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uilding Constructive Dialogues Between Regulators and Implementers During the Pre-Licensing Phase of Deep Geological Repository Development

NUCLEAR ENERGY AGENCY

Radioactive Waste Management Committee

**Building Constructive Dialogues Between Regulators and Implementers During
the Pre-Licensing Phase of Deep Geological Repository Development**

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List of abbreviations and acronyms

ALARA	As low as reasonably achievable
ANDRA	National Agency for Radioactive Waste Management (France)
ASN	Nuclear Safety Authority (France)
BASE	Federal Office for the Safety of Nuclear Waste Management (Germany)
BEIS	Department of Business, Energy & Industrial Strategy (United Kingdom)
BGE	Federal Company for Radioactive Waste Disposal (Germany)
BMU	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Germany), since 8 December 2021 Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)
CNSC	Canadian Nuclear Safety Commission
CSN	Nuclear Safety Council (Spain)
DGR	Deep geological repository
DiP	Decision-in-Principle
DOE	Department of Energy (United States)
DUP	Déclaration d'utilité publique (Declaration of Public Convenience and Necessity)
EA	Environment Agency (United Kingdom)
ENRESA	National Company for Radioactive Waste Management (Spain)
ENSI	Swiss Federal Nuclear Safety Inspectorate
EPA	Environmental Protection Agency (United States)
EU / EC	European Union / European Commission
FANC	Federal Agency for Nuclear Control (Belgium)
FAQs	Frequently asked questions
FSC	Forum on Stakeholder Confidence
HLW	High-level radioactive waste
IAEA	International Atomic Energy Agency
IBRAE	Nuclear Safety Institute of the Russian Academy of Sciences (Russian Federation)
ICRP	International Commission on Radiation Protection
IGD-TP	Implementing Geological Disposal Technology Platform
IRSN	Institut de Radioprotection et de Sûreté Nucléaire (France)
ISIN	National Inspectorate for Nuclear Safety and Radiation Protection (Italy)
KINS	Korea Institute of Nuclear Safety

KORAD	Korea Radioactive Waste Agency
KTIs	Key technical issues
LLW	Low-level and short-lived radioactive waste
MEAE	Ministry of Economic Affairs and Employment (Finland)
METI	Ministry of Economy, Trade and Industry (Japan)
NAGRA	National Co-operative for the disposal of Radioactive Waste (Switzerland)
NDA	Nuclear Decommissioning Authority (United Kingdom)
NEA	Nuclear Energy Agency
NRA	Nuclear Regulation Authority (Japan)
NRC	Nuclear Regulatory Commission (United States)
NSDF	Near surface disposal facility
NUMO	Nuclear Waste Management Organization (Japan)
NWMO	Nuclear Waste Management Organization (Canada)
NWTRB	Nuclear Waste Technical Review Board (United States)
ONDRAF/NIRAS	Belgian Agency for Radioactive Waste and Enriched Fissile Materials
ONR	Office for Nuclear Regulation (United Kingdom)
POSIVA	Radioactive Waste Management company (Finland)
RD&D	Research, Development, and Demonstration
RF	Regulators' Forum (NEA)
R-I	Regulator-implementer
RIDD	Expert Group on Building Constructive Dialogues between Regulators and Implementers in Developing Disposal Solutions for Radioactive Waste (NEA)
RW	Radioactive waste
RWM	Radioactive waste management
RWMC	Radioactive Waste Management Committee (NEA)
RWM Ltd	Radioactive Waste Management Limited (United Kingdom)
SDF	Surface disposal facility
SEA	Strategic Environmental Assessment
SFOE	Swiss Federal Office of Energy
SITEX	Sustainable network of Independent Technical Expertise of radioactive waste disposal
SPOC	Single point of contact
SOGIN	Nuclear Plant Management Company (Italy)
STUK	Radiation and Nuclear Safety Authority (Finland)
SÚJB	State Office for Nuclear Safety (Czechia)

SÚRAO	Radioactive Waste Management Agency (Czechia)
TSO	Technical support organisation
URL	Underground research laboratory
WIPP	Waste Isolation Pilot Plant (United States)

Executive summary

Safe disposal of radioactive waste (RW), including spent fuel, must take into consideration long timescales as implied by radioactive waste management (RWM). The Nuclear Energy Agency (NEA) Radioactive Waste Management Committee (RWMC) supports NEA member countries in the development of safe, environmentally friendly, and economically efficient management of all types of radioactive waste. Stakeholder engagement is crucial throughout the development of long-term waste management solutions. Dialogue between all stakeholders at every stage of the RWM life cycle is necessary to build sustainable relationships and foster trust. In order to improve dialogue between regulators and implementers, the NEA RWMC established in March 2019 the Expert Group on Building Constructive Dialogues between Regulators and Implementers in Developing Disposal Solutions for Radioactive Waste (RIDD). The RIDD is tasked with examining how to more efficiently structure regulator-implementer (R-I) dialogue in the RWM decision-making process.

During its first mandate (from March 2019 to March 2023), the Expert Group focused on regulator and implementer dialogue during the pre-licensing stage of deep geological repository (DGR) projects. Many member countries are at this stage in the licensing process. By reflecting on these experiences, member countries identified effective practices and shared lessons learnt.

In order to collect data on the R-I dialogue process in member countries, RIDD participants filled out a detailed questionnaire – the results of which were used to develop this report, entitled “Building Constructive Dialogues Between Regulators and Implementers During the Pre-Licensing Phase of Deep Geological Repository Development”. These experiences were complemented by a limited number of in-depth interviews. To ensure transversality, the NEA Regulators’ Forum (RF) and the NEA Forum on Stakeholder Confidence (FSC) contributed to drafting the RIDD questionnaire and reviewing this report.

Through analysis of the questionnaire feedback and interviews, this report focusses on the following topics:

1. Roles and responsibilities of the regulator and implementer in the R-I dialogue
2. Goals and expectations regarding R-I dialogue
3. Implementation of R-I dialogue and types of dialogue
4. Conditions for an effective dialogue
5. Dialogue with the public

This report also explores other types of R-I dialogue in relation to RWM, including R-I dialogue on surface disposal facilities (SDF) and on decommissioning nuclear power plants. After assessing the differences in R-I dialogue regarding SDF and decommissioning from R-I dialogue on the pre-licensing phase of DGR development, the RIDD will use this information to extend analysis at a later stage, if deemed relevant. To this end, interviews were also conducted with responsible authorities in Belgium for their SDF, and in Italy and the United Kingdom for nuclear power plant decommissioning.

1. Objective and scope of the RIDD report

The objective of this report is to summarise lessons learnt in structuring R-I dialogue during the decision-making process of the DGR pre-licensing phase. “Pre-licensing” is commonly used in the field of nuclear safety, but is not strictly defined in international literature. Pre-licensing is considered to begin at the first interaction between regulator and implementer, and finish with the official application for a DGR construction licence. Consequently, the principal objective of R-I pre-licensing dialogue is to develop a DGR licence application that considers all applicable regulatory requirements and guidance.

This report is based on an analysis of questionnaire responses submitted in 2021 by 13 countries that participate in the RIDD. The questionnaire aimed to collect a unified national response of regulators and implementers and also covered the involvement of other key stakeholders in addition to the regulator and implementer.

A number of interviews were conducted to complement the questionnaire responses for DGR development in Finland, France and the United States. These interviews provided supplementary information to better understand R-I dialogue in countries where DGR development is already in the advanced stages.

Additional interviews were conducted in Belgium with the regulator and the implementer to explore similarities and differences with R-I dialogue in the pre-licensing phase of an SDF. Interviews were also held with the representatives of regulators and implementers on nuclear power plant decommissioning in Italy and the United Kingdom. These interviews had more of an exploratory purpose, and were not intended to gather in-depth learnings regarding the pre-licensing in these other types of facilities or activities.

2. Methodology

2.1. The RIDD surveys

In 2019, the RIDD conducted an internal survey to gain in-depth information about practices and strategies for structuring R-I dialogue in RIDD participating countries. Fourteen countries responded to this initial questionnaire: Canada, Finland, Germany, Japan, Korea, Luxembourg, Norway, the Russian Federation (hereafter “Russia”), Spain, Sweden, Switzerland, Ukraine, the United Kingdom and the United States. Best practices identified from the 2019 survey are summarised in the table below.

Table 2.1: Best practices identified in the 2019 RIDD report

Question to identify best practices	Best practice and parameters
What comprises an effective R-I dialogue?	Open, honest, transparent and frequent discussions to develop common understanding. Structured dialogue that is sustainable and progresses over long timescales. Regulatory independence and independent knowledge. National and international collaboration. Clarity in expectations and requirements. Regulator and implementer competence and experience.
How is an effective R-I dialogue established and its effectiveness measured?	Structured through legislation or an arrangement between the regulator and implementer. Effectiveness measured by: <ul style="list-style-type: none"> - reduction of unsolved issues over time; - ease of the licensing process and completeness of application; - regulator's ability to complete the licence application review on schedule and with available resources (effective and efficient) and to provide regulatory oversight should a licence be issued; - host communities' trust and confidence in the process (information could be gathered using opinion polls).
What topics should be considered in the R-I dialogue?	Structure of the dialogue <ul style="list-style-type: none"> - roles/responsibilities; - stakeholder engagement. Technical and regulatory <ul style="list-style-type: none"> - regulatory expectations/guidance; - licensing requirements; - research and development programme; - safety assessment and safety case; - conceptual design and technology. Others <ul style="list-style-type: none"> - environmental and social impact and political aspects of siting process; - time schedules; - siting process conceptual design and technology.
How is it made transparent to other stakeholders?	Some R-I meetings open to the public. Documented outcomes from some R-I meetings. Separate regulator meetings with stakeholders and other regulators. Annual or bi-annual reports published by the regulator and implementer. Web posting of reviews conducted by the regulator.
How is the effectiveness of the communication and consultation process assessed?	Stakeholders' understanding of project and the regulator's role, should it move forward.

The report concluded that “structured R-I dialogue is particularly important for projects such as DGRs that may span decades in the pre-licensing phase. This will ensure that the regulator, implementer and other stakeholders are involved and understand the project over these long time periods.” Based on these results, the RIDD decided to focus on the pre-licensing stage of DGR development. The group decided to elaborate on the following topics, which structured the 2021 survey:

1. defining the framework of R-I (or stakeholder) dialogue in the process of developing pre-licensing;
2. establishing an informal and/or formal R-I dialogue during the pre-licensing process;
3. time perspective and monitoring the dialogue quality;
4. dialogue with the public.

An additional topic that the RIDD aimed to explore in this report was lessons learnt from non-DGR nuclear installations, along with other international initiatives. In order to achieve this objective, the following interviews were conducted:

1. An interview with Belgian authorities to identify the specificity of DGR projects compared to SDF projects. The latter are well-developed, and the DGR project could benefit from SDF projects and lessons learnt. This interview could also contribute to designing future topics of research for exploration of R-I dialogue during the pre-licensing phase of a SDF.
2. An interview on decommissioning with authorities in Italy and the United Kingdom to identify traits of R-I dialogue in decommissioning projects compared to DGR projects and, more generally, projects dedicated to RW disposal.

Additional interviews were conducted with the authorities in Finland, France and the United States to complete answers provided by countries who responded to this questionnaire.

A copy of the original questionnaire may be found in Annex A.

2.2. Survey respondents

The reports' questionnaire was submitted to 30 RIDD participants on 1 October 2021. Thirteen responses were received from radioactive waste experts in the following countries: Belgium, Canada, Czechia, Finland, France, Germany, Japan, Korea, Russia, Spain, Switzerland, the United Kingdom and the United States. In certain cases, the implementer and regulator provided a joint answer, while in other countries, only one organisation responded to the questionnaire. While the RIDD focuses mainly on nuclear regulators, other licences are also needed to construct, operate and close a DGR. Therefore, in some countries, responses were received from other relevant organisations outside of nuclear regulation and implementation, as shown in the table below.

The table displays a list of authorities who answered the questionnaire and/or were interviewed.

Table 2.2: Organisations responding via questionnaire and/or interview

Country	Implementer	Regulator	Policy body / TSO / other	Observations
Belgium	ONDRAF/NIRAS	FANC	Bel V (TSO)	In addition to the questionnaire, interviews with ONDRAF/NIRAS and FANC on SDF.
Canada	NWMO	CNSC		
Czechia	SURAO	SUJB		
Finland	Posiva	STUK		In addition to the questionnaire, interviews conducted with Posiva and STUK on DGR.
France	Andra	ASN		In addition to the questionnaire, interviews conducted with Andra and ASN on DGR.
Germany	BGE	BASE and BMUV	BMUV (policy)	
Italy ¹	SOGIN	ISIN		Interview on decommissioning with SOGIN and ISIN.
Japan	NUMO			
Korea (Republic of)	KORAD	KINS		
Russia			IBRAE (Academy of Sciences)	
Spain	Enresa	CSN		
Switzerland	Nagra	ENSI		
United Kingdom	RWM NDA	Environment Agency	BEIS (policy)	Questionnaire completed by the Environment Agency and RWM Ltd. Interviews conducted with BEIS, NDA and RWM Ltd.
United States	DOE	EPA NRC		In addition to the questionnaire, interviews conducted with DOE, EPA and NRC on DGR.

There are differences in terms of status and implementation of HLW/spent fuel disposal programmes between countries that participated in this survey. This is partly due to different stages of development and implementation of their respective legal and regulatory frameworks, along with differences in the extent of programme implementation. However, among all participating countries, application for the first licence or authorisation of the DGR is considered as the end of the pre-licensing period.

In terms of the implementation status in the countries that responded to the survey:

- Finland and the United States crossed the licence application stage, ending the pre-licensing period.
- France has selected a site using the outcomes from their underground research laboratory (URL) and a construction licence for a DGR is expected to be submitted in 2022.
- Russia granted a licence to the implementer for construction of a URL.

¹ Italy did not respond to the questionnaire but the implementer and regulator were jointly interviewed to provide information on the R-I dialogue during decommissioning processes.

- Switzerland's DGR site selection process has entered its final phase, and application for a general licence is expected to follow by the end of 2024. In September 2022, Nagra chose Nördlich Lägern as the safest site for a DGR. This was selected out of three proposed sites that had been considered during the siting process.
- Six additional countries are at various stages in the process of site selection, from the first stages of screening potential sites (without site investigation through physical operations) to advanced stages of characterising sites before final selection.

Most countries have created a national policy for spent fuel and HLW disposal, along with corresponding regulations and safety requirements for HLW disposal facilities. National policy and safety requirements may be revised during programme development. In one country – Belgium – the national policy is pending and the safety requirements are in development. At the end of 2020, ONDRAF/NIRAS proposed a national policy regarding geological disposal as the safe and responsible long-term solution for the management of high-level waste, in accordance with the Council Directive 2011/70/Euratom. This decision-in-principle for geological disposal is still pending. The national policy, set up by Royal Decree, should also include provisions for the next steps of the decision-making process. After a first approval by the supervising Ministry of Energy in the beginning of 2022, the proposal is going through the legislative process. In Spain, the terms of reference of a working group for developing the regulatory framework for the DGR were signed.

Annex B provides specific details on the stages of implementation for each country.

2.3. Analysis of the survey results

In terms of methodology, the following steps were taken to analyse country-level responses to the 2021 questionnaire:

1. A raw table was generated, which was later simplified by erasing all components of answers that were not relevant for R-I dialogue and dialogue with stakeholders and the public.
2. The synthesis of the answers began with a comparison of relevant answers from all responding countries for each question. This permitted identification of the most common responses, as well as responses that highlighted important contributions in seeking an effective R-I dialogue.
3. Answers were grouped in new blocks or clusters related to several questions as they often overlapped; information written under certain topics was complementary to other topics.
4. Dialogue components that could be considered as new cross-cutting topics were identified.

Based on this analysis, the report's structure addresses the following topics:

1. Roles and responsibilities of the regulator and implementer in the R-I dialogue.
2. Objectives and expectations regarding the R-I dialogue.
3. Implementation of the R-I dialogue and types of dialogue.
4. Conditions for an efficient dialogue.
5. Dialogue with the public.

Annex C presents the correspondence between the topics of this report and the questions formulated in the RIDD questionnaire.

3. Roles and responsibilities of the regulator and implementer in the R-I dialogue

The role and responsibilities of a regulator in establishing a DGR programme comprise regulating, granting a licence, establishing regulations and standards in the initial phases of the project, and supervising a DGR. The implementer's role and responsibilities are to develop and implement a safe nuclear installation – taking into account feedback from the regulator on a continuous basis.

Based on the questionnaire responses received, the roles and responsibilities of the regulator and implementer can be summarised in relation to specific fields of activity, as displayed in the table below.

