



## **Deliverable 1.16: Evaluation of the experimental model of interaction between EURAD participants and Civil Society**

Work Package 1, task 8.3

Programme Management Office (PMO)

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## Executive Summary

This deliverable presents an Evaluation of the activities of Interactions with Civil Society (ICS) in EURAD. In accordance with the perspective of the Aarhus Convention that grounds the CS participation, ICS activities are expected to produce Fruitful Interactions among the different categories of actors involved in EURAD, with a view to contribute to enhancing decisions on safety of Radioactive Waste Management. The document provides a description of the innovative methodology that has been designed for the purpose of evaluating EURAD ICS activities in this perspective, the evaluations of selected events that are considered representative enough of the whole process, and reflexive elements on the method stemming from this evaluation.

The evaluation of the experimental model of ICS relies on evaluations of several specific events organised in the frame of ICS. These evaluations are based on a grid of nine key elements, selected and developed with a pluralistic methodology detailed in deliverable D1.14 “Mid-term evaluation of the ICS activities and experimental model of interaction between EURAD participants and Civil Society”<sup>1</sup>: Legitimacy, Methodology, Postural changes, Personal unity, Expertise function, Meaning of the repository, Territory, Shared complexity, and Addressing the long term.

One main transversal conclusion of these evaluations is the importance of trust among members. This growing trust was possible to grasp since the evaluation process happened all along the EURAD programme and thanks to an adequate evaluation methodology. The constitution of stronger links between members, the better understanding of each other, and the creation of common frameworks help build more fruitful interactions between experts and civil society.

This document also concludes on the crucial role of the participative tools for ICS such as the PEP, on the enlightening perspective given by the dynamism of uncertainty management, and on the importance of creating and keeping a community in the long-term to improve understandings and interactions.

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<sup>1</sup> Geisler-Roblin A., Lavelle S. (2022): Mid-term evaluation of the ICS activities and experimental model of interaction between EURAD participants and Civil Society. Final version as of 10.10.2022 of deliverable D1.14 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

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## Acronyms

CS	Civil Society
EC	European Commission
EURAD	European Joint Programme on Radioactive Waste Management
FSC	Forum on Stakeholder Conference, established by Nuclear Energy Agency
GD	Geological Disposal
GDF	Geological Disposal Facility
ICS	Interactions with Civil Society
IGSC	Integration Group for the Safety Case, the main technical advisory body to the Radioactive Waste Management Committee of the Nuclear Energy Agency
IRSN	“Institut de Radioprotection et de Sûreté Nucléaire”, public expertise body in France in charge of radioprotection and nuclear safety
JOPRAD	Joint Programming on Radioactive Waste Disposal
KM	Knowledge Management
LTS/RS	Long-Term Stewardship/Rolling Stewardship
MS	Member State
NGO	Non-Governmental Organisation(s)
NTW	Nuclear Transparency Watch
PEP	Pathway Evaluation Process
PMO	Project Management Office
RD&D	Research, Development and Demonstration
RE	Research Entity
RW	Radioactive Waste
RWM	Radioactive Waste Management
SITEX-II	Sustainable network for Independent Technical Expertise of Radioactive Waste Disposal – Interactions and Implementation
T&PP	Transparency and Public Participation
TSO	Technical Safety Organisation
UMAN	Uncertainty Management multi-Actor Network
WMO	Waste Management Organisation
WG	Working Group
WP	Work Package

## Introduction

Interactions with Civil Society (ICS) were a key component of the EURAD program. These interactions were innovative, for they were done within a R&D program, i.e. in the making of science and not after. As these interactions were an experimental process, it was foreseen in the preparation of the EURAD programme to implement a dedicated evaluation of this ICS process along the programme. This document presents both the method and the results of these evaluations of the experimental process of interactions with civil society.

Having interactions with civil society was considered crucial for many reasons. Not only this importance is grounded in a legal requirement, the UNECE Aarhus Convention<sup>2</sup>, which reinforces the requirement of public access to information and participation in decision-making when it comes to environmental matters, but also in an epistemic and moral stance which supports the following statement : participation of civil society in the Radioactive waste management field improves the global understanding of the activities and helps them make sense in a “global picture”, and thus enhances safety. Moreover, the presence of civil society in such a research program is expected to have an impact on decision-making processes at national levels via CS members, and to improve the interactions between the three EURAD colleges (WMOs, TSOs, REs).

These reasons led to the creation of the experimental model of ICS in EURAD called the “double-wing” model. The goal of the double-wing model was also to ensure that, given the scientific and technical dimensions of the issues at stake in EURAD, the civil society participants were comprehensively documented so that they could form their own views on the R&D performed.

