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NEA
NUCLEAR ENERGY AGENCY

Remembering the Past in the Future

Building Awareness of Radioactive Waste Repositories Together

PROGRAMME

22-24 November 2022

Tabloo Visitor Centre
Dessel, Belgium

General information

Location

Tabloo Visitor Centre
Gravenstraat 3
2480 Dessel
Belgium

Transportation

Daily shuttle transportation will be provided for workshop participants staying in Turnhout, Belgium. Shuttle pickup will take place daily from the entrance of Hotel Corsendonk Turnova (*Kursaalpoort 10, 2300 Turnhout, Belgium)* at 8h00.

Participants who stay in Mol or other surrounding communities will be responsible for arranging their private transport to the Tabloo Visitor Centre.

Registration

Registration will open at 8h00 on Tuesday, 22 November, at the Tabloo Visitor Centre.

Participants will be met upon arrival by NEA staff on the ground floor of Tabloo, and will be requested to register to obtain visitor badges.

Badges are to be worn when attending lectures and all other events.

Key contacts

Morgan Packer, Specialist, Radioactive Waste Management and Decommissioning, Nuclear Energy Agency (NEA)

Morgan.Packer@oecd-nea.org

Linda Okpala, Research Officer, Radioactive Waste Management and Decommissioning, Nuclear Energy Agency (NEA)

Linda.Okpala@oecd-nea.org

Tuesday, 22 November 2022

Master of Ceremonies: *Robbe Geysmans, Sociologist, Belgian Nuclear Research Centre (SCK•CEN), Belgium*

09:00-09:15 **Opening remarks**

Rebecca Tadesse, Head of Division, Radioactive Waste Management and Decommissioning (RWMD), Nuclear Energy Agency (NEA)

Martin Kunze, Founder, Memory of Mankind, Austria; Chair of the NEA Expert Group on Awareness Preservation (EGAP)

Introductory session: Where do we stand?

09:15-10:50 **Building bridges between the Forum on Stakeholder Confidence (FSC) and EGAP**

Pascale Künzi, Specialist for Stakeholder Involvement, Swiss Federal Office of Energy (SFOE), Switzerland

Communication and stakeholder engagement for radioactive waste disposal: IAEA approach

Irena Chatzis, Communication Officer, Department of Nuclear Energy, International Atomic Energy Agency (IAEA)

Belgian partnerships: Aspects of living memory

Kris van Dijck, Member of Parliament, Mayor of Dessel, Belgium, and Chair of STORA

Mark Loos, Member of MONA

Results of the OECD-NEA RK&M Initiative (2011-2019)

Stephan Hotzel, Scientific Officer, Federal Office for the Safety of Nuclear Waste Management (BASE), Germany

Knowledge management in European Joint Programme – EURAD

Niels Belmans, EURAD Representative and SCK•CEN Academy Project Leader, Belgian Nuclear Research Centre (SCK•CEN), Belgium

10:50-11:10 *Coffee break*

Session 1: Awareness preservation process at nuclear heritage sites

Chair: *Benjamin Offen, Scientific Officer, Federal Office for the Safety of Nuclear Waste Management (BASE), Germany*

11:10-13:00

Japanese memorial awareness and efforts for the future

Ayako Araki, Nuclear Waste Management Organization of Japan (NUMO), Japan

Archives and artifacts – Long-term preservation at the Nuclear Decommissioning Authority

Michelle Donoghue, Information Governance Manager, Nuclear Decommissioning Authority (NDA), United Kingdom

Tabloo – A unique visitor and meeting centre in the Campine

Anne-Lize Kochuyt, Co-ordinator, Tabloo Visitor Centre, Belgian National Agency for Radioactive Waste (ONDRAF/NIRAS), Belgium

The evolution of community engagement leads to the provision of public services at the remediated Fernald Preserve, Ohio (United States)

Brian Zimmerman, Site Manager, Office of Legacy Management, Department of Energy (DOE), United States

13:00-14:15 *Lunch*

Keynote session

14:15-15:00

Things that last – Humanising how we think about persistent materials

Rosemary A. Joyce, Interim Director of Global, International, and Area Studies; Distinguished Professor of Anthropology, University of California, Berkeley, United States

Session 2: Existing regulatory approaches in awareness preservation and key challenges

Chair: *Rebecca Tadesse, Head of Division, Radioactive Waste Management and Decommissioning, Nuclear Energy Agency (NEA)*

15:00-16:00

Marking of a repository and stakeholder interaction – The Swiss case

Felix Altorfer, Head of Waste Management Division, Swiss Federal Nuclear Safety Inspectorate, Switzerland

Combining documentary provisions required by regulation and societal interactions to create a robust system for memory and knowledge transmission

Jean-Noël Dumont, Senior Advisor and Programme Manager, Memory for Future Generations, National Agency for Radioactive Waste Management (Andra), France

Florence Poidevin, Programme Manager, Memory for Future Generations, National Agency for Radioactive Waste Management (Andra), France

Post-closure related responsibilities and plans of licence holders and authorities in Finland on knowledge and awareness preservation

Sami Naumer, Research Scientist, VTT, Finland

16:00-16:30 *Coffee break*

16:30-17:40

They do things differently in Finland – Exploring the Finnish approach to awareness preservation

Petri Paju, Adjunct Professor, University of Turku, Finland

Information and knowledge preservation over generations in a regulatory context

Carl-Henrik Pettersson, Investigator, Swedish Radiation Safety Authority, Sweden

Wednesday, 23 November 2022

Session 3: Approaches for an unknown future

Co-Chairs: *Pascale Künzi, Specialist for Stakeholder Involvement, Swiss Federal Office of Energy (SFOE), Switzerland; Morgan Packer, Specialist, Radioactive Waste Management and Decommissioning, Nuclear Energy Agency (NEA)*

09:00-10:45	**Sound mapping project and the nuclear material archive** *Daniel Beck, PhD student, London College of Communication, United Kingdom*
	Markers that convey a message: Communicating with future generations *Arne Berckmans, Project Manager, ONDRAF/NIRAS, Belgium*
	Magazine of the century – A communication experiment *Barbara Habermacher, Documentalist, Nagra, Switzerland*
	Nuclear heritage: Material practices anticipating and resourcing distant futures *Gabriella Ivacs, Head of Section, Archives and Records Management, IAEA*
	"Marking" the Australian nuclear fuel cycle as future cultural and environmental heritage *N.A.J. Taylor, Alfred Deakin Postdoctoral Research Fellow, Deakin University, Australia*
10:45-11:15	*Coffee break*

Session 3: Approaches for an unknown future *(continued)*

11:15-13:00	**How to create specific storages to preserve radioactive heritage objects?** *Thomas Beaufils, Lecturer, University of Lille, France* **Art and intergenerational knowledge transfer** *Ele Carpenter, Professor, Umeå University, Sweden* **Memory of mankind** *Martin Kunze, Founder, Memory of Mankind, Austria* **Future generations' potential information needs** *Carl-Henrik Pettersson, Investigator, Swedish Radiation Safety Authority, Sweden* **Consciousness of the landscape** *Cécile Massart, Artist-Researcher, Belgium*
13:00-15:00	*Lunch break and interactive visit of Tabloo's Exhibition*

Session 4: Conceptualising remembrance across generations

Co-Chairs: *Cornelius Holtorf, Professor and UNESCO Chair on Heritage Futures, Linnaeus University, Sweden; Anders Högberg, Professor, Linnaeus University, Sweden*