Table 3.1: Roles and responsibilities of the regulator and implementer related to pre-licensing of the DGR

Topics	Regulator's roles and responsibilities	Implementer's roles and responsibilities
Advice	Provide advice to the government on issues relevant to nuclear safety (e.g. national policy and national programme for the management of RW).	Implementer can (must) also advise the government on national policies and national programme.
Regulatory framework	Develop regulations for the DGR and provide guidance to the implementer about the application of the regulatory framework. Identify gaps in the regulatory framework and ways to fulfil them, in particular to orient R&D activities.	Interact with the regulator on the interpretation and application of the regulatory framework. This includes developing a common understanding of the regulatory framework, full comprehension of the regulator's formal expectations, and keeping up to date with international guidelines and recommendations (IAEA, ICRP, NEA). Conduct interactions (public or not) with the regulator in respect to compliance with regulatory requirements.
Licensing process	Supervise the pre-licensing phase and its progress, review crucial documents, and issue standpoints, opinions and formally documented key regulatory decisions.	Develop a high-quality licence application: conduct the site characterisation; be transparent about what is learnt from characterisation; establish notes with the regulator to guide the preparation of safety cases; conduct the safety case (or subsets of the safety case) calculations iteratively and communicate the findings to the regulator and public with a tailored messaging process; develop understanding of data gaps and uncertainties to inform performance assessment.
Knowledge related to the development and implementation of the DGR	Develop knowledge, in particular for independent capabilities to review a potential licence application for a DGR and with respect to the implementer's activities and technical research.	Perform the necessary activities for the development and implementation of the DGR project, including: during the pre-licensing period, the development of a plan for the construction and operation of a safe geological disposal; R&D; site characterisation; communication to the public and the regulator about the science/technical work; regular updates to the regulator's staff on the siting and technical programmes, etc. Take into account the various feedback (formal and other) from the regulator for the subsequent programme phase.

Table 3.1: Roles and responsibilities of the regulator and implementer related to pre-licensing of the DGR
(Continued)

Topics	Regulator's roles and responsibilities	Implementer's roles and responsibilities
Independence	Demonstrate independence of the implementer and the government.	
Interactions with other stakeholders and the public	Interact with other regulatory bodies (e.g. those in charge of protection of the environment, land use regulations, mining regulations) and all stakeholders to keep them informed of the regulatory activities through listening and addressing stakeholder concerns. Inform and interact with the public on safety-relevant issues, in particular the development of regulations and the regulator's activities.	Interact with other regulatory bodies and take into account other regulatory requirements (e.g. protection of the environment, land use regulations, mining regulations). Provide information to all stakeholders and the public, keeping them informed of the status of the site characterisation and design activities (transparency).

In certain countries, intermediate bodies may indirectly facilitate dialogue between regulator and implementer. These intermediate bodies often develop reports on selected topics (e.g. feasibility of the repository concept, sealing of the geological repository, criteria used for the different phases of oversight) and provide advice on RW disposal (technical or policy-related) – including recommendations or suggestions.

These intermediate bodies include:

- Technical support organisations (TSOs) that provide technical support to the regulator in all fields of activity. This support is not limited to technical regulatory issues, but includes management and communication activities. Four out of thirteen country responses to the RIDD questionnaire integrate TSO competence in their organisation.
- Regulator advisory groups and boards involved in decision making (e.g. NRC internal advisory committee on nuclear waste for reactor safety).
- Implementer advisory groups and boards (e.g. US Nuclear Waste Technical Review Board, NWTRB, for the DOE; the standing advisory committee of Andra in France or the Ad-hoc Special Review Committee of the Atomic Energy Society of Japan as well as the Standing Technical Advisory Committee for NUMO).
- Advisory groups and boards whose oversight includes the entire process (National Citizens' Oversight Committee or the different conferences – subareas; regional and council of the regions conferences – in Germany).
- Ministries and land authorities, as they facilitate R-I dialogue (e.g. Ministry of Energy in France, Länder in Germany).
- Academia for advice and knowledge development (e.g. National Academy of Sciences in the United States had a permanent panel for 20 years to help the regulator better understand technical issues).
- International organisations (e.g. NEA or IAEA) for co-operation, or regional organisations through the Espoo convention and Euratom Treaty (e.g. Finland and Sweden).
- Other environmental protection and land use regulatory bodies who contribute to the full understanding of the requirements and constraints of developing a DGR programme.

4. Goals and expectations of the regulator and implementer in establishing dialogue

R-I dialogue is an important component of pre-licensing, and contributes to its optimisation by facilitating more effective exchanges. Pre-licensing can be optimised in terms of quality of information, documents shared between the regulator and the implementer, relevance of solutions proposed and adopted, costs and time span. As pre-licensing is a stepwise process, intermediate objectives should be mutually achieved by both the regulator and implementer throughout the pre-licensing phase.

The principal goal of R-I dialogue during pre-licensing is to develop a common understanding of the regulatory framework, DGR project and the licensing process. Through R-I dialogue, the regulator should: i) clarify whether the implementer's methodology correctly implements the assessment of safety criteria and ii) develop understanding of the type of data that the implementer will provide in the licence application. The implementer should develop a thorough understanding of regulatory requirements and anticipate issues to be considered in the licence application based on the regulatory provisions.

R-I dialogue should establish the necessary conditions for the pre-licensing process to be optimised, through:

- developing clarity and mutual understanding of the regulatory framework;
- deepening knowledge of the DGR project and of the licensing process;
- facilitating the licence application and safety case;
- identifying as early as possible potentially problematic topics;
- building confidence between the regulator and the implementer, including in their respective competences.

The regulator and implementer each have their own objectives and mutual expectations in terms of dialogue. These expectations are primarily technical and administrative. However, further into the pre-licensing process, these expectations are more linked to the attitudes and behaviours of the other party. Thus, an important reciprocal expectation is transparency. FSC defines transparency as “an attribute of a process seeking to reveal, in a non-adversarial manner, the information, values and assumptions present behind the arguments or activities of each type of stakeholder” (NEA, 2013). Transparency also involves clarity, comprehensiveness and reliability of information, including making the regulator aware of difficulties encountered. In addition to transparency, other reciprocal expectations include competence, openness to knowledge needs and concerns of the other party, reactivity and anticipation.

The regulator may send a written list of expectations to the implementer. For example, in France, the “ASN decided, based on the specificity of the deep geological disposal, to outline its expectations for the Safety Options Dossier in a letter to Andra in December 2014” (IAEA, 2017). In this letter, ASN requested the following:

First of all, these safety options must cover the entire installation, that is to say the surface facilities, the underground facilities and the surface underground connections, at the preliminary design study stage. Particular attention must be paid to the completeness of the submitted dossier with regard to the concept of disposal system defined in the ASN Safety Guide. The submitted dossier shall be a

standalone dossier, explicitly presenting the objectives, concepts and principles adopted to ensure the safety of the facility when in operation and over the long term, at the different phases of the facility's life cycle: design, construction, functioning, final shutdown, decommissioning or closure, maintenance and surveillance, depending on the facility sub-units concerned. The level of detail presented shall be proportional to the significance of the risks and associated drawbacks. (IAEA, 2017)

The table below provides an overview of regulator and implementer expectations in establishing dialogue.

Table 4.1: Expectations from the regulator and implementer in establishing R-I dialogue

Types	Description of the expectations
Regulator towards the implementer with regards to technical and administrative information	<p>Implementer:</p> <ul style="list-style-type: none"> - develops roadmaps with clear milestones, considering for each key decision step the remaining uncertainties to be reduced and to what extent the performance, robustness and feasibility of the geological disposal system has to be confirmed; - should be ready to provide additional information, in particular validated research findings, ensuring the reliability of the information provided; - develops quality assurance programmes to ensure adequate documentation of their work, in particular justification of the decisions/choices made and traceability for long-term periods.
Implementer towards the regulator with regards to the technical and administrative information	<p>Regulator:</p> <ul style="list-style-type: none"> - Sets up basic rules for the licensing process (regulations, acceptance criteria, timetable of the process, documents format, etc.) and provides guidance. The guidelines should be sufficiently descriptive to focus the implementer's work and should allow for some leeway in order not to produce unsolvable conflicts. - Needs to identify information considered sufficient from the implementer to make a decision on a particular topic.
Clarity and comprehensiveness of information and transparency	<p>Implementer is expected to provide clear and comprehensive information on the project and expects the regulator to provide clarity on the regulatory requirements. Transparency involves openness to sharing information, especially on findings from the implementer's research and the early presentation of unexpected evolutions and uncertainties, without restrictions.</p>
Open dialogue and openness	<p>Employees of both the regulator and implementer should be open to the other party's needs for further interpretation or clarification, and should be receptive to the other party's concerns. In particular, the implementer should be given the possibility to explain its non-safety related constraints (i.e. costs and societal constraints).</p> <p>The regulator should invite the implementer to comment on its requirements and expectations.</p> <p>Implementer should be open to questioning and to reconsidering approaches, while the regulator should not be making judgements based on preliminary information.</p> <p>A self-questioning attitude from both parties contributes to openness.</p>
Professionalism and learning culture of the regulator and implementer	<p>Both regulator and implementer are expected to have competence, along with intellectual and moral honesty. The implementer should have adequate knowledge of regulatory provisions and of the regulator's expectations. The regulator should develop knowledge of the implementer's project. They need to ensure that their understanding is correct and, in case of uncertainty, they should initiate a discussion to clarify issues.</p> <p>Both regulator and implementer should acknowledge unknowns and actively plan how to resolve them.</p> <p>A self-questioning attitude is favourable to knowledge and progress, in particular identifying, discussing and questioning what can be done better and what has gone wrong or needs attention.</p>

Table 4.1: Expectations from the regulator and implementer in establishing R-I dialogue (Continued)

Types	Description of the expectations
Reactivity of the regulator towards the implementer	Responsiveness to the regulator's information requests in a timely manner. Proactive and timely identification (and resolution) of issues, and areas where regulatory advice [opinion] is required.
Reactivity of the implementer towards the regulator	Timely review regarding documents required by the regulator.
Anticipation	Early dialogue with regulator to obtain guidance and prepare the documentation needed for a future licence application. Early identification of all topics/issues that might be challenging to address and need to be discussed. Review of the draft safety case parts by the regulator to develop its knowledge and competencies, giving also the possibility to identify and address possible difficult topics before the licence application is submitted without prejudging the final decision.

5. Structure and implementation of the R-I dialogue

The R-I dialogue should be initiated as early as possible in the RW disposal programme. The main reason is to have preliminary communications on:

- the licensing process, in particular the stages, objectives and milestones to be reached at each step and that make it possible to go to the next step (including key nuclear safety principles; the expectations of the regulator towards the implementer; and guidance on regulatory framework);
- the implementer's approach to RW disposal (including plans, the nuclear safety strategy, the general disposal design and the measures to reach the objectives).

During the beginning stages, R-I dialogue can be implemented on a regulatory basis, or as part of existing arrangements between regulator and implementer. Both regulator and implementer arrangements can benefit from any previous interactions that have occurred in a licensing process for other facilities. In particular for low-level and short-lived radioactive waste (LLW), relations between regulator and implementer during the pre-licensing period of a DGR may be similar to what was done for a LLW facility.

5.1. Existence of the regulatory basis and arrangements for R-I dialogue

In general, R-I dialogue is rarely mentioned within the legal and regulatory framework. In the infrequent cases where dialogue is mentioned, this is often implicit. Only a few countries reported the existence of a formalised legal or regulatory framework for R-I dialogue, such as Belgium, Canada, France and the United States. For instance, in the United States, the legal framework regarding the application for a DGR in Yucca Mountain established that the licensing decision should be made within a three-year time frame (extendable to an additional fourth year). NRC and DOE developed an agreement that governed interactions between the two agencies during the pre-licensing phase and were useful to set the ground rules in advance. The agreement also discussed the extent of public involvement permitted in these interagency meetings. During the technical exchanges, minutes had to be developed to document discussions but no decisions could be made. On the contrary, in the case of the Waste Isolation Pilot Plant (WIPP), there were no formal arrangements but agreements in principle to collaborate. There were more one-to-one sessions, rather than public interactions. However, any decisions were written and made public – even decisions on the expectations of the regulator with regards to the role and performance of the implementer. In Canada, pre-licensing interactions are defined through a special project service arrangement under the Nuclear Safety and Control Act. The special project service arrangement defines interactions between the regulator and the implementer.

Some countries have co-operation agreements in place (e.g. Germany) that can be named differently. For instance, in Belgium, in addition to the law framing the R-I dialogue during the pre-licensing period, a “co-operation agreement” between the regulator and implementer establishes a work programme on a three-year basis, which allows dialoguing about regulatory requirements and the expectations for the safety case. This agreement leads to the writing of “convergence notes” that allow a common understanding of international principles or requirements to be applied to a DGR on radiological protection optimisation or on reversibility and retrievability. In Czechia, a Memorandum of Understanding between the regulator and implementer defines the general framework of

co-operation of both institutions necessary for the successful DGR development, in particular the selection of the DGR.

In some cases, different types of meetings can be defined under R-I arrangements and topics requiring R-I dialogue are planned, which may help to structure and frame the discussions. Annex D summarises the legal arrangements and co-operation agreements by country.

As already mentioned above, only the regulatory tasks are specified in laws and regulations, not specific arrangements for R-I dialogue. These regulatory tasks require necessary exchanges between the regulator and the implementer for the establishment of regulations by the regulator, provision of the safety case (or preliminary elements of the safety case) by the implementer, as well as the review and opinion and possible authorisation of the regulator. From a purely administrative point of view, regulatory tasks might be considered as involving one-way information while effective dialogue goes beyond the mere “bureaucratic” provision of information, documents and decisions or opinions. Even if there are no specific arrangements, respondents to the RIDD questionnaire consider it important to define a structured organisation of the dialogue process and an agenda with proper communication channels.

It is worth mentioning the case of Onkalo in Finland to illustrate the type of R-I dialogue in the pre-licensing phase that is not supported by the existence of specific regulatory arrangements. When Onkalo was constructed, the regulator had no official role in supervising this facility but Posiva requested that STUK supervise it. This enabled a real dialogue between regulators and implementers in the construction of the DGR and in the RD&D area.

5.2. Types of R-I dialogue

Different types of R-I dialogue were identified from questionnaire responses:

- meetings (face-to-face or online);
- telephone conversations;
- email exchanges;
- exchanges on social networks;
- written correspondence.

This dialogue may have different characteristics, such as formal or informal, periodic or regular, ad-hoc, planned or as-needed, topical, strategic, technical or managerial. Annex D describes the various types of dialogues reported by country.

Canada categorises four types of dialogue depending on the topic and frequency defined in the service arrangement mentioned above: monthly interface meetings through the single point of contact (SPOC) between the regulator and the implementer; update meetings on topic specific activities on an annual basis; quarterly progress meetings; and annual planning meetings. SPOC meetings serve as regular planning meetings to discuss the content and scope of any other meetings and identify topics that require discussion at different levels in the organisations and with different subject matter experts.

In Finland, there is a yearly planning of the main R-I management meetings per discipline and related to: a) the site (plans and status of the programme); b) the barrier design and buffer backfill; and c) the safety assessment. In addition, larger meetings are organised twice a year, one of them related to safety.

In a similar vein, Spain has four categories of dialogue:

1. high-level meetings between the regulator and the implementer at least twice per year to comment on upcoming activities, relevant issues and the licensing process (e.g. application dates, significant milestones);
2. project meetings to solve issues;
3. ad-hoc working groups to tackle generic issues;
4. technical meetings to solve/clarify specific technical issues.

In Switzerland, the R-I dialogue takes place approximately once a month and decisions are made available under the Freedom of Information Act. Additionally, specific technical questions are discussed among experts of the regulator and implementer.

In the United States, quarterly public management meetings were arranged during the pre-licensing of Yucca Mountain. The directors of the waste programmes of both the NRC and the DOE participated in these meetings to discuss specific topics, such as the quality assurance programme. The public was also allowed to make presentations during these meetings. In addition, the NRC hosts open houses before public meetings where the NRC staff is available to meet the public informally and answer any questions raised.

In addition to the national-level R-I dialogue, international fora provide another vehicle for dialogue as they help both the regulator and implementer to discuss and clarify their positions and learn from international practices. Such fora, under the auspices of the IAEA, NEA, EC or ICRP, enable regulators and implementers to consider their national dialogue approaches in a wider, neutral context.

5.2.1. Official versus unofficial R-I dialogue

Dialogue between the regulator and implementer can be classified as official (formal or public) or unofficial (informal) based on specific characteristics.

An official dialogue follows certain recognised rules or arrangements between the regulator and implementer, such as being scheduled, organised with an agenda and reported in texts or records. Normally the upper management is involved and strategic questions are discussed. An official dialogue is organised at each regulatory milestone (or key point) of the roadmap of the DGR project, and when reasoned positions need to be established. The outcome of such dialogue is usually binding and jointly documented by the regulator and implementer, or formally agreed upon and published. If the dialogue is open to the public, it is necessarily official. An email or an exchange on social media is considered official as there is an electronic record of the interaction. These documents can be official depending on the position of the sender (hierarchical level) and their level of responsibility as defined in internal procedures.

