

International Conference on Geological Repositories 2016

Conference Synthesis
7-9 December 2016
Paris, France



Radioactive Waste Management

**International Conference
on Geological Repositories 2016**

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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Foreword

Worldwide consensus exists within the international community that geological repositories can provide the necessary long-term safety and security to isolate long-lived radioactive waste from the human environment over long timescales. Such repositories are also feasible to construct using current technologies. However, proving the technical merits and safety of repositories, while satisfying societal and political requirements, has been a challenge in many countries.

Building upon the success of previous conferences held in Denver (1999), Stockholm (2003), Berne (2007) and Toronto (2012), the 2016 International Conference on Geological Repositories (ICGR 2016), brought together high-level decision makers from regulatory/local government bodies, waste management organisations and public stakeholder communities to review current perspectives of geological repository development. The 2016 conference theme, “continued engagement and safe implementation of repositories”, was designed to promote information and experience sharing, particularly in policy development and regulatory frameworks. Repository safety, and the planning and implementation of repository programmes with societal involvement, as well as ongoing work within different international organisations, were also addressed at the conference.

This synthesis was drafted by Russell Walke (Quintessa, United Kingdom) and finalised under the direction of Dr Gloria Kwong of the OECD Nuclear Energy Agency (NEA). It was then approved by the Programme Committee and the workshop participants.



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The ICGR 2016 Conference organisers.

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List of abbreviations and acronyms

CNSC	Canadian Nuclear Safety Commission
DGR	Deep geologic repository
EDRAM	International Association for Environmentally Safe Disposal of Radioactive Materials
FSC	Forum on Stakeholder Confidence (NEA)
HLW	High-level radioactive waste
IAEA	International Atomic Energy Agency
ICGR	International Conference on Geological Repositories
ICRP	International Commission on Radiological Protection
L/ILW	Low- and intermediate-level radioactive waste
NEA	Nuclear Energy Agency
NRC	Nuclear Regulatory Commission (United States)
NUMO	Nuclear Waste Management Organization of Japan
NWMO	Nuclear Waste Management Organization (Canada)
OECD	Organisation for Economic Co-operation and Development
OPG	Ontario Power Generation (Canada)
PURAM	Public Limited Company for Radioactive Waste Management (Hungary)
RWMC	Radioactive Waste Management Committee (NEA)
SKB	Swedish Nuclear Fuel and Waste Management Company
WIPP	Waste Isolation Pilot Plant (United States)

Chapter 1. Introduction

Long-lived radioactive waste must be isolated from the human environment over long timescales, and today there is worldwide consensus that geological repositories provide the necessary long-term safety and security to effectively carry out this function. Such repositories are also feasible to construct using current technologies. The technical merits and safety of these repositories must however be demonstrated, while satisfying societal and political requirements, and this has posed a particular challenge in many countries.

This report provides a synthesis of the fifth International Conference on Geological Repositories (ICGR 2016), hosted at the Organisation for Economic Co-operation and Development (OECD) Conference Centre in Paris on 6-9 December 2016. The conference built on the success of previous conferences held in Denver (1999), Stockholm (2003), Berne (2007) and Toronto (2012), bringing together high-level decision makers from regulatory/local government bodies, waste management organisations and public stakeholder communities to review current perspectives of geological repository development. The 2016 conference theme, “continued engagement and safe implementation of repositories”, was designed to promote information and experience sharing, particularly in policy development and regulatory framework.

The conference had the following objectives:

- To take stock of progress since 2012 in developing and implementing geological repositories for long-lived radioactive waste, and to advance mutual learning through this international forum for the exchange of perspectives and experiences.
- To examine the latest issues and challenges encountered by various stakeholders in different developmental stages by sharing experiences among countries developing geological repositories.
- To consider the social, political, scientific and economic aspects of geological repositories so as to advance understanding of the complexity of implementing geological repositories.

This synthesis of the conference provides a high-level summary of the material that was presented and discussed. The order of the material has been adapted from the precise sequence at the conference to aid in its presentation. The synthesis is intentionally discursive and excludes figures and tables. The conference programme is provided in Appendix A and the presentations are available on the NEA website: www.oecd-nea.org/rwm/workshops/icgr2016.

- Chapter 2 summarises the status of national geological repository projects presented at the conference.
- Chapter 3 provides a summary of issues and challenges relating to engagement of stakeholders in geological repository projects that were presented and discussed at the conference.
- Chapter 4 summarises presentation and discussion of the added value of international collaboration in supporting the safe implementation of geological repository projects.
- Chapter 5 presents some concluding remarks.

In addition to other participants, the conference was attended by nine young professionals, who were selected by their home institutions. A paper summarising their discussions, related to working within the radioactive waste management field, is provided in Appendix B.

Chapter 2. Status of national geological repository projects

Since the last International Conference on Geological Repositories (ICGR) was held in Toronto in 2012, there has been significant progress in several geological disposal programmes. A strong national commitment to safely managing long-lived radioactive waste together with effective engagement at a local level have been common features among these programmes:

- In 2015, the Finnish government granted Posiva a licence to construct a geological disposal facility for spent nuclear fuel at Olkiluoto.
- In 2016, the Swedish nuclear regulator issued a positive response to the Swedish Nuclear Fuel and Waste Management Company's (SKB) application for a spent nuclear fuel repository at the Forsmark site. The regulatory process now passes to the Environment Court in Sweden.
- Notable progress has also been seen in other national programmes, including those in Canada, France and Switzerland.

The ICGR 2016 included updates on the status of several geological repository projects and included a session devoted to the French Cigéo project. These are summarised in the sub-sections below.

Cigéo: The French geological disposal project

The national commitment to resolving the issue of radioactive waste disposal in France has been supported at the level of the national parliament through a cross-party science and technology evaluation body called the Office Parlementaire d'Evaluation des Choix Scientifiques et Technologiques (OPECST). OPECST has a specific remit to adopt a long-term perspective, which is needed when addressing the liability posed by radioactive waste to future generations.

The French National Radioactive Waste Management Agency (Andra) is tasked with managing radioactive waste in France. By the time of ICGR 2012, national screening and engagement had led to a focus on the Meuse/Haute-Marne region for siting of a geological repository in a clay host rock, dedicated to intermediate-level, low-level and high-level radioactive waste. Construction of an underground research laboratory (URL) at the Bure site started in 2000. The "Dossier 2005" study drew on understanding gained from the URL and confirmed:

- the feasibility of disposal in the Callovo-Oxfordian clay;

- a “transposition zone” with the same geological characteristics as encountered at Bure;
- that it is possible to engineer reversibility into the disposal system, as required by French law.