15:00-16:15	**Memory and time – Reflecting on remembrance and narrating the past** *Carina Green, Lecturer in Sociology, Örebro University, Sweden* **Long-term cultural memories and nuclear legacies – A cultural semiotics approach to transmitting narratives of environmental awareness to the future** *Francesco Mazzucchelli, Senior Assistant Professor, University of Bologna, Italy* **History or heritage? Understanding cultural processes over time** *Cornelius Holtorf, Professor and UNESCO Chair on Heritage Futures, Linnaeus University, Sweden*
16:15-16:30	*Coffee break*
16:30-17:40	**Orchestrating nuclear futures: Lessons from the history of scientific prediction** *Egle Rindzeviciute, Lecturer, Kingston University, United Kingdom* **Future literacy – Why it matters to transmit information on high-level radioactive waste to future generations** *Anders Högberg, Professor, Linnaeus University, Sweden*

Thursday, 24 November 2022

Next steps for awareness preservation

09:00-09:20	**Nuclear message** *Martin Kunze, Founder, Memory of Mankind, Austria*
09:20-09:30	**Introduction to roundtable discussion** *Pascale Künzi, Specialist for Stakeholder Involvement, Swiss Federal Office of Energy (SFOE), Switzerland* *Robbe Geysmans, Sociologist, Belgian Nuclear Research Centre (SCK•CEN), Belgium*
09:30-09:50	*Coffee break and break out into discussion groups*
09:50-11:50	**Next steps for awareness preservation – A roundtable discussion** *Group discussions on key topics related to awareness preservation on radioactive waste management, such as:* - *Why preserve?* - *What to preserve?* - *Who should be involved?* - *Where and how should preservation take place?* - *What are the crucial next steps?*
11:50-12:00	**Closing remarks** *Martin Kunze, Founder, Memory of Mankind, Austria*
12:00-13:30	*Lunch*

EGAP workshop site visit

24 November 2022

13:30-16:30 **Site visit to HADES Underground Research Laboratory (URL)**

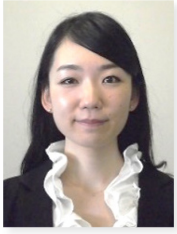
HADES is the oldest underground laboratory in Europe, located in the Boom Clay at a depth of 225 metres. The HADES URL plays a central role in research on the safety and feasibility of geological disposal of radioactive waste, with experts using it to develop and test industrial technologies for building, operating and closing a waste repository in deep clay.

Due to capacity limitations underground, the site visit was limited to 30 participants on a first come, first serve basis.

Registration is now closed. Participants who have received a confirmation email may attend the site visit.

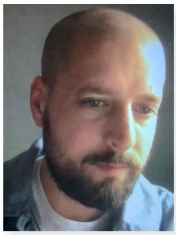
Biographies

Felix Altorfer obtained his doctorate in 1994 at the Laboratory for Neutron Scattering at the ETH Zurich. He has a wealth of experience ranging from working at the NIST Center for Neutron Research, National Institute of Standards and Technology, to undertaking research at the Swiss Spallation Neutron Source (SINQ) of the Paul Scherrer Institute. In 2002, Felix Altorfer joined ENSI, where he worked as a Modeller in the Deep Geological Repositories section and later became Head of the Deep Geological Repositories and Safety Analyses section in 2009. His work has focused on safety calculations for assessments of proof of waste management for highly radioactive waste in the Zurich Weinland region, and on contributions to assessments regarding the choice of sites in connection with the sectoral plan for geological repositories.



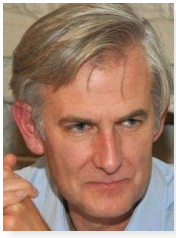
Ayako Araki has worked at NUMO for the last decade since graduating from Waseda University in Tokyo, and holds over three years of experience in safety culture. She is experienced in press relations, community communication and general affairs, including engagement in media relations for NUMO's public conferences and meetings, stakeholder involvement and support of nationwide stakeholder groups. Through her work at NUMO, she hosts study seminars and facility visits. Since 2018, she has been in charge of international co-ordination and provides support for collaborative R&D projects with other DGR implementers and organisations. Ayako Araki is a member of NEA's EGKM and EGAP.

Thomas Beaufils is an anthropologist and lecturer on « Society and culture in Dutch-speaking countries » at the University of Lille. He is a member of the research laboratory IRHiS (Institut de Recherche Historique du Septentrion) and a graduate in preventive conservation of the University of Paris 1 Panthéon-Sorbonne. He also teaches museology at the University of Lille. He mainly carries out research on the conservation of scientific objects (medical design, radioactive heritage objects) in German-speaking countries and in France.



Daniel Beck is a sound artist and filmmaker, in addition to a Techne-funded PhD student at the University of the Arts, London. His current project revolves around a partnership with the BFI National Film Archive that is focused on a series of artworks that engage with the unique nuclear military history of their site in Gaydon, United Kingdom.

Niels Belmans holds a PhD in biomedical sciences from Hasselt University, Belgium. He has been working as a project collaborator at the SCK•CEN Academy for Nuclear Science and Technology since October 2019. He is involved in several EC HORIZON 2020 projects, specifically in work packages dealing with training and mobility (EURAD WP13, PREDIS WP3 and ORIENT-NM WP3).



Arne Berkmans started his career as a geologist in 1987 in the South African gold mining sector. He completed a PhD in geostatistics on the estimation of ore reserves at the Paris School of Mines in 1997. He joined ONDRAF/NIRAS in 2002 supporting the RD&D department on knowledge management. In 2006 he joined the initial team in Dessel working on environmental licensing and the implementation of a conservation plan developed with local stakeholders to enhance biodiversity in the 125 hectares of terrain not used for industrial exploitation. Berkmans facilitates the working group on "Retaining Memory", a joint initiative of NIRAS and volunteers of the local stakeholder groups STORA and MONA on how to ensure memory on the contents under the 2 tumuli will not be lost for future generations.

Ele Carpenter is a Professor of Interdisciplinary Art and Culture at Umeå University, where she is the Director of the UmArts Research Centre for Art, Design and Architecture. Ele Carpenter's curatorial research focuses on nuclear contemporary art, and she is the Director of the Nuclear Culture Research Group. She is the editor of The Nuclear Culture Source Book (2016), and the curator of Splitting the Atom, CAC Vilnius, Lithuania (2020). Previous exhibitions include Perpetual Uncertainty at Bildmuseet, Umeå, Sweden; Z33 House of Contemporary Art, Hasselt, Belgium; and Malmo Konstmuseum (2016-18).

Irena Chatzis is a Communication Officer at the International Atomic Energy Agency under the Department of Nuclear Energy. Since 2015, she is responsible for stakeholder engagement, building and managing relationships, designing and implementing communication strategies and campaigns. From 2007-2015, she served as Principal Secretary to the IAEA Director General.

Kris Van Dijck initially worked as a teacher. He became a fulltime politician and member of the Flemish Parliament in 1995, and remains so today. At the local level he was mayor in Dessel in 1994-2000 and again from 2006 until today. As mayor of Dessel, he was involved from the start of the partnership in 1999. He has been a member of STORA's General Assembly for 23 years and was chosen as its President and Chairman in 2022.