An unofficial dialogue is based upon a formal legal regulatory framework or mutual agreement, but is useful for technical exchange about open questions, such as when there are preliminary discussions for clarifications of some aspects of the regulatory framework, the licensing process or the preparation of key licensing points. No commitments are made in this type of interaction. Telephone calls are informal, as are impromptu meetings or meetings on the side-lines of an event (e.g. conference, symposium). Reasons noted within questionnaire responses for starting an unofficial dialogue include the need to:

- deal with emerging scientific-technical questions;
- improve communication and address co-operation issues;
- resolve misunderstandings, uncertainties, knowledge gaps and doubts;

- treat ideas and positions that are not yet elaborated but worth being discussed in an exploratory manner that is not possible if the dialogue is formal;
- establish a common interpretation of issues, such as regulations and guidelines.

An unofficial dialogue offers more flexibility and freedom to both parties in the pre-licensing phase, when there are few requirements regarding the form and frequency of interaction. Unofficial dialogue, where views and thinking are freely shared, is useful for improving the conditions for later dialogue, but it should be reciprocal. It can be of better use than formal dialogue in the search of solutions because it is more spontaneous and flexible and any consequences are minimised. It also allows an exploratory and innovative approach to the resolution of problems and better reveals the personality, the feelings and the real expectations of each partner.

Official dialogue does not exclude unofficial dialogue. Unofficial or early interactions are considered as a preparatory and documented step to formal procedures and/or decisions. A dialogue often starts as being unofficial at the beginning of the pre-licensing, when it is not yet ruled by regulations, arrangements or usual practice and it becomes more official as the licensing process progresses and the relations between the regulator and implementer are set up. During the pre-licensing period, when the regulatory system is not fully in place and there are uncertainties in the programme, dialogue should be exploratory (informal) before any formal engagements between the regulator and implementer are conducted. An unofficial dialogue, which occurs without public knowledge and/or participation, may result in perceptions of behind-the-scene compromises or secrecy that would hinder future public confidence. In order to avoid this, it is important to maintain transparency as much as possible, choosing to clearly document conclusions that are reached, to allow for public participation as appropriate, and to place documentation on the public record. It is worth confirming the outcome of an unofficial dialogue by both parties and, if not possible, to have it recorded in the information management systems of the regulator and the implementer.

It is generally recognised that dialogue, whether official or unofficial, should start at the very beginning of the pre-licensing period, when the regulatory framework is not fully established and the DGR project is not fully mastered due to uncertainties. As the project progresses, dialogue becomes more official and uncertainties are reduced until the licence application, when dialogue becomes fully official.

5.2.2. Objectives and topics of the R-I dialogue

The objectives and topics of the dialogue need to be clear and agreed at the beginning of the meeting but can be adapted during the dialogue depending on its progress. Topics could include mixed issues: administrative (licence application, documentation), managerial (planning, progress, organisation) or scientific/ technical (development of a common understanding of regulatory requirements; agreement on a R&D programme; convergence on some key concepts). Any topic is eligible for dialogue, and there should be no limit or constraint about that, provided it is relevant. Topics should be addressed in a timely manner in accordance with the planning of the project and the licensing process. For instance, in the United States, the DOE and the NRC conducted quarterly management meetings, technical exchanges on performance assessment, approximately every 18 months and other technical exchanges on a variety of topics as the need arose. The technical exchanges were public meetings and assisted the understanding of issues and concerns for the public, the DOE and the NRC. Technical exchanges improved not only the understanding of technical issues, but also the relationship between the regulator and implementer.

Meeting preparation is an important step to establish effective organisational conditions for the dialogue. Participants should be well-targeted, with the parties and their representatives clearly identified. Participants should also be competent in the subject. Competence is defined as staff with sufficient scientific background, for both the implementer and the regulator, and with an appropriate level of management for nuclear safety issues.

The RD&D programmes are regarded by some regulators and implementers as a helpful example of establishing and maintaining R-I dialogue during the pre-licensing phase. The implementer presents the RD&D programme and the regulator can make comments that allow the implementer to ensure that the expectations of the regulator are met. These R-I dialogues may involve publicly available documents and draft documents that are not available to the public. It will be important to consider the transparency of these dialogues with respect to supporting public confidence.

5.3. Collective and personal attitudes during the R-I dialogue

There is a difference between the “collective attitude” provided by the organisation’s values, which might frame the atmosphere and context of dialogue, and the “individual attitudes” of participants during the dialogue process. On the one hand, the collective attitude promoted by the top management and implemented by the meeting proponents should ensure:

1. Correct chairing and leadership.
2. A pragmatic and constructive atmosphere to foster an environment of understanding and confidence and to establish mechanisms to resolve possible disagreements.
3. Freedom of opinion of the participants. The regulator’s freedom of opinion does not guarantee acceptance of a submission nor prejudgement of the final decision for the licensing procedure. The regulator should not be making judgements based on preliminary information.
4. Flexibility on the topics discussed that can trigger discussions in additional topics and progress towards potential solutions.
5. An ongoing working relationship between the regulator and implementer. Opening a permanent information line between the regulator and implementer (informal dialogue) helps to identify issues and deviations promptly.

On the other hand, the personal attitudes of the participants during the dialogue should be openness, a self-questioning attitude, receptivity, responsiveness, anticipation and reactivity, as explained below.

- Openness is related to the capacity to listen to the questions and concerns of the partner as well as to be questioned without restrictions about one’s respective stance, for further clarification and possible reconsideration of approaches.
- A critical self-questioning attitude contributes to openness and is favourable to knowledge and progress. It should not be viewed by the regulator as a challenge to its authority or by the implementer as a criticism of its technical credibility or integrity. Instead, a self-questioning attitude should help acknowledge uncertainties and plan how to resolve them as well as identify and discuss what can be done better and what needs further attention.

- The regulator and implementer should be receptive to the other party's concerns; in particular, the implementer should be given the possibility to explain its expectations, constraints and difficulties.
- The regulator and implementer should be responsive to the other party's questions and deal with any request in a timely manner, given that replying to questions leads to building confidence.
- Anticipation or early identification of potentially challenging issues is another fundamental quality for managing projects in order to prepare for new or unexpected situations.
- Reactivity by the regulator is needed in a timely manner to review and give an opinion on the documentation presentation by the implementer in order to identify in a proactive and timely fashion the issues in areas where the regulatory opinion is required.

It is widely acknowledged that both sides (regulator and implementer) should not act as competing organisations, but pursue a common overarching goal that is safety in nuclear waste management. A consensus is not always possible, and sometimes not necessary. In this context, and with the correct chairing and leadership, it is possible to cultivate an open and constructive atmosphere that is pragmatic and non-confrontational. This R-I exchange does not detract from the independence of the regulator or from the implementer's responsibility to define and conduct the safety case. In fact, the implementer should provide correct, clear and comprehensive information, and inform the regulator of any difficulties encountered. All parties should feel that they can speak freely and be challenged to achieve the best outcomes. It should be borne in mind that freedom of the regulator's opinion does not guarantee acceptance of a submission. In addition, preliminary advice or an opinion by the regulator does not prejudice the final decision of the licensing procedure.

5.4. Solving disagreements in the R-I dialogue

Disagreements between the regulator and implementer might arise, and may involve not only safety issues but also R&D, logistics, the construction site or other topics. In case the regulator and implementer disagree on a certain issue, the general attitude should be to pursue dialogue for better understanding, and explore several tracks to resolve the disagreement. Disagreements can also be regarded as a way to promote further improvements in both approaches and communication during the pre-licensing stage. In some instances, these disagreements can lead to building trust between the regulator and implementer, and vis-à-vis the public if respected roles are demonstrated.

Public disagreements between the regulator and implementer can have both positive and negative consequences. Disagreements are likely to surface and it is better to be prepared for these with a public communications strategy. It is important to understand what the disagreements mean to the public and what they mean to the organisations. If the disagreement is related to calculations, new calculations with refined parameters or codes can resolve it. If there is a strong R-I disagreement, there is a need for the implementer to re-evaluate the specific issue and provide more argumentation. The regulator might require that the issue be addressed during the licensing phase if the argumentation is not sufficiently solid. In addition, the regulator might further re-evaluate and, if appropriate, adapt its guidance. Altogether, a learning attitude on both sides will help to build trust.

5.5. Records and outputs of the R-I dialogue

Recording R-I dialogue paves the way towards licensing by closing scientific issues or formally acknowledging the DGR safety strategy. The objectives of recording may include saving technical and administrative information, formalising agreements, opinions or decisions taken between the regulator and implementer, keeping memory and providing evidence or proof of certain decisions and enabling their tracking. An additional objective could be transparency, which requires that the dialogue outcome is documented (condition of formal dialogue), publicly issued, and viewed by the public. Therefore, the outputs of a dialogue may be physical (material) or immaterial. Material outputs may include any opinion or decision documented in records, a regulation, a licence application or a safety case, whereas immaterial outputs may include transparency, confidence, changing attitudes or any other psychological conditions favourable to dialogue.

The different ways or modes of recording or documenting R-I dialogue outcome include:

- Meeting minutes: the outcome of the R-I dialogue can be published and is accessible to the public; the records may contain a summary of the content of the meeting and commitments. In the case of public meetings, personal recording by members of the public, video streaming or reporting by journalists is also possible.
- Written correspondence and emails.
- Phone call outcome confirmed by written or electronic exchange.²
- Posts on websites or social networks.
- Information on TV or in newspaper or magazines articles.

Documenting as much as possible the R-I dialogue contents and outcomes (e.g. records of meeting minutes in case of joint agreements) can be considered a good practice among the regulators. In the case of Finland, Posiva is a private company and does not have the obligation to publish minutes of meetings, but the public can ask STUK for this information. It is interesting to highlight that during the pre-licensing phase, STUK started to develop an “issue list” to document and follow the findings from the implementer. However, this issue list proved to be too detailed and led to new issues. The tracking system to follow up on the implementer’s findings was then changed from one with a scientific perspective towards one with a more safety perspective.

In a similar vein, in the phase closer to the submission of the licence application for the DGR at Yucca Mountain in the United States, the NRC issued a resolution report on key technical issues (KTIs). This report clearly and consistently documented all the areas the regulator considered important, their status and whether further work was needed prior to the submission of the licence application. The NRC held meetings and technical exchanges with the DOE to advance the issue resolution process. Meeting summaries and agreements between the DOE and the NRC for each issue are documented for each meeting. The EPA is currently developing the KTIs resolution report informally for the WIPP.

In Japan, the ad-hoc R-I meetings formally organised by the regulator are open to the public via video streaming, and official records are published after the meeting.

² For instance, in the United States, the NRC had a requirement to fill in a form after a phone call with the DOE and document publicly the discussion in order to protect the regulator’s independence.

5.6. Challenges regarding R-I dialogue associated with the long time period

Radioactive waste management is a long-term issue and, therefore, the timescale of any related communication is much longer than that of ordinary communication – such as for operation of a nuclear power plant (NEA, 2017). The long period of development of DGRs (several decades for R&D, licence, construction and operation and even a century for the whole life cycle of a DGR) implies possible changes of opinions and regulations, which need to be adapted and documented. The decision and the rationale behind it should be recorded. As recognised in NEA (2015), “a regulatory challenge thus seems to consist in giving guidance on how to connect records with knowledge and memory”, given that it is widely recognised that the “regulator and implementer will not continue to exist into perpetuity”. Consequently, there is a need to “act upon the idea that the long term starts today” and all the concerned actors (i.e. implementers, regulators, operators, local and regional authorities, other stakeholders) should be aware of the need to preserve records, knowledge and memory with a very long term approach and act responsibly.

Questionnaire responses related to R-I dialogue challenges associated with the long pre-licensing phase pointed out three main topics:

1. Experts and staff in the regulatory authority and/or implementer.
2. Knowledge management.
3. Legal, political or institutional changes. Other challenges are also mentioned and presented in the table below.

Table 5.1: R-I dialogue challenges associated with the long time frame

Country/ challenge	Experts/staff	Knowledge management	Legal/ political/institutional changes	Other
Belgium	Management of staff turnover	Maintaining knowledge and experience		Traceability of: regulatory expectations, advice and decisions; R-I exchanges on fundamentals of safety case and of changes in design or safety concepts over time
Canada		Knowledge transfer and building, particularly within the regulator		Public understanding of the process
Czechia	Independence; personal changes		Changes in legislation	
Finland	Enough communication staff to maintain dialogue	Preservation of knowledge through generations		Difficulty to reach a joint understanding of topics and level of detail to be addressed in the coming licence phase

Table 5.1: R-I dialogue challenges associated with the long time frame (Continued)

Country/ challenge	Experts/staff	Knowledge management	Legal/ political/institutional changes	Other
France	Continuing the dialogue despite staff turnover; Maintaining technical skills on long-term projects	Knowledge management strategy and methodology	Regulator prepared and open to discuss – including for the implementer – in a “two-way” exchange	Maintaining traceability of previous exchanges, in particular the formal ones, key concluding aspects, challenging issues; Accepting the progressivity of the DGR's design
Germany	Staff changes	Knowledge conservation and knowledge transfer, including across institutional boundaries	Changes in political constitution; Ensure division of roles; Ensure continuity over long time periods	
Japan		Common understanding of evolving international consensus, principles and guidelines and relevant issues on application of international instruments to Japanese situation.	Open information understanding of international consensus, principles and guidelines and relevant issues by the regulator to all stakeholders	Identification of key technical issues, such as R&D needs, site investigation methods and results, quality management of data and information and safety case development
Russia			National regulations not specific to DGR; Several licensing bodies stipulate different requirements	
Spain				Communicating outcomes to the public
Switzerland	Staff training			
United Kingdom	Organisation and staff changes at all levels: including maintaining culture and commitment	Recognising and recording decisions that can be retrieved in the future	Changing standards, legislation and policies	

Table 5.1: R-I dialogue challenges associated with the long time frame (Continued)

Country/ challenge	Experts/staff	Knowledge management	Legal/ political/institutional changes	Other
United States	Keeping expertise and institutional knowledge; staff's understanding of the historical basis for decisions	A common understanding of the regulations and technical information, including the uncertainties.		Implementer needs staff that understand research but can speak to compliance issues with the regulator. Regulator needs specialised capabilities and technical support means

6. Conditions for an effective R-I dialogue

An effective dialogue between the regulator and implementer is not only based on the appropriate transfer of technical and administrative information, but on the following additional factors:

- independence of the regulator from the implementer and government;
- knowledge and understanding of the regulator and the implementer (at organisational and individual levels);
- attitudes and behaviours of the regulator and the implementer encouraging transparency, mutual confidence and mutual understanding.

6.1. Independence of the regulator

Independence of the regulator involves effective separation between the regulator's functions and those of the operator or implementer. Following IAEA INSAG-17,

...the performance of [basic regulatory functions] must be entrusted to a regulatory body provided with adequate authority, competence, and financial and human resources to discharge its assigned responsibilities. Moreover, in order to ensure independence in exercising basic regulatory functions, there must be an effective separation between the functions of the regulatory body and those of any other body or organisation concerned with the promotion or utilisation of nuclear energy. (IAEA, 2003)

Therefore, independence of the regulator relies on a regulatory framework, strict definition of the regulator and implementer's respective roles, regulator's competence, and organisational, human and economic resources and information. This is further described in the table below.

Table 6.1: Conditions for the independence of the regulator from the implementer and the government

Topics	Conditions for independence
Regulatory system	Legislative framework guarantees independence of the regulator, clearly defining the roles and responsibilities of the regulator and the implementer. regulator is an independent central state administration body in the field of nuclear safety and radiological protection, whose chairperson is appointed by the Head of the State or any institution at a sufficient level.
Effective roles of the regulator (and implementer)	Regulator does not directly contribute to developing the concept and the design of the facility, and makes sure that the responsibility for safety is clearly taken by the implementer. The regulator's task is to evaluate and raise topics that need further work and, therefore, are not sufficiently fulfilling safety requirements.
Regulator's competence	Regulator develops internal technical expertise (and designated TSOs provide for necessary capabilities) for independence. Regulator builds its own competences and resources in the following fields: i) review and conduct independent calculations and compile conclusions about nuclear safety; ii) regulatory practices; iii) managerial, personal and behavioural matters (leadership, safety culture, communication). An independent R&D programme supports expertise of the regulator, as well as collaboration in international projects.
Organisation and management	Regulator and implementer are independent, and do not have any common management. This is guaranteed through structural separation and a number of procedures to ensure a clear division of roles. Regulator also has stringent requirements about conflict of interest for staff and contractor staff moving from the implementer to the regulator.

**Table 6.1: Conditions for the independence of the regulator from the implementer and the government
(Continued)**

Topics	Conditions for independence
Information on the regulator's role	Regulator sets out clear roles, responsibilities and expectations at the start of dialogue. Regulator conducts public outreach and holds numerous public meetings with State and local governments, and the public, to explain the role of an independent regulator.
Resources	Economic independence (funding securement) of the regulator is normally provided for by law and controlled by the Parliament (own budget item approved as part of the national budget). Regulator defines and implements from the beginning an appropriate organisation to ensure allocation of sufficient resources for an independent and critical review of safety-related documents.