In 2009, after engagement with local elected representatives, attention focused on a 30 km² region within the transposition zone with potential for hosting the geological repository, termed the “zone of interest for deeper investigations” (ZIRA). In 2011, the URL was granted authorisation to continue its research activities until 2030. In 2012, the Cigéo name was coined for the project and the emphasis for the programme shifted towards the site becoming a technical/industrial centre.

In 2013, organised and vocal opposition prevented a new public debate, which had been planned to include 14 public meetings. The time frame for the debate was extended in response, as the debate was successfully moved online and a citizen’s conference was held to obtain an informed opinion from the public.

In 2016, a master plan of operations for the Cigéo project was delivered by Andra together with a safety options dossier. The masterplan documents the status of the project and provides a clear plan for its realisation, including each important milestone.

Also in 2016, a law was published that established a formal definition of “reversibility” as: *the ability in principle to reverse decisions taken during the progressive implementation of a disposal system*. Reversibility therefore requires flexibility to be designed into the concept to enable it to adapt to new understanding and technologies, and so is broader than just retrievability of waste, which is also required.

The formal application by Andra for a construction licence is currently planned in 2018. After review, the authorisation for construction, if granted, will take the form of a decree of the government. At the end of a first phase of construction, operation would commence with an industrial formal pilot phase aimed at testing and demonstrating the viability of the facility.

The Cigéo project is proceeding with the support of the local municipalities. It represents a major industrial project within a relatively sparsely populated and rural region. Public interest groups (GIPs), comprising representation from the government, Andra utilities (Électricité de France, Areva and the French Alternative Energies and Atomic Energy Commission (CEA) and local authorities, receive annual funding to help prepare each affected department for the Cigéo project. The remit of the GIPs encompasses helping to manage the significant infrastructure development, economic development and support for informing, training and educating local communities. The project straddles Haute-Marne and Meuse departments, so there are two GIPs, one for each department. The GIPs help to facilitate engagement among the many different stakeholders that are involved and aim to foster and support a synergy between the implementation of the Cigéo project and regional economic development.

Geological disposal in Switzerland

Progress towards siting geological disposal repositories for high-level radioactive waste (HLW) and low- and intermediate-level radioactive waste (L/ILW) within Switzerland follows the “Sectoral Plan for Deep Geological Repositories”, which was developed by the Federal Office of Energy in consultation with a wide range of stakeholders and was approved by the federal government in April 2008. The Sectoral Plan ensures a fair, transparent and participatory procedure with priority given to long-term safety via a three-stage process. The National Cooperative for the Disposal of Radioactive Waste (Nagra) has the mandate for the safe long-term disposal of radioactive waste in Switzerland:

- Stage 1 involved the selection of potential siting regions based on safety criteria and technical feasibility. Six regions were approved by the Federal Council in November 2011. All proposed regions are suitable for the disposal of L/ILW, while three of them may also host a HLW repository.
- Stage 2 aims at narrowing the selection to at least two potential sites for each type of repository. This includes i) proposals for siting of surface infrastructure, defined in close collaboration with local participation groups, and ii) a safety based comparisons of the six regions. The results of this process were submitted in January 2015 and are currently under review: two regions (Jura Ost and Zürich Nordost) have been proposed for further evaluation in stage 3. Discussions regarding a potential third region (Nördlich Lägern) are ongoing. All three regions have Opalinus Clay as the host rock and are suitable for the disposal of both HLW and L/ILW.
- Stage 3 is anticipated to commence in 2018 and will involve detailed field investigations at the proposed sites, leading to site selection and preparation of general licence applications. The Federal Council will then decide on the licence application prior to parliamentary approval and, potentially, a national referendum.

The Federal Council decision on the general licence applications is currently anticipated c. 2029. It will be followed by on-site underground geological investigations leading to construction licence applications. Operating licences for the L/ILW and HLW repositories are currently anticipated on timescales of 2050 and 2060, respectively.

Geological disposal in the United Kingdom

In the United Kingdom, a consent based framework for establishing a geological disposal facility for higher activity radioactive wastes was established after consultation in 2008. The approach centred around the voluntary participation of local communities. Three expressions of interest were received; however, the process came to a stop in 2013 when one of the tiers of local government that encompassed the volunteer communities voted not to proceed with participation.

Following review and further consultation, a new developer-led siting process was established in 2014, which addresses issues raised through the consultation process:

- A national geological screening exercise is currently being finalised, which will provide early information for communities on their geological suitability for hosting a disposal facility.
- Greater clarity is being provided on the process of working with potential host communities, including investment for communities participating in the process.
- A clear right for communities to withdraw has been enshrined in the process.

Radioactive Waste Management Ltd (RWM) has been tasked with implementing geological disposal in the United Kingdom and currently plans to start engaging with communities in 2017.

The signing of contracts to start construction of the first of a potential series of new nuclear power plants signals a “renaissance” in the nuclear industry in the United Kingdom. Plans for geological disposal in the United Kingdom are an integral part of that renaissance and, as a nationally significant infrastructure project, an important component of national industrial strategy as the country proceeds with a commitment to withdraw from the European Union.

Waste Isolation Pilot Plant (WIPP) in the United States

WIPP is an existing geological disposal facility for transuranic waste associated with the United States’ nuclear defence programme and is located in south-east New Mexico. Waste is disposed 650 metres underground in a salt host rock. The facility is owned by the US Department of Energy (DOE) and operated by Nuclear Waste Partnership LLC. Operations at WIPP ceased in February 2014 due to two completely separate incidents:

- a salt haulage truck caught fire underground;
- continuous air monitoring detected an airborne release of radioactivity caused by the rupturing of a drum after it was emplaced for disposal underground.

At the time of the conference, the DOE was in the final stages of conducting an “operational readiness review”. In addition to addressing findings of the readiness review, authorisation from the New Mexico Environmental Department is required prior to recommencing waste emplacement.

During the period of time that WIPP has been inoperable, the natural creep that occurs within salt rocks has led to failure of rock bolts used to help re-enforce the structure of the tunnels and panels and has resulted in rock falls. As a result of the rock falls, the decision has been taken to permanently withdraw from the south end of the waste disposal panels. Among other benefits, this decision

reduces the footprint of the accessible area contaminated after the radiological release and increases the available ventilation for the remaining affected area.

The surface storage capacity at WIPP will be increased in future to enhance operational efficiency by allowing for continued waste shipments and waste receipts during mining and maintenance outages. A permanent new ventilation system will also be commissioned, including new ventilation shafts and buildings; this will allow underground mining and waste emplacement activities to occur concurrently.