Michelle Donoghue, Information Governance Manager at the UK Nuclear Decommissioning Authority, has worked in knowledge and information management for many years, leading large change programmes and embedding new ways of working. She has experience of leading multi-million-pound heritage projects and is currently responsible for leading on collaboration, knowledge and information management strategy and heritage for the UK Nuclear Decommissioning Authority.

Jean-Noël Dumont has been manager of Andra's programme "Memory for Future Generations" since September 2017. He obtained an Engineering Degree from Mines ParisTech and worked at engineering companies before joining Andra in 1999. His focus has been on radioactive wastes: knowledge and oversight of different types of radioactive waste packages of low, intermediate and high activity; then, on repository design for the Cigéo deep geological repository project, particularly on the concept of reversibility and the interface of the technical and societal domains; and more recently on societal aspects, including the issue of memory preservation, for all kinds of radioactive waste repositories.

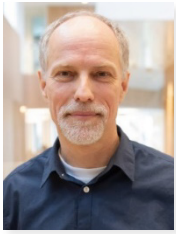
Robbe Geysmans holds a PhD in sociology from Ghent University, where he graduated in 2017. Since 2019, he has worked as a Social Scientist in the Programme for the Integration of Social Aspects in nuclear research (PISA) of the Belgian Nuclear Research Center SCK•CEN. In his work, he focuses on the socio-technical entanglements of various nuclear applications and exposure contexts, with a particular interest in the back-end of the nuclear fuel cycle. Using a range of qualitative methodologies, Robbe has studied topics such as stakeholder engagement in radioactive waste management (and other nuclear contexts), the socio-technical boundary conditions of advanced nuclear technologies, and societal aspects related to natural radiation. Since 2020 Robbe has been a member of the NEA Working Party on Information, Data, and Knowledge Management (IDKM) and the Expert Group on Awareness Preservation after Repository Closure (EGAP).

Carina Green holds a PhD in cultural anthropology from Uppsala University. She is currently a lecturer in sociology at Örebro University. Her main research areas are: Indigenous peoples issues (especially Sámi, native Australian and Maori societies), eco-governmentality, knowledge integration processes, co-management processes, ethnic identity processes, heritage studies (implementation of the World Heritage Convention), and rights of nature.

Barbara Habermacher's academic background is in cultural anthropology, linguistics and information science. She has vast experience working in libraries, museums and the heritage foundation for the Swiss Federal railways.

Since 2019, She has been working as a librarian for the Swiss National Cooperative for the Disposal of Radioactive Waste (Nagra).

Anders Högberg is a Professor of Archaeology at Linnaeus University, Kalmar, Sweden, and an Associated Researcher at the University of Johannesburg, South Africa. He is the Director of the Centre for Applied Heritage and associated with the UNESCO Chair on Heritage Futures, both at Linnaeus University. Together with Cornelius Holtorf, he has been working on long-term memory issues in relation to radioactive waste for more than a decade. He has broad research interests and is currently working with projects on heritage futures, migration, cognitive evolution and cultural entrepreneurship. He is the co-editor of "Cultural Heritage and the Future" (with Cornelius Holtorf, Routledge 2021).

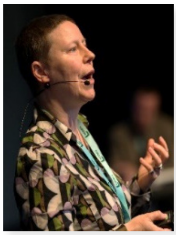


Cornelius Holtorf is a Professor of Archaeology and holder of the UNESCO Chair on Heritage Futures at Linnaeus University in Kalmar, Sweden. He has been working on long-term memory issues in relation to radioactive waste for more than a decade. He is the co-editor of "Cultural Heritage and the Future" (with Anders Högberg, Routledge 2021) and is the co-author of "Wow! The future is calling!" (with Pernilla Frid, open access 2021).

Stephan Hotzel is a Scientific Officer at BASE, the German Federal Office for the Safety of Nuclear Waste Management. Before joining BASE in 2021, he worked at GRS, a technical support organisation for nuclear installations. He holds a physics diploma from Hamburg University and a PhD from Heidelberg. Working at GRS and BASE, Stephan Hotzel has gained 15 years of experience in various aspects of safety assessments for radioactive waste disposal facilities. From 2011 to 2019, he participated in the NEA initiative "Preservation of Records, Knowledge and Memory across generations" and served as Chair from 2015 to 2019. After this period, he was engaged in the planning of and contribution to the NEA follow-up project EGAP (the Expert Group on Awareness Preservation).

Rosemary Joyce is a Distinguished Professor of Anthropology at the University of California, Berkeley, who has directed field excavations in Honduras for more than thirty years. Her work ranges from explorations of gender and sexuality in the past to the ethics of archaeology and museum anthropology. In 2022, she received an honorary doctorate from Leiden University in the Netherlands, and has been named the 2022 recipient of the Alfred Kidder Prize for Eminence in American Archaeology. Her most recent book, entitled "The Future of Nuclear Waste – what art and archaeology can tell us about securing the world's most hazardous material" was published in 2020 by Oxford University Press.

Gabriella Ivacs is Head of the Archives and Records Section of the IAEA. Since 1999 she has been actively involved in developing the records and information management programmes of the Open Society Foundations Network (OSF). She serves as a Lecturer at Central European University (CEU) Cultural Heritage Programme. Currently completing her PhD in interdisciplinary sociology, her research explores the issue of archival transformations in the new technological landscape: the effects of digital and distributed archiving techniques on memory practices, contested cultural heritage, and nuclear records management.



With a degree in biochemical engineering, **Anne-Lize Kochuyt** has always sought contact with the public.

As a communications and public relations manager at the Planetarium Brussels, she has had the opportunity to develop activities and educational projects.

The boundary between science, culture and the public inspires her. This year she became the co-ordinator of the visitor centre of Tabloo and, together with her colleagues, she aims to make it a dynamic place.

Pascale Jana Künzi has served as a Regional Participation Specialist at the Swiss Federal Office of Energy since December 2010. She is responsible for the discussions concerning the placement of the necessary surface infrastructure for a deep geological repository (DGR) with the so-called regional conferences and thus has extensive experience with stakeholder involvement. Künzi became a Member of the Forum on Stakeholder Confidence (FSC) in November 2012 and has been the FSC Chair since September 2016. Previously, Künzi was a Scientific Officer (Environment, Energy, Science and Health) at the Swiss Embassy in Berlin (2006-2010). She has a BA in cross-cultural studies with Minors in philosophy and sociology from Whitworth University in Spokane, Washington, United States. She has an LLM in International Law with International Relations from the University of Kent in Canterbury, United Kingdom.

Martin Kunze is the founder of Memory of Mankind, a project to pass on a snapshot of our era to coming generations, cultures or civilisations using ceramic tiles and a print with ceramic toner, stored in a vault in the world´s oldest salt mine in Hallstatt/Austria. Kunze is a researcher on durable data carriers on ceramic basis and developer of universal and hybrid analogue/digital data formats.

Kunze is also the Chair of the NEA Expert Group of Awareness Preservation, and a board member of initiatives with long-term perspectives such as Long Now Foundation, Arch Mission, and the Human Document Project.

Mark Loos is a civil engineer in electronics. He retired as Director of the Institute for Environment, Health and Safety, after a long career at SCK•CEN, the Belgian Nuclear Research Center.