Separation of the regulator and implementer's functions should not involve an absence of dialogue or the isolation of the regulator or the implementer, but rather the construction of R-I dialogue on a sound basis with the decisions of the regulator not being influenced by other stakeholders. Opinions or the preliminary documented advice of the regulator should not prejudice the final opinion (or decision) of the licensing procedure. Independence is also fundamental for building credibility with the public and gaining trust. In the case of Finland, if the Ministry of Economic Affairs and Employment organises a formal meeting, both the regulator and implementer may be present. However, if STUK organises the meeting, Posiva cannot formally present the implementer's position to clearly show the separation of roles and R-I responsibilities.

According to NEA (2017), "the principle of independency of the expertise function of the regulatory body" needs to be clarified. Independence does not mean isolation (absence of dialogue or exchange). Indeed, co-operation or support is needed in different research areas, either because of the lack of absolute independence from experts or scientists or because of a lack of available researchers in the nuclear sector at the national level.

6.2. Knowledge and mutual understanding

Developing knowledge and mutual understanding at the organisational and individual levels of the regulator and implementer has been addressed in Chapter 5. Through R-I dialogue, the regulator and implementer should share the findings of their safety evaluations, and have a consistent understanding of the safety strategy, the methodological approaches and the project planning for the licensing process. Transparency, a learning culture and responsiveness to the other party's information needs are important for mutual understanding. During the R-I exchange, confidence grows as the regulator gets a realistic overview of the status of the implementer's work – which makes unexpected developments less likely.

6.3. Attitudes, behaviours, transparency and mutual confidence

Attitudes and behaviours during the implementation of R-I dialogue was addressed as a topic in subsection 5.3. Transparency and mutual confidence are among the main prerequisites for effective R-I dialogue. Furthermore, they are closely intertwined. Transparency contributes to gaining confidence and increasing the level of confidence facilitates transparency.

Transparency is crucial for increasing knowledge and understanding of:

1. regulatory requirements and expectations;
2. technical issues;

3. progress of the project;
4. constraints.

There are two domains of transparency recognised in the R-I dialogue: a) transparency between the regulator and implementer; and b) transparency between the regulator or implementer and the public or other stakeholders. With regards to the former, transparency between the regulator and the implementer involves:

- exchanging correct, clear and comprehensive information;
- being open to sharing the findings from the implementer’s research and through regulatory guidance and answering questions;
- providing information on problems encountered in the licensing process or the project and, in particular, discussing unexpected evolutions and uncertainties without restrictions;
- being open about the real expectations of both the regulator and the implementer.

Transparency with the public may be defined by law or the law (e.g. “Act on Transparency”, “Act on Transparency or Freedom of Information”) may provide the right to request access to information held by an organisation. Public records of the R-I dialogue are means for reaching transparency. However, the question is to what extent and in what conditions information can be disclosed to the public and other stakeholders. In the case of complex information, it is generally recognised that an adapted text is preferable, although there should be a balance between the level of detail (correctness and comprehensiveness) and the lay language used.

Mutual confidence is gained through early and continuous communication between the regulator and implementer in order to share results and expectations related to safety. Trust and mutual confidence will build up gradually with time and through multiple interactions.

6.4. Monitoring the quality of the R-I dialogue

In most countries, respondents recognise that although monitoring the quality of R-I dialogue is fundamental, there are no predefined criteria to monitor its effectiveness. However, some achievements are indicative of a good quality dialogue and in most cases, whether the quality of the dialogue is good or bad is known by the parties involved.

Some of the “informal” indicators mentioned as relevant included effective exchanges on technical guides and reports, fulfilment of tasks described in meetings or delivery of good quality reports within the estimated time frame, implementation of regulated procedures established in administrative regulations, etc. In the case of the United Kingdom, the quality of R-I dialogue is being discussed and a full review has been undertaken of the ways of working between the regulator and the implementer. The review has included: a staff questionnaire and discussions on process and procedure, attitudes and behaviours and co-ordination of R-I engagement; a R-I workshop to analyse and respond to the staff questionnaire; and a regulatory engagement strategy and action plan.

7. Dialogue with other stakeholders and the public

Dialogue with the public and other stakeholders during the process of pre-licensing is important to help the public gain an understanding of how decisions about DGR projects are made as well as to engage in the process.

7.1. Dialogue with other stakeholders and the public

When regulators were asked about their role and responsibilities during the pre-licensing phase, most of them included communicating to stakeholders and the public, as follows:

- Communicate i) to stakeholders on the licensing process and the independent role of the regulator versus the role of the implementer; and ii) to the public on the regulator's role and the process to be followed during the application review.
- Make expert knowledge available to stakeholders, local authorities and the public.
- Ask the public how they would like to get information, e.g. in person or via internet, and provide information to the public in the form in which they would like to receive this information.
- Listen to concerns from the public, and ensure the implementer understands and addresses these concerns.
- Take part in discussions with the general public.
- Organise and/or participate in public hearings.
- Provide information on law and regulations, the regulator's role and the respective licensing process.

Both the NRC and the DOE in the United States have highlighted the crucial role that international organisations, such as the NEA and particularly the FSC, have in public outreach and dialogue with the regulatory authority.

In a similar vein, when implementers were asked about their role and responsibilities during the pre-licensing phase, many of them included communicating to stakeholders and the public, as follows:

- initiate (if relevant and depending on the country) and participate in, public hearings, in the framework of establishing law and directive and national policy proposals and of the Strategic Environmental Assessment (SEA);
- conduct public outreach to the communities affected by a DGR to address concerns;
- communicate publicly on the activities of the disposal programme;
- implement safe geological disposal of RW in co-ordination with local communities, in the pre-licensing phase, while building confidence in the local communities;
- develop understanding about concerns and information needs from the public;
- provide information to the public in the forms in which they want to receive it;
- communicate to the public and the regulator about the process being used for communication and the science/technical work;
- operate a website with FAQs related to the development of DGRs.

7.2. Critical stages for public involvement during the pre-licensing

The NEA recognised that the nature and timing of R-I technical interactions and how these are made publicly accessible is crucial to ensuring stakeholder confidence in the regulatory decision-making process (NEA, 2017). Crucial stages for public or stakeholder involvement during pre-licensing might be different depending on the category of public and stakeholders considered. Therefore, the public in the potential host community might have a different opinion than activist groups at the regional and national levels. Hence, the “crucial stages” may be different for the different stakeholders and depending on the country. According to the respondents from Switzerland, the regulator and implementer have to inform during the process according to their roles and the current situation. For instance, the regulator does not inform on the position taken until the review is completed and the results have been published. After that, the regulator has a duty to be ready for all stakeholders’ questions. On the other hand, the implementer has the role, and in some cases the mission or legal obligation, to inform stakeholders.

Several respondents highlight the need to begin public interactions from the very beginning of the pre-licensing phase, in a continuous way and independent of political changes. In Belgium, the respondents also point out the importance of ensuring the connection of the participatory process with the decision-making process as well as having a dialogue on the objectives and targets to be reached for each of the stages, making it possible to go forward to the next one.

In some countries, the stages for public involvement are specified in the law. For instance, in Finland, according to the Nuclear Energy Act, a decision-in-principle (DiP) may be made only if the municipality where the facility is intended to be located is in favour of the facility and if the project can be carried out safely. The municipality of Eurajoki supports the project and the regulator STUK is of the opinion that the final disposal can be carried out in accordance with safety requirements. The fact that the municipality is familiar with the nuclear industry and nuclear activities facilitates a positive public opinion towards the DGR. Before the DiP, the regulator and the implementer had separate meetings with different groups, such as NGOs or municipalities, to inform about the process.

In the United States, regulation also requires public involvement. Open meetings between the NRC and the DOE allow the implementer and regulator to face questions from the public at early stages and to be prepared for subsequent phases. It also helps to show the independence of the regulator. For instance, the NRC engaged with stakeholders (e.g. local units of government and affected Indian Tribes) to explain the NRC’s role and the licensing process, including how to participate in the licensing hearing.

In the case of Germany, in the Site Selection Act (StandAG) the phases for public involvement are:

- Phase I Step 1: Subareas Conference, held in 2020
- Phase I Step 2: Successor conference to be established (Repository Search Forum)
- Phase II and III: Regional conferences
- Phase II and III: Council of the Regions Conference

In France, crucial stages are related to regulatory milestones in the process, preceding either national or local decisions. In this regard, public debates were organised in relation to different regulatory milestones:

- 2006 public debate connected to the 1991 Nuclear Waste Law indicating that the licence has to be preceded by a public debate;

- 2013 public debate connected to the decree 2008-375 indicating that Andra has to request the licence at the latest on 31 December 2014;
- 2020 public debate corresponding to the application for a “Declaration of Public Convenience and Necessity” (Déclaration d’Utilité Publique in French).

In Japan, according to the Nuclear Waste Management Organization (NUMO), public involvement is crucial at each decision-making phase of the siting process: after the results of the literature survey, the preliminary investigation and the detailed investigation. The final decision to go forward to the next step is made by the Ministry of Economy, Trade and Industry by asking the opinions of the mayor of the local government and the governor of the prefecture.

Canada is experiencing a growing interest in the NWMO’s project and more requests for information and meetings with the regulator as the NWMO’s site selection process is close to a decision on the final site.

According to the different respondents of the questionnaire, when not defined in the legislation, some of the crucial stages for public or stakeholder involvement can be seen in the table below.

Table 7.1: Crucial stages for public or stakeholder involvement during the pre-licensing

Stage	Description	Country
Raise awareness regarding the need to manage radioactive waste	To raise awareness of the presence and problems of radioactive waste and the importance of jointly finding a safe, scientifically sound, financially feasible and socially acceptable solution	Belgium FANC and ONDRAF/NIRAS
Determine modality of participatory process	To agree on a modality of the participatory decision-making process that is accepted by all parties and adaptive	Belgium FANC and ONDRAF/NIRAS
Fundamental and/or potentially controversial issues	To establish a dialogue on fundamental and potentially controversial issues: Independence and role of the regulator Issues associated with the safety strategy (e.g. passive safety principle, reversibility, retrievability, long-term post-closure monitoring) Selection of the host rock and/or the site (e.g. development and review of the safety case) Environmental Impact Assessment	Belgium FANC and ONDRAF/NIRAS UK Environment Agency Spain CSN and Enresa
R-I Technical exchanges	To provide opportunities for all stakeholders to observe discussion between the regulator and implementer and provide comments	US NRC and DOE
Engagement of the regulator with specific groups of stakeholders (e.g. affected Indigenous Nations and communities)	To explain the role of the regulator and the licensing process, including how to participate in the licensing hearing; To engage with potential local host communities and municipalities	US NRC; Canada NWMO and CNSC Finland Posiva
regulators’ public meetings	To seek comments on the regulations during their development; To communicate the technical outputs	US NRC Czechia SURAO and SUJB
Informal meetings with stakeholders	To establish an informal dialogue with stakeholders and the public	US EPA at WIPP Germany BASE

7.3. Challenges for public involvement during the pre-licensing phase

The table below summarises the challenges facing the regulator and implementer in engaging with members of the public and other stakeholders during the pre-licensing phase and the ways in which they are addressed.

Table 7.2: Challenges for public involvement from the regulator and implementer viewpoints

Challenge	Approach of the regulator to address the challenge	Approach of the implementer to address the challenge
Communicating updates in the concepts for repository site and design		Implementer can organise online events for beginners, information events for young people or others addressing important topics (e.g. BGE, Germany).
Ensuring a transparent and accessible process of dialogue (including communication of uncertainties)	Regulators need to improve communication tools and approaches, explaining how decisions are made, in a way that builds confidence. Regulators need to be honest and transparent about the fact that some uncertainties remain at every stage of the process and explain clearly how they are handled.	Docketing process (US EPA) and document outcomes. Share and confirm a common understanding of the R-I dialogue as well as common issues for dialogue (NUMO, Japan). Provide records to the public at an adequate level of detail and document open questions in a suitable manner (e.g. BGE, Germany).
Communicating clearly the division of roles and R-I responsibilities	Regulator explains the need to be involved early in the process (identify the benefits of early engagement, before the regulatory process is triggered, e.g. CNSC in Canada). The regulator has to be careful with any public assessment of technical aspects in the implementer's work, when no formal review is foreseen in the relevant step of the procedure (e.g. BASE, Germany).	Implementer can organise online events for beginners, information events for young people or others addressing important topics (e.g. BGE, Germany).
Providing reliable and understandable information	Sufficient level of detail in the presentations so that it is understandable (not too technical but not too simple at the same time) and recalling the context that leads to the decisions taken. This is important because some decisions are taken after a lengthy review during the pre-licensing phase (e.g. ASN, France).	Communicate highly scientific and technical issues to technical and non-technical people, including governance proposals and stakeholders' roles and contributions, in an understandable manner. Clear framework to communicate on the decisions taken during the national programme for radioactive waste management meetings or through local associations, like ANCCLI (e.g. France). Every stakeholder needs to be considered differently and topics need to be presented to the public in an understandable manner (e.g. Posiva, Finland).

Table 7.2: Challenges for public involvement from the regulator and implementer viewpoints (Continued)

Challenge	Approach of the regulator to address the challenge	Approach of the implementer to address the challenge
Remaining an independent regulator	<p>Keep communicating and implementing independence of the implementer (e.g. Environment Agency in the United Kingdom; STUK in Finland).</p> <p>The regulator develops its own independent relationship with communities and other stakeholders, separate from the implementer (e.g. CNSC in Canada).</p>	
How and when to engage with the public	<p>Creating a structured procedure of public and stakeholder engagement.</p> <p>Evolving from a traditional (focused on development guidance, requirements and research) to a modern regulator, where engagement is as important as technical research and reviews (e.g. CNSC, Canada).</p> <p>Building a clear framework to communicate or exchange on the decisions taken (e.g. France, during meetings of the national plan for radioactive material and waste management or through local associations like ANCCLI).</p> <p>Open the process to stakeholders, such as federal commissions and cantons (e.g. ENSI, Switzerland).</p>	<p>Develop platforms where the public and interested stakeholders can discuss relevant topics in Switzerland; as part of the Technical Safety Forum, the regulator (ENSI) and the project lead (Swiss Federal Office of Energy, SFOE) answer questions regarding guidelines and procedure, respectively, while the implementer (Nagra) responds to technical questions. The answers are discussed and resolved in the public forum before they are published on the website. This procedure ensures an open dialogue within the predefined roles and provides a widely used set of answers to FAQs. Additionally, in each proposed siting region, there are local groups that discuss safety-relevant questions and the regulator and the implementer are invited to discuss specific issues.</p>
Coping with changes in staff and institutions due to long timescales	<p>Support stakeholder engagement in a continuous way considering long timescales and intergenerational aspects (e.g. STUK, Finland; FANC, Belgium).</p>	
Developing strict but flexible regulatory requirements	<p>Providing regulatory requirements that are strict but not too much to avoid narrowing too much the technical or siting possibilities (e.g. STUK, Finland)..</p>	

7.4. Strategy for public communication relating to R-I dialogue

A detailed and common strategy for public communication and the sharing of information relating to R-I interactions during pre-licensing has been developed only in a few countries. In some cases, the regulatory authority and implementer have their respective communication plans. In some cases, R-I dialogue records are provided to the public at a certain level of detail and/or if requested. In some countries, for example Finland, Spain and Russia, the regulators select which documents are available to the public through their website or upon request, and mostly publish technical documents once a licence is (or is not) granted – but not during pre-licensing. In Belgium, only relevant summaries of the regulator’s evaluation reports are made public. These documents, which are accessible on the website, are accompanied by an explanatory text in wording adapted to the public. In Japan, records of formal meetings of the Nuclear Regulatory Authority are open to the public. In France, the draft opinion of the regulatory authority can be submitted for public comments on the regulator’s website. All relevant comments are also included in the final opinion of the regulator.

In the United States, interactions between the implementer and the regulator are made at public meetings and the summary of the information is publicly available. The regulatory authority in the United States, the NRC, maintains the Licensing Support Network, which requires all responsible authorities in the licensing proceeding (i.e. regulator, implementer, state) to load all relevant documents and emails into this network for availability to all stakeholders. Similarly, in Canada, summaries of pre-project technical reviews that the CNSC has conducted of NWMO documents are available on the CNSC’s website so that they can be consulted by a broad audience.

In France, the agreement between the ASN and Andra is that the implementer cannot publish the dossier on the website before the end of review of that dossier and before there is an official public opinion. Furthermore, the regulator and the TSO need to co-ordinate the publication of opinions. The IRSN has to ask the regulator in advance if it can publish its opinion and the ASN decides when the opinions of both organisations can be published, which takes place in parallel. The regulator also publishes information notes to disseminate its reports and use simpler and more accessible language.

The NEA (2017) also emphasises that given the fact that “representatives of civil society do not have sufficient knowledge and resources to enter discussions on an equal footing with the implementers, [...] the availability of independent regulatory reviews, and access to independent experts, can provide civil society with assurances that cannot be provided by the implementer or regulatory organisation alone”.