The construction and operation of WIPP, together with the incidents that have occurred, have allowed valuable experience of geological disposal to be gained, as befits the “pilot” nature of the facility. This has highlighted the importance of anticipating and explicitly planning for accidents and associated recovery. The salt host rock has also been shown to behave as expected.

One particular aspect of the incidents that occurred in 2014 that merits highlight is the role that social media played in rapidly disseminating news, reactions and opinions. This emphasises the need for programmes to develop social media outlets and to ensure that communications staff are adequately equipped to rapidly disseminate information via such outlets.

Geological disposal in Sweden

SKB currently has two applications associated for geological disposal of radioactive waste within the Swedish licensing process:

- In 2011, SKB submitted a licence application to build a final geological repository for spent nuclear fuel at the Forsmark site.
- In 2014, SKB submitted an application to extend the operating shallow geological disposal facility for low- and intermediate-level radioactive waste, termed SFR, which is also at the Forsmark site.

Both applications are subject to two parallel licensing processes, which provide regulation under the Swedish Environmental Code and the Nuclear Act:

- The Environment Court is responsible for regulating the applications under the Environmental Code and associated regulations.
- The Swedish Radiation Safety Authority (SSM) responsible for reviewing the applications under the requirements of the Nuclear Act and associated regulations.

There is formal interaction between both strands of regulation, each of which makes formal recommendations to the Swedish government, which will decide on the licences subject to approval of local municipalities. There has been a strong commitment to engaging with the licensing process from the local municipalities (see also Chapter 4).

For the spent fuel repository, the Environment Court has held two rounds of public review and the formal court hearing is anticipated later in 2017. SSM has

provided a positive statement on the site, assessment method and safety of the spent fuel repository to the Environment Court. The court has raised particular questions relating to conventional environmental impacts of large engineering projects, including management of rock from excavation, non-radiological discharges to water, traffic and noise.

Government approval would be the first stage of a stepwise licensing process. Formal licences for construction and then for operation will be needed separately.

SKB is preparing for the implementing phase. Full-scale underground tests will be required as input to the operational licence application. Tests will encompass all steps in the disposal process from canister manufacture through to backfill of deposition tunnels and will cover quality control throughout.

Geological disposal in Canada

The Canadian Nuclear Safety Commission (CNSC) is the sole nuclear regulator in Canada, operating under federal jurisdiction. Responsibility for regular, clear communication, provision of information and engagement with stakeholders, including members of the public, is inherent in Canadian legislation. Both the CNSC and the licensees that it regulates are extensively involved in engagement and outreach activities; engagement and ongoing communication with the public and communities is an explicit regulatory requirement on licensees. In addition, it is important for public confidence that the CNSC be fully transparent in its work and to continuously emphasise and explain its independent nuclear regulatory role.

Ongoing explicit involvement of indigenous and other communities is an integral component of the licensing process in Canada. Engagement can take the form of public hearings/meetings, direct funding of participants to support their engagement, active outreach through aboriginal and public consultations.

In 2011, Ontario Power Generation (OPG) submitted an application for a licence to construct a deep geologic repository (DGR) for low- and intermediate-level operational and reactor refurbishment wastes at the Bruce site in Ontario. The Canadian government convened a joint review panel (JRP) of experts to oversee the review of OPG's submission. The review process included 33 days of public hearings, which were held in the local communities, and over 200 public interventions were addressed. In May 2015, the JRP published its findings, concluding that the proposed DGR:

- is not likely to result in significant adverse environmental effects;
- is not likely to cause significant adverse effects on aboriginal interests.

The JRP's report also includes 97 recommendations, identifying specific issues that merit explicit consideration as the licensing process progresses, as well as opportunities for improving and refining the process itself. In February 2016, the Canadian Minister of the Environment and Climate Change requested additional studies of OPG in relation to the DGR project. Those studies were delivered by OPG in December 2016.

Canada's initiative for long-term management of spent nuclear fuel within a deep geological repository is termed adaptive phased management (APM); APM implementation is the responsibility of the Nuclear Waste Management Organization (NWMO). The APM programme is currently in the site-selection phase, with nine communities remaining under consideration. NWMO continues to engage in partnership with those communities, as well as with the local First Nation, Métis and surrounding communities.

In the current pre-licensing phase of the APM programme, the CNSC is also engaging in outreach programmes to build relationships with the various stakeholders and to explain the independent regulatory role. This engagement takes the form of meetings with elected representatives, public meetings and "open house" events and also extends to First Nation, Métis and surrounding communities.

Experience of engaging with stakeholders over issues relating to radioactive waste management has highlighted that it is useful to establish:

- early active dialogue and engagement with proponents and stakeholders, in order to clarify regulatory requirements, identify and focus on key safety aspects, and maximise national and international collaboration throughout the regulatory process;
- a single point of contact within the outreaching organisation so that people can associate the invitation with a name and a face, thus helping to personalise the engagement;
- an explicit engagement/outreach plan, which is developed with local liaison committees and is pro-actively updated and maintained.

Geological disposal in Hungary

A programme to develop L/ILW disposal in Hungary, called the Ófalu Project, was initiated in 1984 during the country's socialist administration. Site investigation work progressed without opposition until the end of the socialist era in Hungary; during this time, there was no direct public involvement in the process and a lack of communication with the local community. The demise of the socialist regime allowed opposition to be heard and the project was terminated in 1989.

A parliamentary act in 1996 established a new framework for radioactive waste disposal in Hungary. A public limited company for radioactive waste disposal, PURAM, was then established in 1998, owned by the state and financed by the nuclear power generator and other waste producers.

A decision to investigate Bataapáti as a potential site for hosting a geological repository for L/ILW was taken in 1996. As the investigation of the proposed granitic host rock progressed, PURAM actively engaged with the local community through public hearings, co-operation with locally elected representatives and through support for local groups. In 2005, a referendum established that the local community overwhelmingly supported a repository at Bataapáti; this was followed by approval from the Hungarian parliament.

Underground construction was completed in 2012 and was followed by the first waste emplacement. PURAM continues to optimise the disposal process and a new disposal concept will be introduced in 2017, including compaction and the use of an active grout to backfill disposal containers. PURAM also continues to engage with the public, through a visitor centre, educational programmes, press conferences and public events. Opinion polls continue to show strong support in the surrounding communities.

For higher activity wastes, PURAM is investigating the potential for a claystone formation to host a deep geological repository. Borehole investigations are at a relatively early stage. An underground research laboratory is envisaged c. 2030, whereas construction and operation are not envisaged to take place until after 2050.