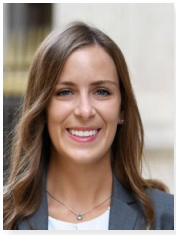
He is a former President of ESARDA (European Safeguards Research & Development Association) and member of the Belgian Society for Radiation Protection. He has been a member of MONA the partnership between NIRAS and the municipality of Mol. Loos served as President of the technical working group of MONA on the "follow-up of the disposal project category A radioactive waste", and as a member of the NIRAS-MONA-STORA working group on "Preservation of Records, Knowledge and Memory".

The works of Belgian artist **Cécile Massart** include different mediums. From 1977 until 2005, she taught engraving. At the beginning of the 1980s, Graph and Pixel Story showcased the artist's passion for the pixel. She produced series of works focusing on that subject until 1994. Since then, Massart's focus has turned to the identification of radioactive repositories in the landscape. Together with the agencies that manage such sites, she endeavours to make them responsible and more aware of the visibility of radioactive repositories. Her first graphic research, shown under the title "Un site archivé pour aplha, bêta, gamma" helps in revealing their nature. The conferences she attends usually also feature photographic reports she made on various sites.

Francesco Mazzucchelli is an Associate Professor of Semiotics at the Department of Philosophy and Communication of the University of Bologna. He is the Director of TraMe, Center for the Semiotic Study of Memory. His research interests focus on the cultural mechanisms of representation of the past, the practices of transmission, construction and renegotiation of cultural heritage, and the semiotics of space and time.

Sami Naumer works in nuclear waste management research at the Finnish research institute VTT. He has experience in radioactive waste repository design, planning and modelling. He recently started working on repository closure and post-closure related topics and has mapped post-closure related responsibilities and plans of licence holders and authorities in Finland. He holds a Master's degree from the European Mining, Minerals and Environmental Programme from Aalto, RWTH Aachen and TU Delft universities.

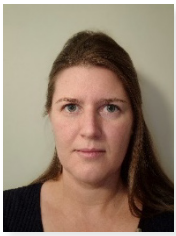
Benjamin Offen is a Scientific Officer at BASE, the German Federal Office for the Safety of Nuclear Waste Management. He works in the Division for Long Term Documentation within the Department for Research and International Cooperation and focuses on the topics of awareness preservation, nuclear semiotics and knowledge management. Offen holds a Master's degree in international information management from the University of Hildesheim, Germany. Before working at BASE, he gained several years of experience in agile software development as a user-experience designer and product owner.



Morgan Packer is a Specialist at the Nuclear Energy Agency (NEA) in Radioactive Waste Management, where she manages a range of multilateral initiatives; these include projects on public policy, knowledge management, stakeholder engagement and enhancing regulator-implementer dialogue. She previously worked for the NEA Division of Radiological Protection and Human Aspects of Nuclear Safety (2016-2017), in addition to working in research management at Sciences Po (2017-2021) and Harvard University (2014-2015). She holds a Master's in international affairs from Sciences Po Paris, and a Bachelor's in international affairs and political science from Northeastern University.

Petri Paju, PhD, works as a Senior Researcher at the University of Turku, Finland, in the Department of Cultural History. He has written broadly on the history of technology in Finland and on computing history in the Nordic countries. In recent years, he has focused on the studies of digital or computational history and on the evolution of nuclear energy production, including the history and future thinking in the field of nuclear waste management.

Carl-Henrik Pettersson has worked as an Analyst at the Swedish Radiation Safety Authority since 2013. He holds a PhD in mineralogy, petrology and geochemistry from the University of Stockholm and has been working with climate-related issues, large-scale geological processes and future human actions as well as regulatory issues for radioactive waste disposal facilities. He has been engaged in the NEA initiative on the Preservation of Records, Knowledge and Memory across Generations and its successor, IDKM, for the past six years.



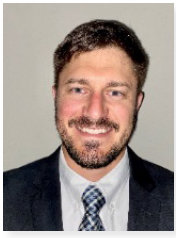
Florence Poidevin is the new manager of the programme "Memory for Future Generations", launched by Andra in 2010.

After graduating as an engineer from Chimie ParisTech, she worked in non-proliferation at the French Institute of Radioprotection and Nuclear Safety (IRSN) before joining Andra, the French Agency for Radioactive Waste Management, in 2016. There she worked in the industrial operations division on waste specifications and acceptance.

Eglė Rindzevičiūtė is an Associate Professor of Criminology and Sociology at the Department of Criminology, Politics and Sociology, Kingston University London, in the United Kingdom. She is the author of The Power of Systems: How Policy Sciences Opened Up the Cold War World (Cornell University Press, 2016) and The Will to Predict: Orchestrating the Future through Science (Cornell University Press, forthcoming in 2023). Rindzevičiūtė is the Principal Investigator in two research projects funded by the UK Arts and Humanities Research Council, "Nuclear Cultural Heritage: From Knowledge to Practice" (2018-2022) and "Nuclear Spaces: Communities, Locations and Materialities of Nuclear Cultural Heritage (NuSPACES)" (2021-2024, funded as part of the European Union's Joint Programming Initiative for Cultural Heritage).

Rebecca Tadesse is the Head of the NEA Division of Radioactive Waste Management and Decommissioning (RWMD). She has a significant role in the co-ordination of NEA activities related to the decommissioning and clean-up of the Fukushima Daiichi site. Prior to joining the NEA, Tadesse served as the Chief of the Radiation Protection Branch in the Office of Nuclear Regulatory Research at the United States Nuclear Regulatory Commission (NRC). She has over 27 years of domestic and international experience in the operation and radiation safety of research reactors, fuel fabrication facilities, nuclear power plants and biomedical research facilities. Tadesse also served as a Senior Policy Advisor for Commissioners and Senior Operational Assistant in the Executive Director's Office. She holds a Bachelor's degree in radiation physics from Purdue University and a Master's degree in environmental science/policy from Johns Hopkins University.

N.A.J. Taylor was educated at The University of Sydney and The University of Queensland, where his doctorate earned the university's prize for research excellence. His fields of research and teaching are international studies and environmental philosophy, with specialisations in international ethics, environmental ethics and politics, and the nuclear humanities. He is currently an Alfred Deakin Postdoctoral Research Fellow at Deakin University (2021-23), and an Australian Defence Force Academy Visiting Fellow at The University of New South Wales (2020-23). Prior to joining Deakin, he held the 2020 John Denis Fryer Memorial Library for Australian Literature Fellowship at The University of Queensland, and a 2020-2022 Izaak Walton Killam Memorial Postdoctoral Research Fellowship at The University of British Columbia.



Since 2017, **Brian Zimmerman** has been working as a Site Manager with the US Department of Energy (DOE), Office of Legacy Management. Zimmerman is responsible for implementing long-term surveillance, maintenance and monitoring strategies at sites that have undergone environmental remediation under a variety of regulatory and programmatic frameworks. Previously, he conducted water quality and wastewater treatment research as an independent contractor to the US Environmental Protection Agency. Zimmerman holds Bachelor's and Master's degrees in environmental science and engineering from the University of Cincinnati (United States) as well as a Master of Business Administration from Penn State University (United States). He is a Certified Project Management Professional.