Identifying the expectations, concerns and questions of civil society may help both the regulator and implementer to understand potential limitations in their approaches and in the information provided and to promote further improvements. The process of identifying expectations and concerns towards the regulator and the implementer during pre-licensing can be undertaken in a number of ways and through different channels – for instance, conducting stakeholder analysis or market research, through public dialogue exercises, public consultations or events for communities interested in hosting a DGR, online webinars, citizen conferences, or providing an email address for queries about nuclear issues. In Belgium, the Strategic Environmental Assessment (SEA) procedures undertaken in 2010 and 2020 as well as ad-hoc initiatives in advance of these legal procedures, provided opportunities to listen to public and stakeholder concerns, questions and expectations and take them into account in the SEA procedure and in the final policy proposal. Exchanges with students in political sciences and engineering were also organised in the framework of a European project by the regulatory authority in Belgium, FANC, the technical support organisation, Bel V, and the University of Liege, as a “serious

game” session. The aim was to discuss and raise awareness of the challenges associated with the safety and disposal of radioactive waste.

In Japan, nation-wide symposia and conferences with the general public held jointly by METI and NUMO for better understanding of geological disposal have enabled the implementer, NUMO, to identify the expectations and concerns of civil society towards the implementer. NUMO has also identified such expectations and concerns with a range of technical experts and the general public on the provision and publication of its safety case.

In France, public consultations for the Cigéo roadmap are organised and supervised by the National Commission of Public Debate (Commission nationale du débat public). This commission issues public reports, conclusions and recommendations reflecting civil society concerns and expectations.

In Finland, the levels of trust towards Posiva and the nuclear operators are already high. At the local level, there is a “co-operation group” that includes Posiva, the nuclear industry, the municipality of Eurajoki and surrounding municipalities that meets several times a year to communicate on nuclear issues.

In the United States, the EPA had the objective “to keep the public informed and involved in the decision-making process” through the EPA’s WIPP oversight program” (EPA, 1995). For this, EPA officials conducted a “Public Communications and Consultation Needs Assessment” which consisted of organising open meetings and interviews to identify the public’s concerns and information needs as well as the best communication methods. This information was the basis to develop the EPA Communications Plan.

The effectiveness of the EPA’s Public Outreach Program during the certification process at the WIPP in New Mexico was independently evaluated by a consultancy team through interviews and focus groups with interest groups, local, state and federal government representatives and citizens. The evaluation recognised the strong effort of EPA to ensure openness and inclusiveness, beyond their regulatory requirements for public outreach (EPA 2011).

The way to address expectations, concerns and questions of civil society will depend on the particular group trying to be reached. Thus, tailoring the communication approach to the specific group is crucial.

R-I dialogue during the pre-licensing phase can affect societal trust, depending on the existing level of trust in institutions. In Belgium, Finland or Russia, R-I dialogue does not seem to have a direct impact on societal trust during the pre-licensing phase. However, as Belgium notes, it is difficult to monitor social trust at the national level. In the United States, trust may increase if the respected roles of the regulator and implementer are demonstrated through their regular technical exchanges. In Canada, communities appreciate knowing there is an independent source of scientific information and having the opportunity to speak directly with CNSC technical staff. This helps explain the nature of the CNSC’s role, and the purpose of the CNSC’s interactions with NWMO in the pre-licensing stage (to provide guidance and build in-house regulatory capacity in advance of a licence application).

According to some questionnaire respondents, communities engaged with the operator in the site selection process have confirmed the importance for them of having early interaction with the regulator and having questions about safety and regulations addressed. Similarly, another regulator pointed out the need to build siting communities’ awareness of the regulatory framework and confidence that safety is a priority. Similarly, publishing agreements between the regulator and the implementer may provide clarity and transparency in the R-I dialogue. Some lessons learnt from efforts with WIPP and Yucca Mountain include the need to understand the different audiences (e.g. asking what they want to know) and developing targeted information and messages as appropriate.

8. Insights from the R-I dialogue in the pre-licensing of other nuclear facilities and activities

This chapter aims to draw some conclusions regarding the R-I dialogue in the pre-licensing of DGRs based on the experience of R-I dialogue in other nuclear facilities, particularly NSDF and decommissioning. In the former, a joint interview was undertaken with ONDRAF/NIRAS and FANC regarding the dialogue during the pre-licensing phase of the disposal facility (i.e. SDF project) to be constructed in Dessel (Belgium). For decommissioning, two countries were interviewed, Italy and the United Kingdom. A joint interview was conducted with SOGIN and ISIN from Italy, whereas in the case of the United Kingdom, a joint interview was conducted with the NDA and BEIS and another with the Environment Agency.

8.1. Dialogue R-I for the near surface disposal facility

8.1.1. R-I dialogue for the SDF in Belgium

In the case of the SDF in Belgium, the design of the facility and the safety assessment work for the licence application took place in parallel with the development of the regulatory framework until 2006. This lack of a complete regulatory framework regarding the steps of the process and the way of reviewing and approving the elements of the safety report posed a major challenge for the R-I dialogue. Generally, the R-I interactions were very different in the two phases related to the decisions taken by the government:

1. Decision in 1998 to dispose of Category A level waste: during this first phase, the interactions were mainly between the implementer, ONDRAF/NIRAS, and the TSO, whereas the role of FANC was limited to follow-up. Despite FANC having been set up by law in 1994, the law entered into force only in 2001 when the corresponding Royal Decree was published. During this transition period, there were only few R-I discussions regarding some radiological safety concepts, as the regulatory requirements and guidance were in development. FANC had to build its own competences during that time and set up specific regulations in the frame of disposal.
2. Decision in 2006 to site the disposal facility in Dessel: after 2006, there was a direct interaction between ONDRAF/NIRAS and FANC based on an agreement on the work programme. Specific objectives and concrete deliverables were jointly defined by both organisations. In this phase, the regulatory elements were clearly defined and structured. From that time onwards, FANC and the TSO have continued to work in synergy. FANC also developed its own R&D programme focusing on safety issues. Developing the R&D programme allowed the regulator to build competences, structure the activities and document the state of knowledge.

The process of structuring the R-I dialogue was long and took several years. It was necessary to have the building blocks (i.e. general approach, general methodology and conceptual elements) before starting to detail each of the elements. Once the general approach was defined, it was possible to define the general design of the facility and the safety function. Having a general agreement on the general approach regarding the safety case is a basic cornerstone in the process.

After the decision in 1998, three local partnerships were created. The partnerships were open to any interested citizen and provided a forum for a critical reflection on the project.

The funds provided to the partnerships allowed them to hire collaborators and experts to review the project. They were established as tools for communication at the local level with ONDRAF/NIRAS. FANC did not actively participate in the meetings but was available to present the regulatory work if requested by local partnerships.

8.1.2. Lesson learnt from the NSDF for the DGR

Some of the lessons learnt from the SDF process in Belgium to be applied to the DGR are:

- It is crucial to have a dedicated regulatory framework as early as possible in the process, recognising that such a framework is by nature evolving.
- It is important to have a general agreement on the safety concept of the facility (e.g. defence-in-depth, optimisation, main safety functions) and its translation in the design of the DGR before launching the safety assessment. This was a major challenge during the SDF process in Belgium.
- The regulator needs to adopt a proactive role regarding public communication and engagement, for better transparency but without promoting the DGR project.
- Transparency regarding the R-I dialogue: the dialogue between the regulator and the implementer during the decision-making process regarding the SDF in Belgium can be characterised as having been closed. With the DGR, a transparency policy will be needed.
- Continuous interaction with different stakeholders, particularly those who were not involved in the SDF Belgian process. For instance, while the SDF process concerned mainly the local level, the DGR will involve the regional, provincial and national levels.

8.2. R-I dialogue for decommissioning

The objective of the interview with Italian and the British representatives was to identify the specificity of the decommissioning projects compared to the DGR projects and more generally the projects dedicated to RW disposal. The comparison was limited and did not make it possible to extract major conclusions, due to the fact that:

- In the case of decommissioning projects, the regulatory process takes place on an existing site and there is no longer the need for a site selection, characterisation and assessment process.
- The concept of dismantling a nuclear installation is much less complex than that of RW disposal and it is the same for the dismantling operations: dismantling of an existing and well-known operating nuclear installation versus constructing a new installation.
- The timescale of the two kinds of projects are quite different: medium-term for decommissioning and long-term for DGR.
- The site (for the installation) already exists compared to a new, non-existent site and, hence, the public concerns are different since, in the first case, the nearby population has already lived with the nuclear installation for some years.

Based on the interviews conducted during this project in the case of decommissioning, two findings are relevant:

1. There is no pre-licensing phase as such for decommissioning. In the case of the United Kingdom, the licence stays with the operator all the way through and when the decision is taken to shut down the nuclear power plant, the operator enters the transition period but the conditions of the licence remain the same.
2. Dialogue is not between the regulator and implementer but between the regulator and operator.

In the case of Italy, there was no interaction between SOGIN and ISIN before the year 2000. When the global decommissioning plan was defined in 2000, SOGIN and ISIN started to have interactions regarding decommissioning during a “transition phase”. The law foresees the need for the regulator and implementer to start dialogue, for example, in case of unclear legal provisions or if there is a need for further details in the application. In this case, there is the possibility to activate the “technical dialogue” (or table for dialogue) between SOGIN and ISIN. In addition, informal dialogue can also occur in order to get the regulator’s opinion from the start during the decommissioning process (as it requires a “step-by-step process” approval).

When there is a dialogue between SOGIN and ISIN, each organisation keeps its own minutes of meetings. The result of this dialogue can be formal letters of observations that are not in the public domain but can be requested by the public.

According to the interviews related to decommissioning conducted in the framework of this project, in the United Kingdom, the dialogue of the regulator (UK Environment Agency) or the operator with the public is not planned in advance. The participatory structures already in place at the local level are the ones requesting the regulator, operator or the organisation in charge of decommissioning to present information in this regard. For instance, in the United Kingdom, each nuclear site has a Site Stakeholder Group, run by the licensee that includes local authorities, trade unions, interested local groups and members of the public. If the site is undergoing decommissioning, there are specific meetings organised to address the related topics. In Italy, the “transparency tables” provided in the law and consisting of local representatives are the spaces to provide information on decommissioning. These transparency tables are managed by local representatives and can be in the format of regional conferences.

In both Italy and the United Kingdom, a recurring theme during the dialogue with communities is how the radioactive waste from the nuclear power plants will be managed.

9. Lessons learnt

This section summarises lessons learnt in relation to the following topics:

1. The regulatory system and the implementation of the DGR project and related pre-licensing process.
2. The R-I dialogue itself.
3. Dialogue with other stakeholders and the public.

The main prerequisites for an effective R-I dialogue in the pre-licensing phase are:

1. Mutual willingness to develop a safe solution for the long-term management of RW.
2. Independence of the regulator from the implementer and the government based on the legal and regulatory framework that should clearly define the roles and responsibilities of the regulator and the implementer. The regulator's independence relies on the legal status, mode of appointment of the regulator's chairperson, attitude and competence. R-I dialogue does not jeopardise the independence of the regulator and does not prevent open and constructive co-operation.
3. Mutual transparency, which involves openness to sharing clear and comprehensive information in an honest and reliable manner, without restrictions. It is particularly important to have early discussion of challenges encountered in the project, unexpected evolutions and uncertainties in order to increase confidence in each other.
4. Mutual confidence, which is gained through early and continuous communication, transparency, honesty, openness and responsiveness. Trust builds gradually with time and through multiple interactions with specialists in particular topics.
5. Knowledge of each other on the organisational and behavioural level to foster a healthy safety culture in both organisations.

If the independence of the regulator from both the implementer and the government is implemented through the legal and regulatory framework, the other prerequisites (mutual transparency, confidence and knowledge of each other) need to be developed throughout the dialogue towards a self-sustaining and cumulative process. The conditions are tightly linked to – and also reinforce – each other. These conditions are also applicable to the dialogue with other stakeholders and the public.

9.1. Lessons learnt in relation to the regulatory system and the implementation of the DGR process

- The regulator starts interaction with the government on the national policy and programme for the management of RW. This initial step is fundamental as it will provide the framework for the development and implementation of the DGR for decades.
- During the initial phases of the DGR process, the regulator should establish regulations and standards, which will only be generic but will be clear and started early enough to avoid misunderstandings and delays. It is advisable that interactions with the implementer start early in order to develop a common understanding of the definition and application of the regulatory framework and to understand each other's expectations.

- The regulator should develop knowledge and independent capabilities to review a potential licence application for a DGR, and with respect to the implementer's activities and technical research, establish clear milestones and feasible interim goals.
- The regulator should not directly contribute to developing the concept and the design of the facility, but should make sure that the implementer fulfils safety requirements.
- The regulator should implement an independent R&D programme to enhance expertise and capabilities to review and conduct independent calculations and compile conclusions on the nuclear safety of the DGR.
- Through R-I dialogue, potential gaps or further clarification can be identified in the regulatory framework and ways to complete them can be defined, in particular, through R&D activities.

9.2. Lessons learnt in relation to the R-I dialogue

- The objective of R-I dialogue in the pre-licensing phase is to pave the way towards a licence application that fulfils regulatory requirements (maintaining the possibility for the competent authority not to grant the licence). For this reason, it is crucial to reach a mutual understanding of the application of the regulatory provisions by the implementer and of the development and implementation of the DGR project by the regulator and their respective expectations. Through R-I dialogue, the regulator should: i) clarify whether the implementer correctly implements the methodology for the assessment of the safety criteria and ii) develop an understanding of the types of information, including limitations and uncertainties in data collection methods, that the implementer will provide in the licence application.
- R-I dialogue should start at the very beginning of the process – or as early as possible – to allow the regulator to communicate the expectations of the regulatory process and the implementer to present the plans and strategies. This dialogue should be continuous and independent of political changes. Both regulator and implementer can jointly identify key principles, objectives and targets to be reached at each step, necessary guidance on the regulatory framework, content of the safety case, etc.
- It is important to define a structured organisation of the R-I dialogue that includes identifying the representatives of both parties, the types of meetings (including public ones), a schedule, potential participants and their background and level of competence, topics to be addressed, etc.
- R-I dialogue often starts as informal interactions and progresses towards more formal interactions through regulatory decisions or close to the authorisation stage, even if discussions continue after authorisation in order to achieve a common understanding. Unofficial dialogue is useful to prepare the formal steps of the licensing process.
- All parties should feel free to speak openly. The freedom of opinion of the regulator neither guarantees acceptance of a submission nor prejudices the final decision for the licensing procedure. The regulator should not make judgements based on preliminary information.

- The regulator and implementer should foster a constructive, non-confrontational and pragmatic atmosphere. However, mechanisms to resolve disagreements must be established, given that consensus is not possible and not necessary in all instances. Potential disagreements between the regulator and the implementer could be solved through informal dialogue (which is less constraining and more flexible) in the search for a better understanding, without compromising safety.
- Distrust or reluctance on both sides to have an open exchange of information and respective questioning may arise if the regulator views this interaction as a challenge to its authority or the implementer views it as a criticism of its technical credibility or integrity. In this case, a self-questioning attitude contributes to open dialogue and openness and is favourable to increasing knowledge and to moving forward. The regulator and implementer staff should be open to the other party's need for further interpretation, clarification, discussion or reconsideration of approaches.
- Receptivity goes with openness, mutual acceptance and respect. The regulator and implementer should be receptive to the other party's concerns. In particular, the implementer should be given the possibility to explain the expectations, constraints and difficulties regarding the DGR programme, even non-safety related (e.g. costs or societal constraints). In a similar vein, responsiveness is also crucial and consists of answering the other party's questions and dealing with any request in a timely manner. The absence of a reply from one of the parties hinders confidence-building.
- It is important to document the contents and outcomes of the R-I dialogue through records of meetings or as part of the information management systems, to avoid an image of secrecy and hindering public confidence.
- R-I dialogue in the pre-licensing process contributes to reaching a common goal, i.e. realising the overarching objective of complying with nuclear safety and radiological protection requirements for a DGR. Thus, the R-I dialogue is effective when both parties agree that the goal of nuclear safety and radiological protection requirements for a DGR is being reached through the continuous process of exchange.
- While there are no predefined criteria to monitor the quality of the R-I dialogue, it is generally recognised that defining these criteria could be helpful for both the regulator and the implementer in order to evaluate the effectiveness of this dialogue as well as to enhance transparency if this assessment is publicly available. Some achievement indicators were mentioned, such as fulfilment of tasks described in meetings or delivery of good quality reports within the estimated time frame. However, they should be completed by indicators more in relation with the dialogue itself as these achievements should be considered as inherent in the licensing process itself.

9.3. Lessons learnt for dialogue with other stakeholders and the public

- Identifying societal concerns and expectations towards the regulator and implementer is the first step to developing an efficient strategy of public engagement. This includes listening to public concerns, understanding these concerns as well as the information needs and, finally, addressing them in an understandable manner. Asking the public how they would like to receive the information and communicating accordingly is part of this lesson. Similarly, the public expects the regulator and the implementer to explain clearly the remaining uncertainties and how they are handled.