Geological disposal in the Czech Republic

The responsibility for implementing geological disposal of the Czech Republic's high-activity radioactive wastes lies with the national Radioactive Waste Repository Authority (RAWRA/SÚRAO). Nuclear safety in all stages of the DGR implementation process is overseen by the State Office for Nuclear Safety. A programme exploring geological disposal was initiated in 1993 and focused on granitic host rocks.

In 2014, the Ministry of the Environment permitted surface-based investigation of seven potential sites for the geological repository. Invasive survey of three to four sites will follow and two candidate sites should be identified in 2020. Site selection is anticipated in 2025 and will be followed by construction of an underground research laboratory. Commencement of DGR operations is expected in 2065.

Local opposition has been encountered at all the sites that have been proposed. Stakeholder engagement is therefore an important topic for SÚRAO and includes public workshops and information sessions. New legislation is being prepared to clarify the involvement of local municipalities in the process of siting of the DGR.

Geological disposal in Japan

Japanese government policy is for deep geological disposal of HLW and low-level radioactive waste containing long-lived nuclides (TRU waste) from Japanese nuclear fuel cycle. However, public attitudes towards geological disposal of radioactive wastes in Japan have been negatively affected by the consequences of the Fukushima Daiichi nuclear power plant accident. In May 2015, a revised Basic Policy on the Final Disposal of Specified Radioactive Waste was published, explicitly allowing for reversibility of policy and including retrievability as part of the geological disposal concept.

The Nuclear Waste Management Organization of Japan (NUMO) is tasked with implementing geological disposal in Japan. NUMO works to steadily promote geological disposal by:

- preparing a peer reviewed generic safety case for deep geological disposal in Japan;
- providing information and communicating at a national level about the safety of geological disposal, including public symposia and seminars;
- providing information about the suitability of specific areas within Japan for hosting a DGR;
- providing information and financial support to municipalities wishing to learn more about geological disposal.

The Ministry of Economy, Trade and Industry (METI) plans to publish the results of a nationwide screening process that categorises all areas within Japan as i) potentially unsuitable, ii) potentially suitable or iii) potentially more suitable for hosting a DGR. METI requested that the NEA conduct an independent peer review; the review has recently been published and concludes that the process being followed in Japan and the associated siting criteria are generally in accordance with international practices. The government is aiming to publish the outcome of the national screening process in 2017.

Chapter 3. Stakeholder engagement in geological disposal projects

The 2016 International Conference on Geological Repositories (ICGR) 2016 included “engagement” in the conference title to emphasise the importance of stakeholder engagement to successful and safe realisation of geological disposal. As an increasing number of programmes progress towards implementation, that importance is reflected in the way that stakeholder involvement has evolved from consultation, through dialogue, to engagement and partnership. The conference itself included active participation from elected representatives from actual and potential host communities and was attended by representatives of other community groups, including First Nation and Métis representatives from Canada.

NEA Forum on Stakeholder Confidence

The NEA Radioactive Waste Management Committee (RWMC) created a Forum on Stakeholder Confidence (FSC) in 2000 to address societal issues associated with waste management. The forum promotes open discussion regarding the societal dimension of radioactive waste management and has broad international participation, including policy makers, regulators, implementers and specialists. The forum hosts annual meetings, which provide an opportunity for participants to discuss issues relating to stakeholder confidence; the 17th annual meeting took place in September 2016.

The FSC also supports national workshops, which are hosted in volunteer NEA member countries. The workshops aim to bring together all the national stakeholders and to provide a neutral ground for discussion, dialogue and advancement of knowledge on long-term radioactive waste management. Participation in the workshops is inclusive of members of the public. The 10th FSC national workshop was hosted by the Swiss Federal Office of Energy, also in September 2016, and involved 84 participants. The workshop addressed long-term sustainability of decisions and knowledge, along with how to engage with the non-involved but potentially affected groups.

Perspectives from local community representatives

ICGR 2016 included presentations from locally elected representatives in host and potential host communities from Canada, France and Sweden. The past 20 years has seen improved engagement with stakeholders in geological disposal projects.

At the same time, public expectations of involvement in the decision-making process have increased. Successful projects now refer to forging partnerships with local communities, implying a more equitable and enduring relationship, to the benefit of safe implementation.

Public fear of radiation risks remains an important factor to be addressed in the safe management of radioactive wastes. Community engagement can help to allay fears through explaining radiation risks and provision of supporting information sufficient for people to draw their own conclusions – i.e. through explanation more than persuasion. Education has a role to play, including contributing to school programmes, which may be best supported from the regulatory side to avoid a potential perception of manipulation.

Important factors for the municipality of Östhammar in Sweden, which host the SFR facility and is the proposed location for the geological repository for spent nuclear fuel are summarised below:

- Long-term safety is a key concern.
- The municipality wants to play an active role in the whole decision-making process.
- Conditions placed on any licensing terms need to be clearly stated before the municipality is asked to make a decision.
- The municipality wants to understand the assessment that the safety authorities undertake when making decisions and when making recommendations to the government.

Local communities have extensive knowledge and understanding of the local environment. This is particularly true in the context of First Nation and Métis communities, whose culture is close to the land and is founded on inherent respect for the natural environment. Drawing on the knowledge and understanding of local communities both strengthens safety analyses and encourages engagement and participation.

Good engagement allows local communities to have a greater degree of ownership in the decision-making process.



Experiences of stakeholder engagement

Public meetings were held as part of the Yucca Mountain project for proposed geological disposal of radioactive wastes in the United States. The meetings involved scientists and engineers with a strong understanding of the technical basis for geological disposal. However, although experienced in presenting to scientific audiences, the speakers were unprepared for the wide variety of questions that can be encountered in public hearings.

This experience led the US Nuclear Regulatory Commission (NRC) to shift its engagement strategy. A dedicated multidisciplinary outreach team was employed to help tailor information to each audience, including provision of fact sheets for frequently asked questions. Greater care is now taken over the way that information is presented, including greater use of graphics, a focus on plain language and inclusion of glossaries. Explicit communication plans are now also prepared, which include definition of the key messages and identification of the target audience. Understanding the audience, in terms of their concerns and the way in which they prefer to access information, is an important part of the process.

Social media played an important role in the way in which news of the recent incidents at the WIPP facility became public. This highlights that informal social media, including instant messaging and posting, is an increasingly important component of communication. Engagement strategies therefore need to encompass social media, which also provides a powerful tool for reaching out to stakeholders. All programmes also need to plan to rapidly respond and disseminate official information in the event of adverse news and/or misinformation breaking over social media.