Abstracts

Keynote session

Things that last – Humanising how we think about persistent materials

Rosemary Joyce

In this talk, I build on the exploration of the expert advisory process for the US Waste Isolation Pilot Plant (WIPP) that I presented in my book *The Future of Nuclear Waste* (Oxford University Press, 2022) to examine how humans think about materials that are by-products of our intentional activities. This is the question of how materials become seen as waste, rubbish, or problems. As an archaeologist, I reflect on contradictions to assumptions many people, including the experts consulted in planning a marker system for a WIPP, have about materiality and its stability. This requires the need to rethink "durable" (mainly geologic) matter as changing more slowly, but as continuously, as organic beings like ourselves – never stable, never inert. I consider how these misconceptions come together in respect to the "wicked problem" of safeguarding the by-products of nuclear technologies, and lead us to take as our goal concealing, removing, and isolating such material. Drawing on indigenous commentary, I suggest the challenge we face is acknowledging a continuing responsibility of care for potentially dangerous matter, and that the role of the people as the caretakers of memory and the reproduction of knowledge over time hinted at in a few places by the WIPP experts is critical for this task.

Introductory session – Where do we stand?

Communication and stakeholder engagement for radioactive waste disposal: IAEA approach

Irena Chatzis

Viable solutions for radioactive waste management, including waste disposal, are a cornerstone and key enabler of the continued sustainable use of nuclear power. At the same time, public perceptions and concerns about radioactive waste management remain the most influential factor for the public acceptance of nuclear power. Hence, understanding stakeholders' opinions, awareness and knowledge regarding radioactive waste and, in particular waste disposal, as well as addressing their concerns, is crucial for decision making and for the success of a nuclear power programme.

The IAEA has developed a comprehensive programme to build capacity in member states to plan, design and implement stakeholder engagement activities. This includes communication and stakeholder engagement for new and expanding nuclear programmes but also other aspects of the nuclear fuel cycle, including uranium mining

and radioactive waste repositories. This presentation will give an overview of the IAEA approach and methodology for building stakeholder engagement capacity in member states, with a focus on communication and engagement in radioactive waste disposal.

Belgian partnerships: Aspects of living memory

Kris van Dijck and Mark Loos

We will reflect on the importance of living memory in the case of the low-level disposal site in Dessel. The partnerships and their community councils have agreed on a number of socio-economic conditions upon accepting the presence of a repository in their community. We will discuss the ways in which an aspect of living memory is inherently present in almost every one of these conditions: in Tabloo, in the Local Fund, in the continuation of the partnership approach, and others. There are also dedicated "memory projects" of which the first one, "Reporters of tomorrow", a collaboration with local primary schools, will be presented.

Results of the OECD-NEA RK&M initiative (2011-2019)

Stephan Hotzel

This session will explore the NEA co-ordinated initiative on the "Preservation of Records, Knowledge and Memory (RK&M) across generations", also known as the "RK&M Initiative", which lasted from 2011 to 2019. Its scope is 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 long after repository closure.

This presentation will touch upon the project's conclusion 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.

Reflections will also be made regarding the toolbox of 35 RK&M preservation mechanisms and the RK&M initiative's final report, which constitutes a general guide to the RK&M preservation topic and provides the basis for necessary discussions and eventual decisions on the implementation of RK&M preservation strategies in a national context.

EURAD's knowledge management activities

Niels Belmans

In 2019, the European Commission asked the European Joint Programme on Radioactive Waste Management (EURAD – grant agreement N°847593) to achieve a step change in European collaboration towards safe radioactive waste management (RWM).

A part of this step change is to develop a sustainable knowledge management (KM) programme. For this aim, EURAD has three dedicated KM work packages (WPs): State-of-Knowledge, Guidance, and Training & Mobility. The documents, authored by experts, are structured based on the EURAD Roadmap. The EURAD Roadmap is a representation of a generic RWM programme that enables users and programmes to "click-in", and access existing knowledge and active work in EURAD and elsewhere. The content is focused on what knowledge and competencies (including infrastructure) are considered most critical for implementation of any type of RW disposal.

This presentation describes how the work performed within the three KM WPs is linked to the EURAD Roadmap, what their goals and long-term objectives are and how they aid in achieving EURAD's KM goals.

Session 1

Japanese memorial awareness and efforts for the future

Ayako Araki

This presentation presents a broad overview of efforts to pass on memory in Japan, not limited only to nuclear power. It includes the Tsunami Stone Monument as a warning from the ancestors against natural disasters, the 2011 Great East Japan Earthquake Reconstruction Memorial Park, and the Peace Memorial Park from the World War II atomic bombing of Hiroshima. Lessons learnt will be gradually forgotten by people if monuments, parks, and archives exist only as structures. Each of these efforts has in common a participatory approach, such as storytelling and events, to make the monuments and parks interact with people's daily lives.

Archives and artifacts – Long-term preservation at the Nuclear Decommissioning Authority

Michelle Donoghue

Nucleus, the Nuclear and Caithness Archive, is the UK Nuclear Decommissioning Authority's (NDA) archive and it holds, manages and provides access to long-term records while meeting legal, statutory, and regulatory requirements. The archive opened in 2017 and is key to a variety of strategic programmes and business areas across the NDA group, including the Geological Disposal Facility (GDF).

This session will showcase the archive, explain why it is required, its role, and the vision for its future in ensuring the preservation of information and providing a long-term legacy for future generations. The session will also share the NDA's Heritage Strategy, which is in development, and highlight some of the challenges and benefits to working with stakeholders and communities to decide what should be kept and how we tell the story of the nuclear industry now and in the future.

Tabloo – A unique visitor and meeting centre in the Campine

Anne-Lize Kochuyt

Tabloo just opened in March this year and is the result of a long and prosperous participative journey that ONDRAF/NIRAS took with partnerships in the local community. It is a unique visitor and meeting centre showcasing science and social encounters.

We will explain how the concept of Tabloo originated and how it was developed in co-design to become a marker in the landscape, even after hundreds of years.

The centre has only just opened and yet the first projects of living memory have started already, not only on scientific themes but also with cultural and artistic collaborations. Tabloo has a long-term vision and wants to foster communication with and for people both at the local and national (even international) levels.

The evolution of community engagement leads to the provision of public services at the remediated Fernald Preserve site, Ohio (United States)

Brian Zimmerman

This session will discuss the restorative journey of the 1 050-acre Fernald Preserve, a former uranium metals production site 18 miles northwest of Cincinnati, Ohio, which is managed by the US Department of Energy (DOE) Office of Legacy Management (LM). This session will delve into the site's history of community mistrust, the challenges associated with achieving consensus among regulators, site contractors, community groups and others about clean-up levels, waste disposition, and future site use, as well as the establishment of a single clean-up mission involving community stakeholders.

This presentation will further discuss how stakeholder groups have moved from a position of little trust to one of increased trust and collaboration, facilitating progress towards establishing a final clean-up and land use plan. This session will thus share how a former warehouse was repurposed at the end of the clean-up into what is now the Fernald Preserve Visitor Centre, which preserves the site's history, provides current information and serves as a community asset.

Session 2

Marking of a repository and stakeholder interaction – the Swiss case

Felix Altorfer

In various national programmes, the regulatory framework defines a set of provisions that should be implemented for knowledge and awareness preservation over the life cycle of radioactive waste repositories. This session will reflect on the Swiss case in which the Federal Energy Act states in Art. 40 that the Federal Government stipulates that the repository be permanently marked. The corresponding ordinance stipulates that the

marking of the deep geological repository is permanent. This raises regulatory questions regarding the term "permanent" and the layout of the marking of a repository requires public participation and engagement with the local stakeholders.