- As a prerequisite for dialogue with the public, the roles of the regulator and the implementer must be differentiated and clearly communicated and the independence of the regulator from the implementer must be shown.
- Mutual understanding is required between the regulator, implementer and civil society to guarantee a continuation of the process of establishing a DGR (in terms of dialogue, opinions, regulations, research and development).
- While some level of public engagement is ensured when this is linked to specific milestones in the law, there are other crucial stages for public or stakeholder involvement during the pre-licensing phase, such as raising awareness of the radioactive waste issue, agreeing on the modality of participation or establishing a dialogue on potentially controversial issues.
- Lessons learnt for dialogue, considering the long-term perspective, could be summarised in the need to plan, recognise and record decisions and the rationale behind the decisions, ensuring that these records can be retrieved in the future. It is important to understand the rationale and the historical, socio-political, economic and cultural context driving certain decisions in order to ensure continuity of the decision taken and to justify changes.
- It is important that the regulator and implementer build and structure their own separate procedures of public and stakeholder engagement, taking into consideration the different stakeholder groups (e.g. young generations or associations of local communities through which communication can be channelled).
- While few countries have developed a strategy for public communication in the pre-licensing stage or have publicly accessible documents of the R-I dialogue, there are examples in several countries that might be useful to support an efficient dialogue of the regulator and the implementer with the public. One example is the Licensing Support Network in the United States, where responsible authorities in the licensing process make documents and emails available to all stakeholders. In other countries, the documents of the regulatory authorities include an explanatory text in lay language that is available on the public website.

10. Conclusions

The objective of this report is to provide some lessons learnt for structuring the R-I dialogue in DGR projects during their pre-licensing phase. For the report, pre-licensing is considered to start with the first interaction between the regulator and the implementer and to finish with the official application of the DGR construction licence. This report draws on information collected from regulators and implementers in the countries that responded to the RIDD questionnaire and through interviews. Therefore, the lessons and practices described here are based on a limited set of cases and are neither exhaustive nor exclusive.

This report provides a framework for the effective organisation and management of R-I dialogue. The approach listed below is dependent on the national context (historical, socio-political, economic and cultural) in each country and, therefore, there is a need to be cautious regarding generalisations.

The main conclusions of this report can be summarised as follows:

1. Roles and responsibilities of the regulator and the implementer in dialogue

On the one hand, the roles and responsibilities of the regulator are mainly to provide clear and comprehensive guidance on the regulatory system, establish documented opinions, discuss the preparation of the licence application and the related safety case with transparency and independence and inform the public. On the other hand, the roles and responsibilities of the implementer are to develop a common understanding of the regulatory framework, inform the regulator of the progress of its work and difficulties encountered, be transparent, take into account feedback from the regulator and inform the public.

Expectations of the regulator and implementer in dialogue during the pre-licensing phase are technical and administrative at first, but they are quickly tied to the attitudes and behaviours of the other party. One important reciprocal expectation is transparency, which involves clarity, comprehensiveness and reliability of information including making the regulator aware of the difficulties encountered.

Satisfaction regarding the reciprocal expectations of the regulator and the implementer is important for R-I dialogue and, in addition to transparency and technical or administrative exchanges, reciprocal expectations include competence, openness to the need of knowledge and concerns of the other party, reactivity and anticipation. When transparency is lacking, for example due to limited clarity and comprehensiveness of information provided, dialogue is limited and confidence is difficult to achieve.

2. Goals of the R-I dialogue

The goals of the R-I dialogue in the pre-licensing are mainly to:

1. pave the way towards licence application;
2. develop a common understanding of the regulatory framework, the respective roles, the DGR project and the licensing process;
3. arrive at a mutual understanding of what is needed for the safety case and scope of documentation in order to propose and submit a fit-for-purpose safety case;
4. identify as early as possible potentially problematic topics and issues;
5. develop knowledge and confidence in the capacities and competences of the regulator and the implementer and between each other.

Dialogue is an iterative, self-sustaining process. It can contribute to strengthening the conditions for an effective dialogue and, in turn, as feedback, these conditions make dialogue progress. Beyond the mere one-way exchange of information specified in the licensing process, the goals of the R-I dialogue are implementing the conditions favouring the optimisation of the pre-licensing process (see conditions in conclusion 6 below).

3. Conditions for an effective dialogue

As mentioned above, the goals of the R-I dialogue in the pre-licensing phase are to implement the conditions favouring the optimisation of the pre-licensing process, i.e. easier, richer and more effective back and forth exchanges. The conditions are related to the organisation of the R-I dialogue (e.g. schedule, agenda, relevance and competence of the participants), the clear definition of its topic (and correct definition of the objectives and of the possible problems that might prevent reaching these objectives), quality and comprehensiveness of information provided and solutions considered for the dialogue issues, ways to discuss the dialogue topics and issues and the appropriate attitude of the participants during the dialogue. In summary, these conditions mainly include:

1. providing additional knowledge and understanding of the subjects discussed by the regulator and implementer in their fields of activity and competence;
2. increasing knowledge and understanding both at the organisational and individual levels;
3. showing appropriate attitudes and behaviours.

The third category of conditions belongs to the social and psychological field. Among them, mutual transparency, confidence and understanding are requisites for effective dialogue. The attitudes of the regulator and implementer during the dialogue influence the level of confidence and facilitate transparency.

A collective attitude provides the general “psychological” context and atmosphere of the dialogue. It is promoted by the organisation’s top management, in relation with the values of the organisation such as independence, transparency, objectivity, intellectual honesty or stringency.

The nature of the R-I dialogue seems more or less consistent with the general approach of each country for its regulatory system, depending on whether it is more or less prescriptive. R-I dialogue would be more or less formal, constrained and closed (or open) according to the prescriptive approach of the regulatory system. It is interesting to think about how the regulator reproduces its vision of enforcing the nuclear regulatory system into the R-I dialogue and how the R-I dialogue can lead to an evolution in enforcement and, more generally, in the safety management system.

4. Independence of the regulator from the implementer and the government

The independence of the regulator from the implementer makes it possible to construct R-I dialogue on a sound basis, the decisions of the regulator not being influenced by other stakeholders. Independence is also fundamental for the regulator’s credibility towards the public and for gaining trust.

The independence of the regulator relies on the regulatory framework, the strict definition of the respective roles of the regulator and the implementer, the regulator’s competence, organisation, human and economic resources, and information (in particular about its independent role). Independence stems from the fact that the regulator does not rely on other bodies to fulfil its mission (except a possible TSO). Formal reviews and opinions issued by the regulator can illustrate the independence of the regulator from the implementer and the government.

5. Implementation of the R-I dialogue and types of dialogue

Whether a dialogue is identified as formal or informal, it is important for it to start at the very beginning of the pre-licensing period and progress between the regulator and the implementer. Even if there is no arrangement, it is important to define a structured organisation for the dialogue process, including dialogue with the public, and an agenda with proper communications channels.

Formal dialogue is the standard but informal dialogue is useful, especially at the beginning of the pre-licensing period, when the regulatory framework is not fully established or stabilised and the DGR project is not fully mastered due to uncertainties. The advantage of informal dialogue is that it makes it possible to be freer, less constrained, more spontaneous and flexible than with formal dialogue. This is made possible because it should be less engaging, with reduced consequences for the participants. Informal dialogue allows an exploratory and innovative approach to the resolution of problems.

The dialogue becomes increasingly formal as the project progresses and uncertainties reduce until it is almost fully formal when the application for a licence is made. Many dialogues, considered as informal at the beginning of the dialogue process, become formal insofar as they are organised and their outcome becomes jointly documented by the regulator and the implementer or formally agreed and published. A binding outcome of the R-I dialogue makes the dialogue formal even though it started in an informal manner and is not opened at the preparatory level. When a binding outcome is expected (for regulatory steps, key points, milestones, etc.), the R-I dialogue should be formal.

6. Effectiveness of the dialogue

A dialogue is effective when it allows the regulator and the implementer to reach a common goal, notably compliance with nuclear safety and radiological protection requirements for a DGR. Dialogue is an iterative and self-sustaining process as far as its results constitute feedback for more effective dialogue and fuel it.

Dialogue is a necessary part of the regulatory process but it cannot be purely bureaucratic or informative. Dialogue is more than just a one-way transfer of information and involves back and forth exchanges. The joint answer by the regulator and the implementer to the RIDD questionnaire was considered by some of the respondents as an example of an effective dialogue for both authorities and a particular achievement of the RIDD group.

7. An effective dialogue with the public

Dialogue with the public is recognised to be crucial and should start as early as possible. However, few countries have developed a strategy for public communication in the pre-licensing stage or have publicly accessible documents of the R-I dialogue. In some cases, the regulator and the implementer each have their respective communication plans or strategies.

The R-I dialogue in the long term poses a number of challenges, namely regarding the maintenance of expertise in the responsible authorities, the management of knowledge and the legal, political or institutional changes. In this regard, trying to monitor the quality of R-I dialogue could be helpful for both the regulator and the implementer in order to indicate the effectiveness of this dialogue over time. It could also be used as a tool to enhance transparency if this assessment is publicly available.

8. Topics for future consideration

The report conveys the importance of R-I dialogue in preparing licensing. The results from R-I dialogue in other nuclear facilities investigated in this report (i.e. NSDF and decommissioning) show that they are not easily transferable to DGRs. Therefore, other initiatives aside from RIDD may be well suited to investigate the conditions of effective dialogue for projects other than a DGR (e.g. NSDF, decommissioning, interim and long-term storage, transportation infrastructure development) and for periods beyond the pre-licensing phase.

Within the RIDD initiative, it is relevant to maintain focus on the pre-licensing dialogue phase for DGRs. Topics for further consideration by the RIDD initiative include:

- Establishing a generic roadmap towards licensing that takes into account the following aspects considered in this report:
 - a stepwise approach towards licensing;
 - a common understanding of the needs at each step of the licensing process, the criteria and regulations that will be used, and the level of detail required;
 - a clear definition of the roles and responsibilities of the various actors (e.g. waste management organisations, regulators and TSOs);
 - an approach to ensure the independence of the regulators;
 - outlining the life cycle / feedback loop from the safety case towards regulation and vice versa.
- Exploring the balance between an independent and an involved regulator during the pre-licensing phase for DGRs, including investigating how this balance is perceived by different stakeholders. This topic could be addressed in close collaboration with the RF and FSC.
- Exploring the responsibility and room for manoeuvre of the implementer, taking into account guidance from the regulator and the obligation to optimise the system.
- Continuing the investigation into how to structure an effective R-I dialogue, notably through developing a set of indicators to assess trends in the effectiveness of R-I dialogue and proposing ways to improve these outcomes.

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Annex A. Questionnaire “Building Constructive Dialogue Between Regulators and Implementers During the Pre-Licensing Phase of Deep Geological Repositories Development”

The scope of the 2021 questionnaire covers the so-called pre-licensing period, which is considered to start with the first interaction between the regulator and the implementer and finish with the official application by the implementer of a licence to implement a DGR.

The purpose of this 2021 questionnaire is to go beyond the mere list of good practices and recommendations, which are already known but often remain theoretical.

The aim of the questionnaire is to go deeper in explaining how efficient practices are concretely implemented in countries and how they have succeeded in the R-I dialogue. The expected outcome of the questionnaire is information for guidance in the implementation of efficient R-I dialogue.

The organisations are asked to consider the occasions on which successful R-I dialogue occurred and their significant communication features in order to focus on real experience and concrete facts rather than general principles. In particular, the questionnaire asks, for each reported occasion, to identify the challenges of the R-I dialogue, how they were addressed (communication tools and behaviours used during the dialogue) and solved.

We would be grateful if both the regulatory authority and the implementer could complete the survey to provide a national response (involving the regulator and the implementer) to this questionnaire. For questions five, six and 17a to 19, the answers will be specific to each organisation.

Explanatory note

The survey consists of the five following sections / topics that include 24 questions.

Topic 1 - Defining the framework of the R-I (or stakeholders) dialogue in the process for developing pre-licensing

Pre-licensing of a DGR covers all the stages from the first interaction between the regulator and the implementer to the finalisation of the files for the application by the implementer for a licence (or, where relevant, licences) for implementing a DGR, including the safety case.

Topic 2 - Establishing an informal and/or formal R-I (stakeholders) dialogue during the pre-licensing process

The aim of this section is to report the practice for successful dialogue (based on concrete experience). For questions 13a to 13c, respondents are invited to choose the events in which R-I dialogue was efficient and effective, and present: i) the conditions that enabled an efficient and effective dialogue; ii) how these were implemented inside their organisations and in the interactions between organisations.

The following R-I dialogue occasions are solely examples, given that each country has developed its own approach: discussion on licensing procedures and guides, discussion on national RW management plan, presentation by the implementer of the DGR concept and regulator opinion on it, presentation by the implementer of the approach to site selection and / or selected site (in parallel with interactions /

communications with other stakeholders such as potential host communities), discussion on the contents of the siting file (regulation or guide) including the safety case, presentation by the implementer of the site characterisation and regulator opinion on it, presentation by the implementer of the DGR safety (including environmental protection) options and design and regulator opinion on them, discussion on the contents and data of the file of the licence application (regulation or guide or letter), discussion on the contents and data of the safety case (regulation or guide or letter), etc.

For the conditions of R-I dialogue please consider the relevant parameters of the table in Appendix 1 “Indicative list of parameters or behaviours in the R-I dialogue” together with any other ones specific to your own experience. This table is a synthesis of relevant conditions and parameters for an efficient R-I dialogue already identified in the RIDD document of 18 June 2021 and the 2019 Survey. They are organised in seven themes, including 31 items.

The questionnaire strives to go beyond a mere list of good practices and recommendations and, for this reason, the organisations are urged to show how they concretely implemented these parameters or would implement them. This is the core of the questionnaire and the future report.

In terms of any less successful (or failed) R-I dialogue events, the organisations could also mention what learning has been taken from this – for example what should have been done or improved such that the R-I dialogue could have been successful.

Topic 3 - Time perspective and monitoring the dialogue quality

This section explores the challenges associated with the long time period of the pre-licensing phase and how to monitor and trace the quality of dialogue experienced.

Topic 4 - Dialogue with the public

This section explores the extent to which the R-I dialogue is made transparent to – or extended to – other groups of civil society and how this dialogue with the public has an impact on the R-I dialogue.

SURVEY

Background information

Country:
Name of the organisation/s that you represent:
People participating in answering the questionnaire, positions and email addresses:
Brief description of the status of the geological disposal programme in your country (if new situation from the responses provided in the 2019 survey)
Stage of implementation of the DGR Project, i.e. national HLW management policies, conceptual/generic design, potential sites investigation and selection, site characterisation and confirmation, licence application, licence application review, licensing, others
Decisions taken so far by the regulator(s) at the various stages of the DGR Project (regulations and guides, agreements, opinions...)

Topic 1: Defining the framework of the R-I (or Stakeholders) dialogue in the process for developing pre-licensing

N°	Question
1	What are the roles and responsibilities of the implementer and the regulator(s) during pre-licensing?
2	Is the dialogue in the pre-licensing period framed in a legal/regulatory framework or some other specific arrangement? If so, can you indicate which one/s?
3	What are the main goals of the R-I dialogue in the pre-licensing phase?
4	How would you define the main types of dialogue between the regulator(s) and implementer and the occasions or circumstances under which these are held (e.g. periodic review, exchanges related to specific issues, based on regulations, informal meetings, etc.)? Identify the main types of dialogue and circumstances / occasions of R-I dialogue reported as successful experience
5	What does the implementer expect of the regulator(s) in the pre-licensing phase in terms of establishing a dialogue?
6	What does the regulator(s) expect / require of the implementer in the pre-licensing phase in terms of establishing a dialogue?
7	Are there any other or intermediate bodies that may also interact and facilitate the dialogue between the implementer and the regulator(s) (e.g. TSO)?
1.1	Any other issues that may be of relevance / interest under this topic?

Topic 2: Establishing an informal and/or formal R-I (stakeholders) dialogue during the pre-licensing process

N°	Question
8	When and for which topics are informal dialogues between regulator(s) and implementer considered to be appropriate and helpful?
9	When and why does any of the dialogue between regulator(s) and implementer need to be formal? And for which topic(s)?
10	How, in practice, are the records of – and the transparency surrounding – the dialogue (formal and / or informal) between regulator(s) and implementer ensured?
11	How can the independence of the regulator(s) from the implementer be ensured in practice? What tools and mechanisms are available?
12	How is mutual confidence built between regulator(s) and implementer? Please, provide practical examples.
13a	Which dialogue occasions between regulator(s) and implementer have been considered successful or most significant for efficiency and effectiveness in your country?
13b	For each successful occasion indicated in 13a: how was the R-I dialogue planned and implemented and what were the factors of success? <i>In your answer, please identify concrete factors for successful R-I dialogues and show how your organisation concretely implemented these factors of success. As examples you can consider the relevant parameters of the table in Appendix 1 “Indicative list of parameters or behaviours in the R-I dialogue” and other ones specific to your experience.</i>
13c	Can you provide any advice for implementing a successful R-I dialogue based on your experience?
2.1	Any other issues that may be of interest under this topic.