Chapter 4. International co-operation in supporting geological disposal

The small number of geological repositories needed to manage radioactive waste arising within any one country means that international co-operation is essential in establishing and disseminating best practice. Also, geological repository programmes in different countries encounter the same sorts of challenges, whereby collaboration results in pooled resources that add significant value to research programmes and other studies.

International co-operation in relation to geological repositories occurs via a range of routes:

- Some supra-national bodies, such as the NEA and International Atomic Energy Agency (IAEA), have a specific remit to co-ordinate international co-operation, to establish and disseminate best practice that encompasses geological repositories.
- The European Commission (EC) funds and co-ordinates collaborative research that supports safe implementation of geological repositories.
- Collaborative forums provide a route for joint studies and pooled research outside some of the constraints of supra-national bodies, examples include:
 - strategic-level collaborative fora, such as the World Association of Nuclear Operators (WANO), the International Association for Environmentally Safe Disposal of Radioactive Materials (EDRAM) and the Implementing Geological Disposal of Radioactive Waste – Technology Platform (IGD-TP);
 - fora with a more technical focus, with examples including the Development of Coupled Models and their Validation against Experiments (DECOVALEX), Febex and BIOPROTA.
- Collaboration is also seen in support of some underground research laboratories, e.g. in the framework of the Mont Terri Project and the Aspö Hard Rock Laboratory.
- Bi-lateral agreements, including, for example, formal arrangements, such as the recent memorandum for co-operation between the Czech Radioactive Waste Repository Authority (SÚRAO) and the Italian Nuclear Plant Management Company (SOGIN).

ICGR 2016 included a session on the added value of international co-operation, the topics of which are briefly summarised below.

NEA Radioactive Waste Management Committee

The NEA Radioactive Waste Management Committee (RWMC) is an international committee of senior representatives from regulatory authorities, radioactive waste management and decommissioning organisations, policy-making bodies, and research and development (R&D) institutions from NEA member countries. The RWMC facilitates and co-ordinates collaboration within member countries on a range of topics, include in support of safe implementation of geological repositories. Its work contributes to advancing scientific knowledge and defining international best practices for safe geological repository implementation.

Initiatives within the NEA that are relevant to geological disposal are summarised below:

- The Integration Group for the Safety Case (IGSC) includes studies of engineered barrier systems, cementitious materials and sorption projects; it maintains the NEA Features, Events and Processes and Thermodynamic databases, as well as hosting topical workshops and publishing associated reports.
- The “Salt Club” and “Clay Club”, together with a new “Crystalline Club”, provide fora for collaboration and research relating to the associated host rock types for geological repositories.
- The FSC is described in Chapter 3.
- The Expert Group on Operational Safety assesses operational safety issues in the pre-closure phase, along with longer-term monitoring.
- The “Preservation of Records, Knowledge and Memory across generations” (RK&M) initiative develops international guidance on technical, administrative and societal mechanisms to address preservation and transfer of the relevant information on various timescales.

The Repository Metadata Management project (RepMet) co-ordinates collaboration and guidance pertaining to the management and retention of repository data.

The RWMC also facilitates international peer reviews and has assisted in more than 20 peer reviews since the 1980s. Senior representatives and subject matter experts are provided as expert reviewers through the peer review approach. Recent examples include a peer review of the siting criteria for high-level waste (HLW) disposal in Japan.

International Atomic Energy Agency

The “Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management” is a legal instrument to directly promote the safety of waste management on a global scale. The convention applies to spent fuel and radioactive waste resulting from civilian nuclear reactors and includes obligations based on the principles contained in the IAEA Safety Standards series.

The IAEA Safety Standards encompasses safety fundamentals, safety requirements and safety guides. These include geological repositories within their remit.

In addition to overseeing the Joint Convention and maintaining the associated Safety Standards, the IAEA facilitates international co-operation through a wide range of projects including, for example, ongoing projects relating to:

- Human Intrusion in the Context of Disposal of Radioactive Waste (HIDRA);
- Demonstration of the Operational and Long-Term Safety of Geological Disposal Facilities for Radioactive Waste (GEOSAF II);
- Practical Illustration and Use of the Safety Case Concept in the Management of Near-Surface Disposal Application (PRISMA);
- Integration of Perceived and Actual Risk for Stakeholder Communications (IPARSC);
- Modelling and Data for Radiological Impact Assessments (MODARIA II).

The IAEA also co-ordinates international peer reviews under three different topic areas:

- International Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS);
- Integrated Regulatory Review Service (IRRS);
- Operational Safety Review Team (OSART).

Several ARTEMIS reviews are currently in planning and development, including reviews relating to the French (Cigéo) and Australian programmes.

International Commission on Radiological Protection

International Commission on Radiological Protection (ICRP) Publication 122 provides the most recent explanation of how the ICRP system of radiological protection can be applied in the context of the geological disposal of long-lived solid radioactive waste. It encompasses radiological protection of workers, members of the public and the environment. The recommendations apply to facilities where there is still an opportunity for their implementation (i.e. they do not apply to closed legacy facilities). Key principles of justification, optimisation and dose limitation are applied.

When considering the justification for potential radiological exposures, waste management and disposal operations should be considered as an integral part of the practice generating the waste. Waste management and disposal operations should therefore be included in the assessment of the justification of the practice generating the waste. This assessment should include consideration of different options for waste management and disposal including the justification of these options. It is wrong to regard waste management and disposal as a free-standing practice that needs its own justification.

Radiological protection associated with geological disposal needs to assess potential exposures that may arise in the far future. Uncertainties associated with any estimates of potential radiological consequences will increase as a function of time. Nonetheless, the commission's recommendations are made on the basic principle that individuals and populations in the future should be afforded at least the same level of protection as the current generation.

The application of the radiation protection system of ICRP on long timeframe concerns oversight. From a radiological protection point of view, all possible operational phases of a geological disposal facility (design-basis evolution) are treated as planned exposure situations. No design-based evolutions, including inadvertent human intrusion, are treated as emergency or existing exposure situations. In application of the optimisation principle, the radiological criteria for the design of a waste disposal facility are an annual dose constraint for the population of 0.3 mSv per year and an annual dose limit of 20 mSv per year or 100 mSv in five years for occupationally exposed workers. A risk constraint for the population of 1×10^{-5} per year is recommended when applying an aggregated approach combining probability of the exposure scenario and the associated dose. In the very long term, dose and risk criteria should be used for the comparison of options rather than as a means of assessing health detriment.

European Commission and Euratom activities

Three of the EC's Directorate-Generals (DGs) have significant programmes relating to geological repository programmes: DG for Development and Co-operation, DG for Energy and DG for Research and Development.