ENSI's guideline G03 states that a concept for permanent marking of the deep geological repository has to be submitted with the construction licence application. The permanent marking concept has to be specified in concrete terms in subsequent licensing steps. A permanent marking pursuant to Article 40 of the Federal Energy Act must not compromise long-term safety. This has to be taken into account in the safety case for the post-closure phase.

Combining documentary provisions required by regulation and societal interactions for a robust system dedicated to memory and knowledge transmission

Jean-Noël Dumont and Florence Poidevin

This session will discuss the implementation of Andra's Memory for Future Generations programme and its four pillars: archives and regulatory provisions, societal interactions, studies and research and international co-operation. This presentation will underscore aspects of French Environment Law relating to a nuclear waste repository and the provision of a first version of a Summary Memory File (SMF) when entering the closure phase, and a Detailed Memory File (DMF) when entering the surveillance phase that follows a closure. This talk will refer to the DMF, similar to the Set of Essential Records studied within the RK&M and IDKM, which is being prepared for Andra's two nuclear facilities presently in operation. Furthermore, it will explore Andra's efforts to engage with various audiences and allow society, as widely as possible, to be aware of the issue of memory preservation for nuclear waste repositories and to be able to transmit memory to the next generations.

Post-closure related responsibilities and plans of licence holders and authorities in Finland on knowledge and awareness preservation

Timothy Schatz and Sami Naumer

The closure of nuclear waste repositories in Finland is still decades in the future. However, some aspects should be planned prior to closure to most effectively meet strategic aims according to current regulations. This session will seek to examine a recent study which analysed existing Finnish and international closure- and post-closure related requirements, rules and legislations that define responsibilities for the involved parties such as licence holders and authorities. This study assesses how such parties have addressed these responsibilities and where efforts are missing, particularly relating to knowledge preservation. This presentation will share the key issues identified by the study and follow-up discussions regarding nuclear knowledge preservation in Finland as well as discuss the position of these issues within an overarching knowledge preservation strategy.

They do things differently in Finland – Exploring the Finnish approach to awareness preservation

Petri Paju

As Finland expects to start operating the world's first repository for spent nuclear fuel at Olkiluoto in south-west Finland within a few years, it is timely to ask how awareness preservation stands in the country. Finland is curiously not very present in the Nuclear Energy Agency's rich studies about Records, Knowledge & Memory preservation regarding nuclear waste management. Finland's nonappearance applies to both research publications and other materials. The movie "Into Eternity" (2010), which Michael Madsen and his crew filmed at Onkalo in Olkiluoto, is the one major exception. What (if anything) can we find elsewhere, and how can we better understand this situation?

This paper will present findings from a research project seeking to shed light on the views and work of the Finnish expert community on nuclear waste management related to issues on knowledge preservation and awareness (memory) preservation. Based on these expert interviews and a selection of published materials on the Finnish case, this paper will focus on key ideas and features of these developments, and discuss their implications for possible future work on knowledge and awareness preservation.

Information and knowledge preservation over generations in a regulatory context

Carl-Henrik Petterson and Annika Bratt

The NEA RK&M initiative identified regulation as one method for Record, Knowledge and Memory (RK&M) preservation. This session will consider how legal requirements and regulations are important by giving a base level for RK&M preservation. Weak or absent RK&M preservation regulations means that any RK&M preservation measures provided by the implementer to a large extent depend on the implementing organisations' present attitudes and values regarding RK&M preservation. Attitudes and values can change over time. From a stakeholder perspective, legal requirements and regulations addressing RK&M preservation can strengthen the public's confidence in the decision-making process. The RK&M initiative summarised the present regulations regarding RK&M preservation in 12 member countries. This work shows that current regulations generally focus on archiving repository records related to the licensing activities but less consideration is given as to why RK&M preservation is required beyond licensing as well as what records a future receiver might be interested in. This presentation will draw attention to the way in which the Swedish Radiation Safety Authority is currently exploring how RK&M preservation can be addressed through regulations in an ongoing regulatory update for geological repositories. This update intends to address the areas that the RK&M initiative deemed to be inadequately regulated.

Session 3

How to create specific storages to preserve radioactive heritage objects?

Thomas Beaufils

Every year, hundreds of radioactive objects linked to the history of science and radioactivity are taken in charge by the national radioactive waste management agencies and stored for good in nuclear waste storage sites without having been studied by researchers. While most of them are ordinary, others are rare and of great heritage value. The law in this area is nowadays inflexible. Health law always takes precedence over heritage law. Should these objects be systematically considered as waste or should they be reclassified, protected and preserved? And if these objects were saved, which institution would take care of them? In what kind of storage facility? Managed by what kind of staff? And for what purpose? A debate on this subject would be worthwhile. Today, hardly any museum is capable of recovering them in good condition. Should we create a specific place for radioactive heritage objects within the nuclear waste storage facilities themselves, as COVRA does in the Netherlands?

Lessons need to be learnt on how to safely keep these heritage objects, while taking care of the precepts of preventive conservation, which aims to keep the object intact. Preserving and exhibiting radioactive heritage would allow for a better understanding of radioactivity by the general public. This paper will present and describe concrete cases from institutions in different countries, including the Musée Curie in Paris where Thomas Beaufils has done fieldwork.

The BFI film and nuclear archive

Daniel Beck

This presentation focusses on two artworks made in partnership with the BFI National Film Archive. Situated within a Cold War era defense ministry nuclear facility, the BFI's Master Film Store contains thousands of tonnes of film and television media. In order to preserve both the content and material integrity of this media, a world-leading cold storage facility sits at the centre of a large site scattered with bunkers, storage rooms and operational relics of its nuclear history. Presenting at EGAP are two works that explore the unique nuclear military history of the BFI site. Both pieces seek to offer new ideas for the preservation and understanding of nuclear histories, exploring the potential for artworks and cultural archives to act as conduits for the preservation of post-atomic consequences.

The practice will be presented in printed format as a sound mapping project that combines images and interviews with nuclear era veterans, archivists and technologists, with field recordings taken at each of the bunkers, workshops, woodlands and modern storage facilities throughout the site. In addition, a further project sees a collection of audio-visual webpages designed to inherit the nuclear half-lives of radioactive materials, transmediated to 35 mm film print and VHS tape. The project explores the potential for film and sound-based media to act as witnesses to the legacies of nuclear materials, and questions the role the archive can play in preserving these for the future.

Markers that convey a message: Communicating with future generations

Arne Berckmans

As part of a Master's degree in product development, he designed a marker and tested its efficiency to convey messages to future generations and deter them from disturbing the tumuli. It is to be positioned next to the tumuli covering the LLW repository in Dessel.

The study sought to determine what parameters influence the chances of survival of a marker and its message, the characteristics of the marker itself, the different ways of communication, a vison on how the far future might look like and reasons for loss of data.

Based on the insights gained and using the principles of integrated product design, several concepts of a marker were developed, leading to a final design being presented. The efficiency of the message integrated within the marker was verified using VR technology. A small sample of public volunteers, unaware of the reason for the tumuli or its contents, was asked to answer a set of questions after viewing a 3D VR model of the marker.

The results were encouraging in that the majority of interviewees understood that not disturbing the tumuli was a better idea than trying to gain access to its contents.

Art and intergenerational knowledge transfer

Ele Carpenter

Ele Carpenter will present two projects which demonstrate how contemporary visual art creates intergenerational knowledge about nuclear sites in Australia.