Topic 3: Time perspective and monitoring the dialogue quality

N°	Question
14	What are the main challenges in terms of R-I dialogue associated with the long-term period of the pre-licensing phase?
15	What approach have you adopted to monitor the quality of the dialogue (i.e. continued effectiveness and efficiency)? What criteria, if any, do you use to monitor or measure the quality of the dialogue?

	<i>In your answer, you can refer to the relevant parameters listed in the table “Indicative list of parameters or behaviours in the R-I dialogue” in Appendix I.</i>
3.1	Any other issues that may be of interest under this topic.

Topic 4: Dialogue with the public

N°	Question
16	What are the crucial stages of public or other stakeholder involvement during the process of pre-licensing?
17a	What are the main challenges for the implementer regarding the ongoing dialogue with regulator(s) when engaging with members of the public and other stakeholders during pre-licensing? How are these challenges addressed in concrete ways?
17b	Is there a strategy for public communication and sharing of information relating to R-I interactions during pre-licensing? If yes, what is the strategy?
18a	Which are the main challenges for the regulator(s) regarding the ongoing dialogue with the implementer when engaging with members of the public and other stakeholders during pre-licensing?
18b	What is the strategy for public communication and sharing of information relating to R-I interactions during pre-licensing?
19	Are the considerations or views of the regulator(s) regarding any documents shared by the implementer publicly available? <i>Note that this might include formal submissions as well as any other information exchange.</i> Are any efforts undertaken to reach out to the public by supplying additional documents in understandable language?
20	How are the expectations and concerns of civil society towards the regulator(s) and implementer identified during Pre-Licensing?
21	Are the expectations, concerns and questions of civil society addressed and if so, how are they addressed?
22	How, in concrete terms, has the dialogue between regulator(s) and implementer affected societal trust in practice? <i>Being recognised that the experience of dialogue might have had a negative impact, depending on the quality of the dialogue – and so to draw out experience whether positive or negative</i>
23	What lessons have you learnt about the R-I dialogue for public engagement based on your experience?
4.1	Any other issues that may be of interest under this topic

Other topics

N°	Question
24	What are, from your point of view, the specificities of DGR pre-licensing versus other nuclear facilities from the point of view of the dialogue between the implementer and the regulator(s)?
5.1	Please note below any observations you may wish to share with us.

Appendix 1. Indicative list of parameters or behaviours in the R-I dialogue

The table below is a synthesis of relevant conditions and parameters for an efficient R-I dialogue (best practices and recommendations) already identified in the 2019 Survey and the RIDD document of 18 June 2021. They are organised in seven themes, including 31 items.

Parameter	Regulator/implementer mode of assessment for each parameter
<p>R-I dialogue organisation</p> <ul style="list-style-type: none"> - Regulator giving guidance on regulatory framework, its application, plans, principle and time schedules - Dialogue structured through legislation/regulatory requirement or arrangement between the regulator and implementer - Formalisation of a guidance on R-I dialogue and update along pre-licensing - Frequent discussions - Governance of the R-I dialogue - Focus on the right level of issues at the right time 	
<p>Organisational issues inside organisations</p> <ul style="list-style-type: none"> - Regulator's independence - Definition of roles/responsibilities and management system (appropriately) - Organisational development - Quality assurance programme - Competence building 	
<p>Efficient dialogue parameters (behaviours)</p> <ul style="list-style-type: none"> - Openness - Regulator prepared and open to discuss - Honesty - Transparency - Communication and transparency in case of discrepancies (mutual confidence) 	
<p>Exchanges clarification</p> <ul style="list-style-type: none"> - Clarity in expectations and requirements - Clarity on how and when regulator comments will be addressed to the implementer over time - Solid and shared grounds - Common understanding - Stepwise approach 	
<p>Dialogue outcomes</p> <ul style="list-style-type: none"> - Documented outcomes from some R-I meetings - Formalisation of the context of the decisions at the early stages - Traceability of exchanges and associated documents 	
<p>Experience feedback and sustainability of the process</p> <ul style="list-style-type: none"> - Structured dialogue that is sustainable and progresses over long timescales - Maintain continuity and coherency of the process over decades - Revisit previous outcomes - Feedback from past successes, failures and misunderstandings in the dialogue - Learning from NEA/RWMC and other related international initiatives 	
<p>Reporting and assessment</p> <ul style="list-style-type: none"> - Measure of the successful implementation of the process through time - Assessment indicators 	
<p>Others</p> <ul style="list-style-type: none"> - Adequate time schedule - Clear milestones and feasible interim goals - Sufficient competency on both sides (<i>See theme 2 above</i>) - Regular update to improve the process 	

Annex B. Stage of DGR implementation per country

Status of Implementation	Pre-licensing	Licensing	Observations
Belgium	x		There is nowadays no national policy established in Belgium for DGR and therefore no selected site. ONDRAF/NIRAS prepared a policy proposal subject to a Strategic Environment Assessment (SEA) and a public consultation procedure in 2020. FANC, in consultation with the TSO Bel V, delivered an advice on this proposal with regard to nuclear safety and security aspects. ONDRAF/NIRAS submitted in April 2021 a modified version of the national policy proposal to the federal government taking into account the results of the SEA procedure and the FANC advice. The modifications strengthen the flexibility of the decision-making process including civil society and public participation during the pre-licensing phase. The federal government asked the advice of FANC on the final proposal and FANC provided a final advice in May 2021. A policy decision is pending at the level of the federal government (as of January 2022).
Canada	x		Preliminary site characterisation activities are being carried out by the NWMO at two potential sites; the current intention is to select a site in 2024 and submit the documentation to trigger the federal review process in 2024. No decisions have been made or are required by the CNSC in the pre-licensing stage. CNSC's formal regulatory oversight begins after a site is selected, once the implementer submits a licence application and an Impact Assessment is completed. Activities that CNSC is conducting in the pre-licensing phase are carried out under the terms of a "special project service arrangement". The service arrangement describes the pre-licensing activities that CNSC may undertake, when available, and also provides a mechanism for the regulator to cost recover for those pre-licensing activities.
Czechia	x		The national policy for radioactive waste and spent fuel management in Czechia was updated and approved by the Czech Government in 2019. The Czech Government approved the proposal to reduce the number of potential sites from 9 to 4 in 2020. The Czech implementer, SURAO, is preparing the site characterisation programme, including deep drilling and update of disposal concept. The selection of final and backup site is estimated in 2030 while the safety assessment of generic disposal concept is expected in 2026.
Finland		x	Construction of the DGR ongoing. Operating licence application submitted in December 2021.

Status of Implementation	Pre-licensing	Licensing	Observations
France	x		<p>Stage of implementation of the DGR Project: For Cigéo (Centre Industriel de stockage GÉologique - Industrial Centre for Geological Disposal), the licensing process, launched in 2020 with the application for a Declaration of Public Convenience and Necessity (DUP), will be followed by several authorisation/permit applications to prepare the previously selected site to host Cigéo.</p> <p>The construction licence application (DAC – Demande d’Autorisation de Construction) for the deep geological repository will be submitted to the regulator (Nuclear Safety Authority, ASN) in the coming months in 2022 (according to the regulation, safety options of the DGR were submitted by Andra in 2006 to the ASN).</p> <p>Decisions taken so far by the regulator(s) at the various stages of the DGR Project (regulations and guides, agreements, opinions...):</p> <p>Safety guide on deep geological repository was published in 1991 and updated in 2008;</p> <p>Several opinions (step-by-step approach) have been issued by the regulator since 1991. One of the major opinions – Feasibility of the deep geological disposal facility in the Callovo-Oxfordian clay formation in Meuse/Haute-Marne – in 2006 was framed by the law of 30 December 1991;</p> <p>The opinion on the safety options file was issued by the regulator in 2017.</p> <p>As soon as ASN receives the licence application file, the regulatory process (opinions, decree...) will be framed by the Environmental Code, notably the Article L.542-10-1.</p>
Germany	x		<p>The site selection process, according to the Site Selection Act, is in progress aiming at selecting a site by 2031. The site selection procedure consists of three phases: phase 1 (current) – siting regions for surface-based exploration; phase 2 – at least two sites for subsurface exploration chosen and phase 3 – the site of best possible safety will be identified and determined by national law.</p>
Japan	x		<p>The government revised the Basic Policy on the Final Disposal of the Specified Radioactive Waste in May 2015. The Final Disposal Act promulgated in 2000 specifies a staged siting process to select a site for geological disposal facility through the steps of literature survey, Preliminary Investigation and Detailed Investigation in the pre-licensing phase. The Nuclear Waste Management Organization of Japan (NUMO) was established in 2000 and initiated the siting process for disposal of high-level waste (HLW) by open solicitation of volunteer municipalities in 2002. The final decision to go forward to the next step is made by the Minister of the Ministry of Economy, Trade and Industry (METI) by asking the opinions of the Mayor of local government and the Governor of the Prefecture. In November 2020, NUMO started literature survey at Suttu Town and Kamoenai Village in Hokkaido prefecture.</p> <p>According to the 2015 Basic Policy, the Nuclear Regulation Authority (NRA) will identify important issues to be addressed for each step of the site selection from the viewpoint of its pre-licensing regulatory involvement.</p>

Status of Implementation	Pre-licensing	Licensing	Observations
Korea	x		<p>The 2nd HLW management basic plan was established in December 2021 in accordance with Article 6 of the 'Radioactive Waste Management Act' to present principles, roadmaps and tasks for the HLW management policy. This plan was established in consideration of the recommendations of the Review Committee set up to review the management policies such as the 1st basic plan from 2016, including the gathering of opinions from interested parties, and the opinions of experts through the operation of the Working Group, as well as the results of solicitation of public opinions such as debates. This plan includes basic policies for radioactive waste management, facility plans such as site selection, and investment plans. In principle, the final disposal facility and the interim storage facility will be constructed at the same site, but it will take 13 years from the establishment of the site selection investigation plan to the securing of the site. An objective and transparent site selection procedure and method will be prepared and announced in advance, and the results of stage-by-stage site investigation and evaluation will be transparently disclosed to enhance public trust. The generic URL for research will be constructed separately, which will be used to secure empirical data and a disposal system for site selection, design, construction and operation of the disposal facility.</p> <p>The project for final disposal is expected to take 7 years from site selection to construction of the interim storage facility, and construction and empirical research for the site-specific URL will begin within approximately 14 years after the site is secured; the final disposal facility will be constructed within about 10 years after the completion of the research.</p> <p>It is planned to secure a final disposal facility within 37 years after the site selection procedure.</p> <p>The government plans to establish a basic plan every five years with a planning period of the next 30 years, and the management agency plans to establish and implement an implementation plan every year according to the basic plan.</p>
Spain			<p>An update of the dates regarding the implementation of the DGR programme is included in the draft of the 7th Radioactive Waste National Plan. A working group on DGR with representatives from the Ministry of Ecological Transition and Demographic Challenge (MITERD), CSN and Enresa has been established to create a roadmap for the implementation of a DGR programme in Spain, including the development of the regulatory framework.</p>

Status of Implementation	Pre-licensing	Licensing	Observations
Switzerland	x		The implementer submitted an update of the national disposal programme (EP2021) at the end of 2021. The site selection process for geological repositories has entered its final phase. The implementer is convinced to have carried out the necessary field work and expects to present its choice for repository sites by the end of 2022. The application for a general licence will follow by the end of 2024. The regulator has reviewed the safety cases for stage 1 (identification of possible sites) and 2 (reducing the number of possible sites to three) of the sectoral plan. The licence application will be also reviewed by ENSI, followed by a broad public consultation. It is expected that the federal government will make its decision known by the end of 2029.
Russia	x		According to legal provisions, siting phase is seen as the first stage in the development of radioactive waste disposal facilities in Russia. Several regulatory bodies are to a different degree involved in the review of materials validating the choice of a DGR site and the feasibility of construction.
United Kingdom	x		UK Policy for the management of HLW was updated in December 2018. RWM Ltd is currently carrying out generic preparatory work and searching for a willing community to host a DGR. No regulatory decisions have been made by the regulatory authorities. There is a project underway to update the 2019 guidance on Requirements for Authorisation (Geological Disposal Facilities on Land for Solid Radioactive Wastes).
United States		x	<p>The licence application for the DGR at Yucca Mountain was submitted in June 2008 and the review was underway, but was suspended in 2011 due to the termination of funding for the project by the government. The NRC staff published the safety evaluation report in 2015.</p> <p>Waste Isolation Pilot Plant (WIPP) has been receiving and emplacing transuranic radioactive waste from national defence activities since March 1999. Pre-licensing activities were conducted in the 1990s. EPA certified WIPP in 1998 and is nearing completion of the fourth recertification review. The Department of Energy is required to submit a recertification application to EPA every 5 after the start of operations. The current Compliance Recertification Application was submitted in March 2019 and supplemented in December 2019. With the need to recertify WIPP every 5 years, there is a process of R-I dialogue between recertification decisions that is similar to pre-licensing discussions, though the focus is on changes over each 5-year period in operations, science and/or understanding of future disposal needs and requirements.</p>

Annex C. Correspondence between topics of the present report and questions of the questionnaire

The following table shows the correspondence between the topics identified in the report, the topics contained in the questionnaire and the groups of topics addressed by the RIDD first plenary meeting (13-14 April 2021). The logic behind the succession of the topics of the report is described below.

Topic 1: The **roles and responsibilities** (Q1 of the questionnaire) of the regulator and implementer are addressed at the very beginning when establishing the regulatory framework leading to the regulatory system.

Topic 2: The R-I dialogue is aimed at achieving **objectives or goals** (Q3) that, once reached, contribute to the realisation of the overarching objective of the regulatory process: achievement of the nuclear safety and radiological protection requirements. In relation to these common objectives, the regulator and the implementer have their own objectives and related expectations in the R-I dialogue (Q5 and Q6).

Topic 3: The **framework of the R-I dialogue** should be adapted to its objectives. The framework of the R-I dialogue can be completed by arrangements between the regulator and the implementer (Q2). The implementation of the R-I dialogue calls for various types of dialogues (Q4) that should be adapted or created all along the regulatory process.

Topic 4: The identification of the **conditions of an effective R-I dialogue** is the last topic and the core of the report dedicated to the R-I dialogue.

For those questions that are not immediately associated with one of the specific topics mentioned above, the answers are integrated into new topics, as follows:

Question 11 relates to the independence of the regulator and **question 7** relates to intermediate bodies:

When the respondents considered Q1 (“roles and responsibilities of the regulator and the implementer”), some mentioned already the “independence” of the regulator addressed also in question 11 of topic 2. Thus, the questions 1 and 11 could be linked to **topic 1** of the report (see table below).

Moreover, question 7 (“intermediate bodies”) can be also addressed as part of that topic, as a number of answers considered that the intermediate bodies could help the regulator and the implementer to be in compliance with their responsibilities under two fundamental and basic domains that are respectively “DGR Regulations” and “DGR Project development”.

Question 10 about dialogue, records and transparency:

As a number of answers to questions 4, 8 and 9 about the various types of dialogue also presented in which way the dialogue and its outcome were documented and published, we can consider that the question 10 (“records and transparency”) also belongs to **topic 2** of the Report.

Question 12 about mutual confidence:

The efficiency of the R-I dialogue is the core of the questionnaire with the question 13 made of 3 sub questions (13 a to c) about efficiency, to which we can add question 12 about mutual confidence between the regulator and the implementer, which is a condition of an effective dialogue. Questions 12 and 13 of topic 2 belong to **topic 4** of the report.