The EC Directive on Responsible and Safe Management of Spent Fuel and Radioactive Waste (2011/70/EURATOM) assigns basic requirements on European Union (EU) member states to establish national policy, legislative, regulatory, organisational framework and a national programme to manage all types of radioactive waste from generation to disposal. To date, all member states have notified the EC that the directive has been fully transposed in their national legal frameworks. The EC is conducting conformity assessments, which expected to complete in 2017.

The EC also facilitates and provides funding for research and training under the Euratom programme. Since 1975, a large number of collaborative projects have been supported. Funding for the next round of research is being switched from individual projects to a joint programme between the member states. Feasibility of such joint programme is being assessed as part of the Towards a Joint Programming on Radioactive Waste Disposal (JOPRAD) project. A common strategic research agenda, governing rules, implementation mechanisms and a deployment strategy will be defined in a programme document. The programme document will be discussed at a milestone workshop in London in April 2017 and is due to be published at the end of 2017 for potential launch in 2019.

Implementing Geological Disposal of Radioactive Waste – Technology Platform

The Implementing Geological Disposal of Radioactive Waste – Technology Platform (IGD-TP) is a collaborative network led by 11 European waste management organisations (WMOs) to foster research and development towards implementation of geological disposal. The network was established in 2009 and now encompasses 130 participating organisations from Australia, Canada, Japan, Switzerland and the EU.

Through collaboration, IGD-TP aims to help to contribute towards a sound, shared and transparent scientific and technological basis for geological disposal. The platform meets once each year in an “exchange forum”. Activities such as conferences and handbooks have been arranged to transfer knowledge towards less-advanced disposal programme. A strategic research agenda serves as the basis for the co-operation.

IGD-TP consciously focuses on the research and development needs of countries that are closest to licensing geological repositories. The results are then shared by all participants and should be of benefit to all disposal programmes. Clear added value is gained from multilateral co-operation on research and development.

International Association for Environmentally Safe Disposal of Radioactive Materials

The EDRAM is a collaborative forum to promote exchange of knowledge, experience and information among senior executives from national agencies worldwide. Participation includes 12 organisations from Europe, North America and Japan.

The forum includes discussion of strategic issues among implementers based on the principles that:

- the burdens and responsibility for taking care of radioactive waste should not be passed on to future generations;
- radioactive waste management is a societal, as well as a technical issue;
- there is a need for flexibility, as well as for open and ethical involvement of stakeholders in decision making.

Drawing on international expertise, experience and collaboration is of great value and leads to better solutions for the safe implementation of radioactive waste disposal.

Chapter 5. Concluding remarks

Experiences shared at previous ICGR conferences have been related to issues of geology, inventory, feasibility, radionuclides, siting, safety case and long-term safety. At the ICGR 2016, new challenges were discussed, such as licensing procedures, organisation of operations, local development, operational safety and the importance of continued engagement. These issues are symptomatic of the way in which several geological repository projects have progressed since the first ICGR conference in 1999.

The safe implementation of geological repository projects may take many decades, reflecting the long and complicated process leading up to implementation, which can include the establishment of appropriate organisational and legislative frameworks, site selection, characterisation, underground research and pilot studies. Stakeholder engagement and the associated establishment of enduring partnerships provide an important common theme throughout this whole process. Such long-term projects can only proceed on the foundation of a firm national and parliamentary commitment.

The long time frames needed for implementing geological repository projects means that maintenance of knowledge, skills and experience within associated institutions is essential. The participation of young professionals in knowledge sharing fora, such as the ICGR 2016, provides an important contribution to such ends.

As several programmes move towards safe implementation, the nature of the challenges have changed. Implementing organisations must go from developing strategy, planning and licence applications to managing the implementation of large infrastructure projects. Regulatory bodies also need to develop a capability to review the implementation phase, including the verification of construction standards against licensing conditions. Experience will need to be drawn from other large infrastructure projects, including from the knowledge accumulated in relation to the construction of nuclear power plants.

Experience can also be drawn from pilot projects, underground research laboratories and examples of geological disposal facilities for lower activity waste. This experience highlights that contingencies and resilience planning is needed for various scenarios (including accidents) that may affect operations.

Each geological repository project is typically a “first-of-a-kind” project for the individual country. Each programme will encounter its own unique challenges and a safe and effective route will need to be found through these challenges. The conference has nonetheless highlighted the significant value of international collaboration in helping to identify common themes, and to develop and disseminate good practice.

Appendix A. ICGR 2016 programme

Opening session

Fabrice Papillon, Master of Ceremonies

Welcome address and introductory remarks

William D. Magwood, IV, NEA Director-General

Virginie Schwarz, Director of Energy, Ministry of Environment, Sustainable Development and Energy, France

Session 1a. National geological disposal projects: Status of national geological repository projects

Chair

Jean-Paul Minon, NEA RWMC Chair

Speakers

1. **Thomas Ernst**, CEO, Nagra, Switzerland – Radioactive Waste Management in Switzerland: *Progress since ICGR 2012*
2. **Bruce McKirdy**, Managing Director and Executive Director, UK Radioactive Waste Management (UK RWM) – *Perspectives from the UK*
3. **Christi Leigh**, Manager, US Sandia National Laboratories Repository Investigations – *Perspectives on the Waste Isolation Pilot Plant (WIPP) Site*
4. **Christopher Eckerberg**, President, Svensk Kärnbränslehantering (SKB) – *Perspectives from Sweden*

Co-ordinator

Mari Gillogly, NEA

Session 1b. National geological disposal projects: Panel debate on progress achieved

Chair

Pierre-Marie Abadie, CEO, Andra

Panellists

1. **Robert Watts**, Associate Vice-President, Nuclear Waste Management Organisation (NWMO), Canada – *Addressing Social Considerations in Canada*
2. **Shunsuke Kondo**, President, Nuclear Waste Management Organization of Japan (NUMO) – *The Political Dimension of Radioactive Waste Disposal in Japan*
3. **Andrew Griffith**, Associate Deputy Assistant Secretary for Fuel Cycle Technologies, US Department of Energy – *Scientific and Technical Challenges in Preparing for Design*
4. **Olivier Giroud**, Head of High Level Waste Industrial Projects, EDF DP2D, France – *Expectations of a Radioactive Waste Producer*
5. **Jussi Heinonen**, Director, Finland Radiation and Nuclear Safety Authority (STUK) – *The Regulator's Role in Different Stages of Repository Development*