Alex Ressel and Kerri Meehan are working in collaboration with aboriginal artists in Gunbalanya, Arnhem Land, in the Northern Territory of Australia. The artists are focusing on the highly developed cultural forms of indigenous intergenerational knowledge transfer about Sickness Country, where uranium lies very close to the surface of the earth in the Kakadu National Park. The artists are interested in following the material trace of uranium mined from their lands for the European nuclear industry and its eventual reburial as waste.

Gabriella Hirst is an Australian artist living and working in London and Berlin. Her recent public artwork "An English Garden" was a memorial to the British nuclear test in Montebello, United Kingdom, and was forcibly removed amid intense political debate in the United Kingdom. The artwork reveals a certain level of ignorance of Britain's nuclear history, and the importance of global solidarity between nuclear communities to share, understand and gain recognition for the way in which knowledge of nuclear sites and histories can have agency in the present, and provide evidence in the future.

Magazine of the century – A communication experiment

Barbara Habermacher

In the fall of 2022, the Swiss project for a deep geological disposal entered a decisive phase: the National Cooperative for the Disposal of Radioactive Waste (Nagra) announced its siting proposal for the deep geological repository. At the same time, Nagra launched the project called the "Magazine of the Century".

This project foresees publishing an issue of the "Magazine of the Century" once a year for the next one hundred years until the closure of the deep geological repository. The journalistic and creative examination of the topic of radioactive waste disposal will document how society and science deal with this important task. The journal will thus serve as a chronicle of the social and ethical aspects surrounding the repository.

The first issue was published in June 2022 and was written by a journalist who investigated how Switzerland views the deep geological repository. Different people have their say: an author, a politician, Nagra's CEO, a critic.

Together with the magazine, a special website was launched where everyone is invited to leave a message for future generations to read. In one hundred years, these messages will be released to the public to reveal what was considered to be important one hundred years ago.

The magazine will be archived digitally, on paper and on microfilm.

Nuclear heritage: Material practices anticipating and resourcing distant futures in the present

Gabriella Ivacs

The emerging heritage definition entails assembling, building and designing future worlds (Harrison 2020): this concept radically differs from the traditional heritage definitions. Using Niklas Luhmann's language, conservation practices of different heritage domains can be seen as apparatuses or "technologies" oriented to future presents. They transform them into a string of anticipated presents.

Heritage is generally tasked – according to the above definition- with preserving an endangered object, and each heritage domain is concerned with establishing conservation/ preservation targets as both objects of knowledge and fields of intervention. The discrete yet adjacent heritage domains – among them archives – can be said to be actively engaged in the work of assembling and caring for future worlds. This also means that the heritage concept is defined by certain information management practices in our societies – practices that are intended to control uncertainty and to identify, define and secure the existence of their subjects into the future. These practices can be sometimes not only robust, controversial and driven by utopistic ideas but also realistically designed solutions. In our context: planning and management systems can in parallel produce and enact futures they try to prevent.

Until recently, radioactive waste and nuclear waste management were labelled as "toxic heritage", managing redundant and superfluous objects. Disposal itself is a continual practice of holding things in a state of absence. On the other hand, current scholarship suggests that we should consider the conceptual proximity of heritage management and nuclear waste management. The presentation is about different temporalities and different conceptions of archives and history. A future that must fall under administrative control exceeds the cumulative historical record from which inductive support may be drawn.

Future generation potential information needs

Carl-Henrik Pettersson

The RK&M initiative emphasised that it is not just a question of handing down a message, but of keeping that message interpretable, meaningful, credible and usable over time. It is therefore equally important to create processes to ensure that happens.

This presentation will seek to unpack the important question of how long such a message needs to be available to future generations and for what reasons. Due to safety reasons, the value of information related to a repository for radioactive waste will decrease with time as a function of the radioactive decay. Beside safety reasons, the value of the information to future societies can also be seen from an ethical perspective, for example providing future generations freedom of action regarding the management of the waste.

This session will also discuss the top-down methodology when developing scenarios for future human actions in post-closure safety assessments that could be used when exploring future generations' potential information needs.

Memory of Mankind (MOM) project

Martin Kunze

The dire vision that the only written remains of our era might be the embossing on the bottom of stainless steel pots triggered the idea of using ceramics as durable data carriers by misusing a technology which was developed to print company logos on coffee cups: 20x20 cm high quality white bathroom tiles with a colour print with ceramic toner, fired onto the surface. These most durable data carriers of humanity are stored in ceramic boxes deep in a vault within the oldest salt mine in Hallstatt, Austria, which is part of a UNESCO World Heritage site.

These possibilities allow us to pass on what we find most important from our era. The contents are compiled by entities that use MOM as a medium to store information for the long term and also by individuals worldwide who upload text on the webpage to be sent to the future, yielding the first bottom-up history of mankind.

"Marking" the Australian nuclear fuel cycle as future cultural and environmental heritage

N.A.J. Taylor

The earth is marked by the nuclear age — earth is, in effect, a nuclear archive. This is true whether we consider the history of the nuclear age or its future. High-level radioactive waste repositories are intended to be sealed and passively monitored (without human intervention) for the next 100 000 or more years. Technical solutions have been established to manage the ecological risk, but there is broad agreement that the risk of (human) intrusion remains. It remains an open question as to how, if at all, these sites should be archived by the establishment of "markers". That is, what symbols, texts, images and warnings might humans responsible for such markings use today in order to communicate to beings 10s and 100s of thousands of years into the future? Will these intruders comprehend — and agree with — the warnings delivered by present-day humans at all?

This paper is part of a much larger three-year project that addresses these transdisciplinary concerns by approaching the Australian nuclear fuel cycle as a future cultural and environmental heritage. Specifically, the project is the first systematic study of the limits and possibilities of far-future nuclear communication in relation to the Australian nuclear fuel cycle. Focusing on Australia is both theoretically interesting and empirically important since the country contains more than one third of the world's known uranium, as well as the world's oldest continuous cultures on earth's most arid and stable bedrock. Australia is a critical site for the conception of the nuclear fuel cycle as a future cultural and environmental heritage. In so doing, the empirical innovation of foregrounding Australia's nuclear archive is met by the conceptual innovation of addressing contemporary concerns with interdisciplinary methods and theories.

The proposed paper for the NEA workshop develops a central research question to which I seek interdisciplinary engagement from fellow panellists in order to devise a robust answer: What methods and means can be identified in Australia that advance international best practice for communicating nuclear heritage into the far future?

Consciousness of the landscape

Cécile Massart

The first part of this presentation focuses on a series of photos taken at radioactive waste sites, with a summary of exhibitions and videos designed to reflect the link with respective reports. Whether in a gallery, museum, cultural centre or enterprise, these works address topics like the public's level of knowledge, environmental issues, technologies used, future changes in the landscape, transformations, migrations and politics. These elements represent the main triggers outlined in a study which started in 1994.

Cécile Massart's research on memory transmission for the future started in this context. Her book entitled "COVER" (Lettre Volée, 2010) is a compilation of drawings created during her travels to historic sites throughout the world, a testimony to vanished civilisations, and her markers intended for low-level radioactive waste sites. Projects based on these markers were studied for France's National Agency for Radioactive Waste Management (ANDRA) CSM Manche site.