Groups of topics of interests discussed during the 1 st RIDD Plenary meeting (April 2021)	Topics of the questionnaire	Topics of the report	Main topic of the questions of the questionnaire
1. Main goal of the pre-licensing: Defining the consequent process for developing the safety case and its review	1. Defining the framework of the R-I dialogue (Q1 to 7)	1. Roles and responsibilities of the regulator and implementer in the R-I dialogue	1. Roles and responsibilities of the regulator and implementer. 7. Interaction with other and intermediate bodies.
		2. Objectives and expectations regarding the R-I dialogue	3. Goals of the R-I dialogue. 5. Implementer expectations of the regulator. 6. Regulator expectations of the implementer.
		3. Structure and Implementation of the R-I dialogue	2. Existence of legal / regulatory basis or arrangements as a framework for the R-I dialogue. 4. Main types of R-I dialogue.
2. Establishing an informal and/or formal pre-licensing process	2. Establishing an informal and formal R-I dialogue (Q8 to 13)	4. Conditions for an efficient dialogue	8. Interest of informal R-I dialogue. 9. Need for formal R-I dialogue. 10. Records and transparency. 11. Independence of the regulator from the implementer. 12. Building mutual confidence between the regulator and implementer. 13a. Successful dialogue occasions of dialogue waiting for concrete cases. 13b. Planning and implementation of successful dialogue occasions and factors of success. 13c. Advice for implementing a successful R-I dialogue. 14. Main challenges in terms of R-I dialogue associated with the long-term period. 15. Monitoring and measurement of the quality of the dialogue.
		5. Dialogue with other stakeholders and the public	13a. Successful dialogue occasions of dialogue waiting for concrete cases.
3. Time perspective and monitoring the dialogue quality	3. Time perspective and monitoring of the dialogue quality (Q14 & 15)	5. Dialogue with the public	16. Crucial stages of public or other stakeholder involvement. 17. Main challenges for the implementer regarding the ongoing R-I dialogue when engaging with members of the public and other stakeholders. 18. Strategy for public communication and sharing information relating to R-I interactions. 19. Availability to the public of the regulator's considerations or views regarding documents submitted by the implementer. 20. Expectations and concerns of the civil society towards the regulator and implementer. 21. Are they addressed (including questions) and, if so, how? 22. Affection (effects) of the societal trust by the R-I dialogue. 23. Lessons learnt about R-I dialogue for public engagement. 14. Main challenges in terms of R-I dialogue associated with the long-term period.
4. Lessons learnt			

Annex D. Types of dialogue per country

Official R-I dialogue origin		R-I dialogue categories		
Legal / regulatory basis	Arrangements	Periodic or regular	Ad-hoc or as needed	Informal R-I dialogue
Belgium				
Law frames the dialogue between the regulatory body and the implementer during the pre-licensing period.	R-I dialogue is implemented in practice through a "Co-operation agreement" between the regulatory body and the implementer establishing a work programme on a three-year basis. "Convergence notes" are established in the work programme guiding the R-I interactions during pre-licensing. They consist of good practices to develop common views on fundamental safety principles and concepts to be applied to DGR.	<ul style="list-style-type: none"> - Regular interactions framed in the "Co-operation agreement" and planned in the work programme. These interactions aim at reviewing pre-licensing reports (e.g. safety strategy, biosphere model, etc.) and/or new technical guides (e.g. safety analysis requirements) - Periodic consultation meetings with the respective boards of Directors in order to assess the "Co-operation agreement" - Periodic meetings throughout all the topics (i.e. addenda) - Periodic meetings to comply with international commitments such as the Joint Convention reports or 2011/70/Euratom National Reports. 	<ul style="list-style-type: none"> - Topical interactions initially planned or not in the work programme in order to draft agreements such as "notes de convergence" on dedicated topics (e.g. optimisation, reversibility and retrievability, monitoring) - Ad-hoc meetings related to important milestones in the decision-making process such as a national policy proposal, SEA (), etc. - Ad-hoc meetings related to international studies requiring common / shared views at a national level. 	<p>"Informal" interactions are understood as a preparatory, documented step to formal procedures and/or decisions.</p> <p>Early (informal) interactions are important to communicate:</p> <ul style="list-style-type: none"> - Expectations of the regulatory body to the implementer and exchange on the information that may be used in the safety case - Objectives and targets to be reached at each step enabling to go forward to the next step, the safety strategy, the management system, the methodological approaches to assess operational and post-closure safety and the content of the safety cases. <p>Informal interactions should take place as early as possible in the disposal programme.</p>
Canada				
During the pre-licensing stage, while site selection is still ongoing, there is no regulatory requirement for R / I dialogue. Pre-licensing interactions are defined through a special project service arrangement under the Nuclear Safety and Control Act. The R-I service arrangement is posted on the regulator's website.	The special project service arrangement defines interactions (exchange of information (correspondence) and meetings) between the regulator and the implementer, provides their main mechanism and that agreement is published. Communication between the implementer and the regulator staff is controlled using the single point of contact (SPOC) approach. The person communicating the message is responsible for the content and quality of the information in the message as representations of the implementer or the regulator. There are four types of meetings defined in the service arrangement:	<ol style="list-style-type: none"> 1) Interface meetings: the designated single points of contact for regulator and implementer meet monthly to provide status updates or highlight any potential major issues. 2) Quarterly progress meetings: these meetings include director-level staff, and are held to discuss overall progress on the implementer activities and review status of actions. 3) Annual planning meetings: these meeting include senior management, and are held to review the implementer's business plan for the upcoming year as well as a 4-year look ahead. These meetings include the regulator's pre-project reviews that the implementer intends to 	<ol style="list-style-type: none"> 4) Update meetings on topic specific activities: on an annual basis, the regulator and the implementer plan topical update meetings on implementer's activities as their work on the project progresses. The purpose of these meetings is to familiarise the regulator staff with advancements in the programmes. 	

Official R-I dialogue origin			R-I dialogue categories	
Legal / regulatory basis	Arrangements	Periodic or regular	Ad-hoc or as needed	Informal R-I dialogue
	monthly interface meetings through the SPOC; update meetings on topic specific activities on an annual basis; quarterly progress meetings; and annual planning meetings.	request for resource planning purposes.		
Czechia				
No formal regulation is available.	A Memorandum of Understanding between the regulator and the implementer was signed on co-operation in the field of DGR development, which defines the general framework of co-operation of both institutions necessary for successful DGR development, in particular the selection of DGR site.	The dialogue is based on regular meetings (1-2/year) where the mutual topics are being discussed.		Interaction via informal technical meetings and involvement of the regulator in an observatory role in specific working and expert groups.
Finland				
Legal framework required three-year R&D plan to be submitted for regulatory review.	The regulator made a decision after decision-in-principle (2001) that established main elements of pre-licence dialogue. Main elements of arrangements: See categories of dialogue.	1) The implementer prepared draft safety case parts and the regulator performed regulatory review – findings were provided officially and addressed in several meetings. 2) The regulator maintained so-called issue lists, that contained topics the regulator had raised in reviews. Evolution in these were followed. 3) Three-year R&D plan review and decisions by the Ministry on Economic Affairs and Employment (MEAE) was a mechanism from legislation.	4) Updates of regulations and related consultation.	Regular <u>formal</u> and informal meetings enable issues to be clarified. In <u>informal dialogue, views and thinking are also shared, but in some occasions argued positions need to be established</u> : the outcome of the R-I dialogue is traced through meeting minutes that, together with draft reports, are recorded on an internal knowledge management system.
France				
The dialogue between the implementer and the regulator is both framed in a legal/regulatory framework (formal dialogue) and specific arrangement (informal dialogue). - Formal exchanges The formal exchanges correspond to a formal dossier (file) at each key milestone of the development of the project. The dossier is formally submitted to the regulator by the implementer and a subsequent review of this dossier on behalf the		- Informal exchanges Between formal exchanges, specific exchanges are organised towards milestones: for instance, content of regulatory guides, methods (such as safety analyses), technical topics and documents (such as the contents of the dossier for the licence application). Some dialogues are organised between the implementer and regulator, some of them with the regulator's TSO and some with the Ministry of Energy.		All the occasions and circumstances contribute to a successful R-I dialogue. Informal meetings, involving relevant experts, are often key to allowing a better (and quicker) resolution of specific technical issues.

Official R-I dialogue origin		R-I dialogue categories		
Legal / regulatory basis	Arrangements	Periodic or regular	Ad-hoc or as needed	Informal R-I dialogue
regulator is implemented. Some intermediate formal dossiers were also submitted to the regulator based on preliminary exchanges to prepare the licence application. All dossiers that were submitted to the regulator and the results of their reviews are available both on the implementer and regulator websites.				
Germany				
The dialogue is anchored in the Site Selection Act (StandAG) vis-à-vis BASE (previously BfE), which is responsible for legal supervision in this phase. In addition, BASE is responsible for public participation. BASE examines the implementer proposal for the "areas to be further explored" and forwards it to the BMU, including all consultation and participation results and a justified recommendation.	In the pre-permitting phase of granting of permits for surface and underground exploration by "Länder" (state) authorities, a dialogue with them is a future task in the framework of site-related exploration programmes, establishing a dialogue concept with the Land Authorities as the regulators of this sub-pre-licensing-phase. Apart from these formal steps, no specific arrangements are made within the legal or regulatory framework. However, an agreement exists on co-operation in the site selection between BASE (previously BfE) and the implementer, which foresees the establishment of a formal dialogue.	Two main types of dialogue exist: 1) A formal dialogue (so-called Supervisory Status Meetings) is conducted periodically according to a given structure. The upper management is involved. Fundamental questions are discussed. Issues are tracked. Project milestones are monitored. Commitments are documented in the meeting notes and published. The implementer provides quarterly status reports in order to inform BASE on the progress of the implementer's work.		2) An informal dialogue is conducted at a technical level. It serves the mutual scientific and technical exchange about open questions. No commitments are made. Basic information about the meeting is documented in the notes but not the content of the meeting. The meeting notes are publicly available on request. Informal dialogue is appropriate and helpful in: - discussing emerging scientific-technical questions in detail - improving communication, co-operation issues or resolving misunderstandings - establishing common interpretation of guidelines and regulations - open discussion of open questions, uncertainties, knowledge gaps and doubts is practised - treatment of ideas and positions that are not yet elaborated but worth discussing. In informal dialogue, basic information is recorded, but not the content of the meeting. The records are available on request.
Japan				
	There are no arrangements or legal/regulatory frameworks for dialogue at the current pre-licensing stage.		The implementer has so far been invited officially twice to the LLW I-R dialogue where it expressed its opinion concerning the common regulatory issues	"Informal dialogue" could only be realised as discussions in such situations where the experts of implementer and regulators occasionally both

Official R-I dialogue origin		R-I dialogue categories		
Legal / regulatory basis	Arrangements	Periodic or regular	Ad-hoc or as needed	Informal R-I dialogue
			to LLW near-surface and deep geological disposals: for institutional control to avoid human intrusion and for the safety assessment method. These dialogues were held fully open for anyone who would like to attend as part of the audience, physically or via video streaming service.	participate in open symposia, conferences, workshops and meetings. The discussions are however not purpose-oriented and without clearly defined goals. Common understanding is developed in the informal dialogues.
Korea				
There is no specific regulation regarding dialogue in pre-licensing on the legal/regulatory framework	Regarding the R-I dialogue in the pre-licensing period, the goals, objectives, topics and methodology have not been discussed so far due to the initial stage of developing DGR. However, the R-I dialogue in the pre-licensing period is considered to be essential even in the early stage of developing DGR, so we are considering the R-I dialogue on the regulatory framework to be established in the future.			
Russia				
The co-ordination procedure is specified under regulatory provisions governing the following aspects: the procedure for the submission of "thematic" issues, information exchange between regulator and implementer as well as implementer and regulator opportunities for presenting some additional arguments and arranging for some additional time needed to elaborate them.	The procedure provides for both personal interaction (regulatory on-site inspections) and off-site expert reviews of documents submitted by the applicant. Each stage of a review involves discussions of emerging issues and submittal of additional information required. Based on the discussion of a licence application, the questions posed by the regulator can be clarified and validated; it also allows for the interpretation of research results and calculations.			
Spain				
There is no legal provision for dialogue in the pre-licensing period. Nevertheless, dialogue among different stakeholders has occurred; a DGR working group, for instance, has been set up by three parties.	There are four types of dialogue at different levels: periodic high-level meetings between the regulator and the implementer; ad-hoc working groups; project meetings; technical meetings. Example of successful experience in Spain: The Centralized Interim Storage project for High	Although the questionnaire has not defined what is a Formal Meeting, we have considered as a formal meeting those which were documented (signed notes of the meeting, including possible agreements). These formal meetings are not necessarily publicly available. 1) Periodic high-level meetings between the	2) Ad-hoc working groups are formed to tackle generic issues in different licences or applications. These are formal meetings. 4) Technical meetings to solve/clarify specific technical issues in licences or applications. These are generally formal meetings.	3) Project meetings to solve issues in specific licences or applications. These include project follow-up meetings. These are generally informal meetings but there are common records of agreed actions (use of excel files or SharePoint).

Official R-I dialogue origin		R-I dialogue categories		
Legal / regulatory basis	Arrangements	Periodic or regular	Ad-hoc or as needed	Informal R-I dialogue
	Level Waste and Spent Fuel (ATC project).	regulator and the implementer to comment on upcoming activities, relevant issues and licensing processes (application dates, significant milestones, etc.) These are formal meetings occurring at least twice per year.		
Switzerland				
In a position paper, "Supervision of Deep Geological Repositories", the Board and Executive Board of the regulator express their opinions on, among other things, the division of roles between the regulator and those subject to the supervision. In particular, the position paper deals with the attribution of roles between the regulator and the waste producers as well as communication with the stakeholders.	Interaction with stakeholders: the regulator receives safety questions from all stakeholders at an early stage. The regulator brings its conclusions to the relevant issues into the set of rules, into its reports and statements as well as into the safety-related dialogue with its stakeholders.	R-I dialogue takes place approximately once a month. These meetings are documented (scope / decisions) and available under the freedom of information act.	In addition, specific technical questions are discussed among the R-I experts. All meetings are documented. During the review process, the regulator asks questions. These regulatory questions and the implementer's answers are collected in a report and published. The answers listed are the result of the technical discussions between the regulator and the implementer, during which the answers were specified and discussed in an iterative process until all ambiguities were resolved. In some cases, the answers led to follow-up questions.	
United Kingdom				
The Environment Agency ("regulator 1") has no formal regulatory decision-making role until the start of intrusive site investigations (e.g. site investigation boreholes). However, Section 37 of the Environment Act 1995 allows the Environment Agency to provide advice and to charge for that advice.	The Environment Agency has set up a voluntary agreement (legal agreement) with the implementer to provide pre-application regulatory advice and also to support interested communities on regulatory matters. The Environment Agency manages a joint programme of work with the Office of Nuclear Regulation ("regulator 2") and the implementer to provide regulatory oversight of the implementer and also to advise and support communities. An annual work plan is agreed upon and standard project arrangements ensure the plan is delivered to time, quality and cost. Within the programme	Some dialogue is regular and some occurs as and when required by the agreed work plan. Topics covered range from policy and strategic matters and major organisational issues over longer time frames to detailed technical issues or specific aspects of regulations. The Environment Agency provides feedback to the implementer for matters important for regulatory decision making: regulatory issues, regulatory observations (both recorded by the regulators and responses tracked); and recommendations (recorded and tracked by the implementer and responses available to the regulators).		

Official R-I dialogue origin		R-I dialogue categories		
Legal / regulatory basis	Arrangements	Periodic or regular	Ad-hoc or as needed	Informal R-I dialogue
	there is a structured framework for engaging with the implementer at a range of levels from senior leadership to detailed technical.			
United States				
Under the Nuclear Waste Policy Act, the Site Characterisation activities of the implementer, the Department of Energy (DOE), are subject to certain requirements: for example, keeping the State and the regulator, the Nuclear Regulatory Commission (NRC) informed of the information collected with reports every six months. EPA (Environmental Protection Agency), regulator of the WIPP, Waste Isolation Pilot Plant, in operation: The pre-licensing period for WIPP was not formally defined. The pre-licensing period ended after the submission of the original application to EPA when the Agency formally started the review. There was also a pause in informal interactions when EPA proposed the compliance criteria implementing regulations for WIPP and EPA entered its formal rulemaking process.	The NRC, the regulator of the Yucca Mountain disposal facility (in the licensing process) and the Department of Energy (DOE, the implementer) have a formal agreement for interactions (such as technical exchanges and quarterly management meetings) during the pre-licensing period that included requirements for the meetings to be held in public and the documentation of agreements reached during the meetings.	NRC: NRC and DOE used a formal process for conducting technical exchanges and management meetings that were held on a quarterly basis and open to the public. EPA: Informal and formal interactions with staff; same with management. EPA staff used the pre-licensing period for WIPP to develop a robust understanding of the details of the performance assessment, site characterisation and parameter development process. EPA and DOE used a technical exchange process whereby the DOE technical support organisation for performance assessment would formally brief EPA staff on different topics. These technical exchanges were open to the public. Clarifications on regulatory criteria/requirements and expectations on the format and information to be provided in the licensing application were conveyed in writing – letters and guidance documents that were in the public record.	NRC: The technical exchanges covered a variety of topics and were held on an as-needed basis that included discussion of the regulatory requirements or specific technical topics. During the technical exchanges, the NRC and DOE frequently would make separate presentations, based on their independent evaluations, on the results of overall performance assessments for post-closure safety. However, when issues did arise, they could be raised at the quarterly management meetings for resolution.	EPA: Informal interactions are effective in the pre-licensing period for defining technical issues and areas in need of additional work on the part of the implementer or additional clarification/guidance on the part of the regulator. Clarity and understanding of: process, roles, requirements, needs and expectations, in writing or through informal exchange / conversations. In the pre-licensing phase, as few requirements restrict the form and frequency of interaction, this allows significant freedom to explore issues more informally and efficiently, and to define information exchange platforms that support open exchange, offer more flexibility and ease of communication between both parties. It is nevertheless important to maintain transparency as much as possible, choosing to place documentation on the public record and to clearly document conclusions that are reached.