Co-ordinator

Jelena Bolia, Andra, France

Session 2. Cigéo: The French Geological Disposal

Chair

Jean-Yves Le Déaut, MP, Office parlementaire d'évaluation des choix scientifiques et technologiques, France

Speakers

1. **Frédéric Plas**, Andra – *Overview of Cigéo, History and Current Status*
2. **Frédéric Launeau**, Andra – *Cigéo's Core Components*
3. **Marc Demulsant**, Préfecture de la Meuse – *Cigéo and the Host Territory Development*

Panellists

1. **Jean-Yves Le Déaut**, MP, OPECST
2. **Pierre-Frank Chevet**, Chair, ASN
3. **Marc Demulsant**, Préfecture de la Meuse
4. **Denis Stolf**, Chair, CLI
5. **Pierre-Marie Abadie**, CEO, Andra
6. **Jussi Heinonen**, STUK, Finland

Co-ordinator

Nicolas Solente, Andra, France

Session 3a. Dialogue between stakeholders in advancing a geological repository project: Role and involvement of various stakeholders at each stage of projects, from siting to licensing

Chair

Walter Blommaert, Chair of Regulators Forum, NEA RWMC

Speakers:

1. **Jo-Ann Facella**, Vice-chair, Forum on Stakeholder Confidence – *Recent Learnings from the Nuclear Energy Agency’s Forum on Stakeholder Confidence*
2. **Haidy Tadros**, Director-General, Canadian Nuclear Safety Commission – *Stakeholder Involvement in Canadian Initiatives for Deep Geological Repositories for the Long-term Management of Radioactive Wastes*
3. **Gabriella Honti**, Head of the Communication Department, PURAM – *Implementer Perspectives in Hungary: Lessons Learnt from Stakeholder Involvement*
4. **Stéphane Martin**, Mayor, Gondrecourt-le-Château – *Local Dialogues concerning Cigéo*

Co-ordinators:

Mari Gillogly, NEA/**Shawn Smith**, NRC, United States

Session 3b. Dialogue between stakeholders in advancing a geological repository project: Panel discussion on stakeholder relations and communications throughout the development of a geological repository

Chair

Elena Mantagaris, Director, Government and External Relations, Nuclear Waste Management Organisation, Canada

Panellists

1. **Ladislav Havlíček**, Head, Fuel Cycle Strategy and Services, ČEZ (Waste producer) – *The Viewpoint and Experience of the Waste Producer*
2. **Lisa Thompson**, Member of Provincial Parliament for Huron-Bruce (Government representative) – *Engaging communities – Why It Is a Must*
3. **Janne Mokka**, President, Posiva (Implementer) – *Spent Fuel Final Disposal Program from Planning to Closure of the Repository: Long-term Commitment from All the Stakeholders*
4. **Scott Moore**, Deputy Director, Office of Nuclear Material Safety and Safeguards, Nuclear Regulatory Commission (Regulator) – *Stakeholder Communications During Pre-Licensing: US Perspectives*
5. **Jacob Spangenberg**, Mayor, Chairman of the Executive Board of Östhammar Municipality (Local community representative) – *Empowerment of Local Government – A Precondition for a Successful Siting Process*

Co-ordinator

Elena Mantagaris, NWMO, Canada

Session 4. The added value of international co-operation (through international initiatives and organisations) for the safe implementation of geological repository projects

Chair

Michael Siemann, Head of the NEA Division of Radiological Protection and Radioactive Waste (RAD)

Speakers

1. **Gloria Kwong**, NEA Radioactive Waste Technical Specialist – *NEA Work of the IGSC, Records, Knowledge and Memory (RK&M), Reversibility and Retrievability Project*
2. **Wolfgang Weiss**, International Commission on Radiological Protection (ICRP) – *Defining/Discussing Radiation Safety Criteria*
3. **Andrew Orrell**, Section Head at the International Atomic Energy Agency (IAEA), *Waste and Environmental Safety – IAEA Safety Standards*
4. **Christophe Davies**, European Commission – *Overview of EC Activities*
5. **Monica Hammarström**, IGD-TP – *Activities Supporting Safety Demonstration*
6. **Thomas Ernst, Chair**, EDRAM – *The Added Value of Co-operation: International Association for Environmentally Safe Disposal of Radioactive Materials (EDRAM)*

Co-ordinators

Gloria Kwong, NEA/**Stefan Mayer**, IAEA

Session 5. Stocktaking

Rapporteur

Patrick Landais, Andra

Co-ordinators

Elena Mantagaris, NWMO, Canada/**Monica Hammerström**, SKB, Sweden

Session 6. Summary and closing session

Closing addresses

William D. Magwood, IV, NEA Director-General

Pierre-Marie Abadie, CEO, Andra

Appendix B. Summary statistics from young professionals in the radioactive waste management field

The first meeting of the young professionals took place during the 5th International Conference on Geological Repositories (ICGR 2016). Eleven nominated participants represented nine different countries (Belgium, Canada, Czech Republic, France, Hungary, Japan, Korea, Romania and the United Kingdom). What follows is a summary of the ideas expressed during sessions addressing four broad topics.



A number of young professionals (YPs) were hand-selected by their home institutions to attend the ICGR 2016 in Paris and contribute to an active, closed-door discussion to answer questions regarding the following:

- **Challenges and opportunities:** We asked YPs to describe the challenges they face in achieving their development goals, and to identify potential hindrances for their development.
- **Motivational factors:** What motivates YPs to keep working and to further develop themselves in the radioactive waste management field; what awards or incentives do YPs respond to?
- **Organisational support:** How can organisations help with YP development and promote long-term engagement?

- **Contributions of YPs:** What role can or do they play in improving communications between technical and non-technical stakeholders in developing DGRs?

Among the topics discussed, **challenges and opportunities** were the largest concern for young professionals in the field of radioactive waste management. When entering this field, there seems to be substantial pressure to absorb as much knowledge and experience as is possible from more experienced and soon-to-retire colleagues. This is possibly more pronounced than in prior decades, as now more than ever there is a large class of professionals who are due to exit these organisations. If YPs do not or cannot achieve the appropriate information and skill transfers within the first couple of years of their position or within the allotted final years of their senior colleagues' positions, it is recognised that institutional knowledge and tacit experience gained over the working lifetime of their predecessors might simply be lost. This group therefore felt that *management and transfer of institutional knowledge* is part of a larger discussion of the multi-generational complexity that makes up our work in radioactive waste management.