Following an artistic residence at the Waste Isolation Pilot Plant (WIPP) and at Beatty, Nevada next to Yucca Mountain, Cécile drew seven concepts entitled "LABORATOIRES". These drawings are of environmental structures situated near high-level radioactive waste repository sites under construction, and visible to everyone in the landscape. "BatLab" – a marker with unprecedented architecture, fits into this plan to unite researchers from various disciplines to discuss modes of transmitting memory (e.g. film, wandering, songs, markings, tools and technology) in connection with universities, art schools, rural associations, communities, in order to imagine a regeneration.

This landscape structure opens the path towards forming a new way of oversight monitoring by everyone for everyone, and learning to live with waste. Art is a powerful vector, and a nuclear culture can help to understand challenges.

Session 4

Futures literacy – Why it matters to transmit information on high-level radioactive waste to future generations

Anders Högberg

Futures literacy empowers decision-making. It is a learned capacity to: 1) visualise a variety of possible futures that are different from the present; and 2) be in control of theoretical and practical tools for acting in the present in relation to the future. It is an ability that develops with knowledge and experience. It is not about predicting the future or controlling it, but becoming better at understanding the roles of the future in contemporary society and its practices and how such practices can enable the realisation of a variety of futures. Futures literacy creates an awareness of the assumptions about the future that present-day decisions (often un-reflected) tend to be based on. It is a capacity that liberates people from the tight shackles of "presentism": the unquestioned and disabling assumption that the current status quo is timeless. In developing futures literacy, the ways in which past knowledge and future expectations shape understanding and action in the present are clarified. I will discuss what this means in terms of remembering the past in the future. I will present what futures literacy is, and give concrete examples to illustrate why it matters and how we can benefit from it.

History or heritage? Understanding cultural processes over time

Cornelius Holtorf

I will discuss how, in talking about remembrance over time or about awareness preservation, we can distinguish between two seemingly incompatible approaches and ways of thinking. On the one hand, there is the approach of "history" (e.g. public history), which seeks to gain and maintain knowledge of the past in the present (including future presents). According to this way of thinking, such knowledge is valuable in its own right, and due to historical research, it is being improved continuously. This approach seeks to operate as much as possible isolated from the contemporary context and is concerned neither with the shifting meanings of the past nor with whom or what this knowledge benefits in society.

The alternative approach is associated with "cultural heritage" and asks about the significance of the past in the present (or indeed in the future: the realm of heritage futures). According to this line of thinking, manifestations of the past occur in societies because they play certain useful roles, which change over time. This approach asks about (re-)interpretations, (re-)uses, and (re-)creations of the past in specific contemporary contexts but it is not primarily concerned with the question of whether any such manifestations are historically accurate or not. The difficulty in the context of preserving awareness of radioactive waste repositories is that many desire solutions based on the approach of "history" (maintaining knowledge of the past) when at the same time just as many expect that repositories and associated media of communication will end up as "cultural heritage" (manifesting reinterpretations of the past).

Memory and time – Reflecting on remembrance and narrating the past

Carina Green

This presentation revolves around the concept of memory, drawing primarily on anthropological understandings of "social memory". Memory is here seen as constructed in specific cultural and societal contexts. Memory is not merely a narration of the past, but rather a reflection of how the present is understood and how futures are imagined. Moreover, memory is intrinsically linked to ontological notions of time and space, and thus differs among human societies. In relation to nuclear waste depositories, we can gain valuable tools to imagine how radioactive waste could be communicated and remembered by reflecting on the creativeness of memory and on diverse ontological notions of time.

Long-term cultural memories and nuclear legacies – A cultural semiotics approach to transmitting narratives of environmental awareness to the future

Francesco Mazzucchelli

Semiotics has always made important contributions to the debate on the "symbolic management" of radioactive waste. In the 1980s, a new discipline – nuclear semiotics – was created to address the problem of how to communicate the risks of radioactive waste to future generations. But what kind of semiotics is invoked in this debate? Semiotics is indeed a broad field in which different epistemologies and approaches, as well as different understandings of meaning processes, coexist and compete. Recently, especially in Italy, a school of "semiotics of memory" has emerged that focuses on the processes of construction and transmission, codification and translation of the past. This approach is situated in the convergence of various theoretical traditions, but places a particular emphasis on issues of narrativity and enunciation. In my paper, I will argue how this variant of semiotics might reformulate some of the traditional viewpoints of nuclear semiotics by transforming what has usually been considered a problem of long-term communication into a problem of memory transmission (in other words, a "heritage issue").

Orchestrating nuclear futures: Lessons from the history of scientific prediction

Eglė Rindzevičiūtė

One of the greatest challenges facing the nuclear sector is planning for the extreme long term, which is required to secure the safety of radioactive waste. The long term, however, has been notoriously inconvenient for modern governance: neither the epistemology of scientific prediction nor the cyclical nature of political process bodes well with the requirements of the long term. In the context of radioactive waste management, there is an additional challenge of complexity pertaining to technoscientific, material, social and political uncertainties. In this talk, I will revisit the history of the modern scientific prediction, a form of knowledge that deals with complexity and uncertainty that I have explored at length in my book, *The Will to Predict: Orchestrating the Future Through Science* (Cornell University Press, forthcoming in 2023), to argue that there is a need to

raise awareness of different models of scientific prediction as they inform policy and management decisions at different levels of complexity. Governing the long term, from this perspective, is striving for an appropriate orchestration of scientific predictions.

Closing session

Nuclear message

Martin Kunze

The challenge of creating a compact description of a nuclear waste repository is the uncertainty about future languages and writing systems – or rather the certainty that they will be significantly distinct from the ones we use today. This talk will reflect on the question of how we can pass on information about the location, characteristics and content of a NWR that will still be comprehensible in one million years. Given that the audience that a nuclear message is aimed at will have the technical means to intentionally intrude into a geological repository, their understanding of the universe and the fundamental forces must be at least similar to ours. This is the core of a new concept to use "universal icons", derived from phenomena which are equal throughout the cosmos. For example, the periodic table of elements must look similar in any technically industrialised civilisation. The table of elements is not an arbitrary list, but is based on the characteristics and properties of matter. And given that any technical society will never invent quantum physics before the steam machine, a highly advanced civilisation would have passed our stage of understanding the universe in their path of development. We can therefore assume that they will be able to correctly interpret the nuclear message we leave behind today.

Workshop takeaway

Do not forget to imagine the future!

Long-term disposal sites for potent radioactive waste should be known across many generations to prevent harm resulting from inadvertent intrusion.

But how can those responsible in the present facilitate this:

- *When values, concerns and priorities of future stakeholders are going to keep shifting, much as we see them shifting during our own lifetime?*
- *When technological innovation and scientific advancement might transform, in unknown ways, our knowledge both of the problem and of possible solutions?*
- *When languages and frames of human (or other intelligent?) beings' understandings of these sites and their content will differ from our own?*

As a starting point, we recommend:

(1) To become aware of the assumptions we all keep making about the future today and;

(2) To improve our capability of imagining different futures that could come about.

We imagine our shared future as participants of the 02022 "Remembering the Past in the Future Workshop" to have three simple phases, using a five-digit notation in writing the current year to express our long-term thinking in tens of thousands of years.

1. *As you return home, remember to plant your seeds of forget-me-nots!*
2. *On or before 24.11.02023, don't forget to take a picture of your living plant and send it per attachment to egapworkshop2022@oecd-nea.org*
3. *At any time, think about what we could create from the arriving pictures: we will show you in January 02024!*

Please send any questions to: egapworkshop2022@oecd-nea.org

Notes

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