (Kärnavfallsrådet)
Johanna Swedin	Swedish National Council for Nuclear Waste (Kärnavfallsrådet)
Ingvar Persson	Swedish National Council for Nuclear Waste (Kärnavfallsrådet)
Evis Bergenlöv	Swedish National Council for Nuclear Waste (Kärnavfallsrådet)
Carl-Reinhold Brakenhielm	Swedish National Council for Nuclear Waste (Kärnavfallsrådet)
Johan Swahn	Swedish NGO Office for Nuclear Waste Review (MKG)
Tomas Almberger	Swedish Nuclear Fuel and Waste Management Company (SKB)
Mikael Gontier	Swedish Nuclear Fuel and Waste Management Company (SKB)
Anders Ström	Swedish Nuclear Fuel and Waste Management Company (SKB)
Patrik Vidstrand	Swedish Nuclear Fuel and Waste Management Company (SKB)
Sofie Tunbrant	Swedish Nuclear Fuel and Waste Management Company (SKB)
Erik Setzman	Swedish Nuclear Fuel and Waste Management Company (SKB)
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Ansi Gerhardsson	Swedish Radiation Safety Authority (SSM)
Charlotta Floberg	Swedish Radiation Safety Authority (SSM)
Anders Wiebert	Swedish Radiation Safety Authority (SSM)
Pelle Zettersten	Swedish Radiation Safety Authority (SSM)
Charlotta Floberg	Swedish Radiation Safety Authority (SSM)
Carl-Henrik Pettersson	Swedish Radiation Safety Authority (SSM)
Annika Bratt	Swedish Radiation Safety Authority (SSM)
Mats Djurberg	Swedish UNESCO Commission
Carina Green	Swedish University of Agricultural Sciences
Florence Fröhlig	Södertörn University
Matti Kojo	Tampere University (Finland)
Reine Ryden	Uppsala University
Johan Redin	Uppsala University