To expound further, the opportunity to learn from more experienced colleagues was agreed to be one of the most useful learning experiences available for YPs. A specific challenge highlighted was that these opportunities can sometimes be de-prioritised when individuals within the organisations comes under stress (last-minute reports, shifts in focus, end-of-career demands, etc.). When these mentors endure this kind of stress, YPs often find that the important focus on the mentoring aspect of inter-generational pairings becomes lost in the shuffle. When this happens, some YPs expressed their concerns with regard to mentors or managers retreating to a pattern of assigning YPs only menial work and tasks instead of engaging them with more challenging projects. If the latter were a consistent option offered, YPs felt they could ultimately, and positively contribute to these new or shifting priorities or assist their mentors in other ways.

Heads of organisations should challenge employees to keep this pattern to a minimum once a good mentoring relationship is established. Regarding the utility of such relationships, it was noted in particular that administrators and heads of division or organisations should encourage cross-talk and co-working for those occasions when a mentor must focus on something that they have done quickly and well in the past. These are excellent learning opportunities for YPs to improve skills and training.

Another challenge or *opportunity* discussed was a desire to build networks of younger colleagues within and across organisations. This is not necessarily the responsibility of the host organisation, but the need for such networks for YPs should be acknowledged. This allows YPs to build contacts, to share experiences and ideas and it also provides a greater sense of community within this field. It enhances camaraderie among those inheriting the quite inter-generational work of radioactive waste management. An additional aspect of networking across organisations and geographical diversity is that young professionals can compare and contrast their jobs, work and life balance, career goals and ideas outside of the formal interactions of a workplace or conference setting. It is understood that, in light of growing budget cuts and zero-nominal growth year upon year, for most

organisations this provision is a challenge. However, this opportunity was discussed at length as a motivating factor for young professionals.

Similar to this, another **motivating factor** included the availability of a wide-ranging network of colleagues and mentors. Workplaces tend to have (or individuals establish) both broad and specific networks and social groups that exist only for more experienced, older employees, often excluding YPs. This can be discouraging for professionals entering the workforce who wish to meet others and share interests and discuss challenges. In other fields, such as IT or business management, this could pose less of a challenge since there is significant uptake of young people each year.

Additionally, YPs agreed that they felt motivated by opportunities for further training and advancement. Across several organisations, it seemed that there is a lack of adequate support at an institutional level for achieving early and future career goals. It was noted that the desire to keep and train employees in their career paths, as to maintain the most current and capable professionals as possible, did not seem to be a pressing objective or priority. The challenge to organisations here is to support YP goals, not only in practice but also to back it up through policies.

Some de-motivating factors were also mentioned. For example, it was acknowledged by many around the table that in the past, opportunities for advancement required remaining in one location, with one organisation for 10-15 years. Individuals would work up through the hierarchy and become a knowledge expert. For young professionals just beginning their careers today, this is not always feasible. A long-term investment of time to become an expert does not make early career professionals uncomfortable; but today there is often a requirement for physical and geographical relocation to gain experience and opportunities for advancement. Organisations have been slow to recognise this within their working, pipelining and advancement culture(s). Furthermore, YPs who must leave their organisation for another in order to gain more experience and opportunity for advancement are often confronted by a “job hopping” stigma broadly existing in today’s organisations. This is another organisational/internal *cultural shift* that is needed so that YPs are not at risk of being perceived as less serious or less motivated; especially by colleagues who have had an opportunity for internal advancement and are approaching retirement age.

A positive and often overlooked or forgotten reality is that, like in many years in the past, young professionals, and even early- to mid-career professionals, are exceptionally eager to learn, and for that they require support from their organisations. If they are not motivated in this regard, there is a far greater chance they will perceive themselves as undesirable and will seek challenges elsewhere.

As discussed within the first two topics, **organisational support** for young professionals will come from within, in the form of training and advancement, and externally, through promotion of networking and exchange in the radioactive waste management industry. Strong networks, plus links to and regular exchanges within and between waste management and decommissioning communities will make it more likely that young professionals will stay in the industry longer and contribute more. Organisations such as the NEA could encourage companies and

organisations working in these fields to invest more in information exchange for young professionals, and to the extent possible, offer opportunities to attend conferences, such as the ICGR, particularly in early career years.

Finally, with regard to **contributions of YPs**, the role of young professionals in improving communications between technical and non-technical stakeholders, particularly in developing DGRs, should not be underestimated. There often exist certain demographics of stakeholders (women, younger individuals, students, etc.) who respond better to communications from younger professionals. This could be especially true when organisations are tasked with talking to communities about the often complicated ideas surrounding nuclear energy and nuclear waste. Naturally, people may also respond to communications from those further established in their careers who are understood to be experts in their fields, but it remains an important challenge for organisations to recognise that people across generations communicate differently. There is no one-size-fits-all way of explaining technical issues to a less technical audience.

In conclusion, the first meeting of Young Professionals at the 5th ICGR was an excellent opportunity for these early career professionals to meet one another and connect with the radioactive waste management community on an international stage. Sponsorship from their organisations allowed these individuals to engage with other, more experienced professionals in the field who are typically participants for these type of conferences.

The group has decided to remain in contact through unofficial means for now. They hope that there will be an official channel for them to continue the discussions begun here, and that there will be opportunities to continue to expand. Including a greater number of young professionals in radioactive waste management will advance the necessary long-term engagement (especially of the inheriting generation) for deep geological repositories.

This group also wished to thank their nominating organisations, and also Andra, the NEA and the organisers for bringing them together.

NEA PUBLICATIONS AND INFORMATION

The full **catalogue of publications** is available online at www.oecd-nea.org/pub.

In addition to basic information on the Agency and its work programme, the **NEA website** offers free downloads of hundreds of technical and policy-oriented reports.

An **NEA monthly electronic** bulletin is distributed free of charge to subscribers, providing updates of new results, events and publications. Sign up at www.oecd-nea.org/bulletin/.

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International Conference on Geological Repositories 2016

Worldwide consensus exists within the international community that geological repositories can provide the necessary long-term safety and security to isolate long-lived radioactive waste from the human environment over long timescales. Such repositories are also feasible to construct using current technologies. However, proving the technical merits and safety of repositories, while satisfying societal and political requirements, has been a challenge in many countries.

Building upon the success of previous conferences held in Denver (1999), Stockholm (2003), Berne (2007) and Toronto (2012), the ICGR 2016 brought together high-level decision makers from regulatory and local government bodies, waste management organisations and public stakeholder communities to review current perspectives of geological repository development. This publication provides a synthesis of the 2016 conference on continued engagement and safe implementation of repositories, which was designed to promote information and experience sharing, particularly in the development of policies and regulatory frameworks. Repository safety, and the planning and implementation of repository programmes with societal involvement, as well as ongoing work within different international organisations, were also addressed at the conference.

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