The two “wings” of this model are two categories of CS participants involved in the EURAD process: the Civil Society larger group, on the one hand, the Civil Society experts group, on the other hand. The following figure illustrates the functioning of the double wing model in EURAD:

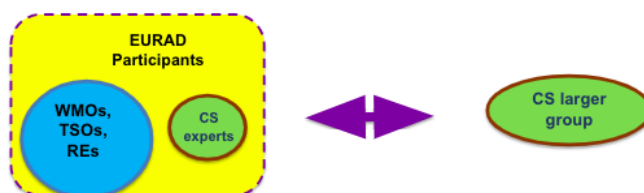


Figure 1 – Double-Wing model of interactions with Civil Society in EURAD

*The double wing model involved two categories of CS participants: the Civil Society larger group, on the one hand, the Civil Society experts group, on the other hand.*

The CS larger group involved on a voluntary basis, local, national and European representatives from the civil society that had a specific interest in RWM, to have the opportunity to bring their views and exchange with EURAD participants (WMOs, TSOs, REs) along the programme through the CS experts group. This group was informed on a regular basis and participated yearly to a dedicated workshop involving a panel of the different colleges of EURAD participants and even more often to specific events related to ICS.

<sup>2</sup> UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters - Aarhus Convention (1998). Link : <https://unece.org/environment-policy/public-participation/aarhus-convention/text>

## EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

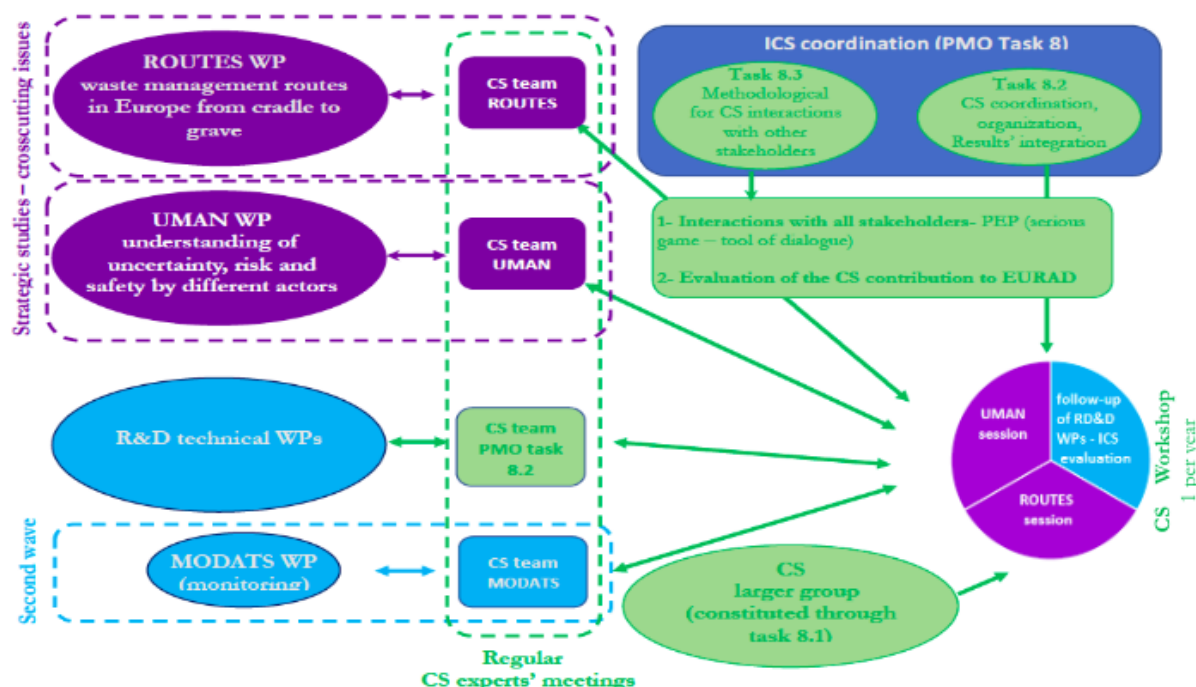
The procedure of invitation and selection of the members and the list of the 22 persons that composed the group is detailed in D1.13 “List of members of the Civil Society group”<sup>3</sup>. At the end of this process, the group had an equilibrium between representatives coming from Western and Eastern countries, a quite well-balanced gender representativity (9 Women and 13 Men), a good repartition between the categories of involved stakeholders (12 individual or/and local stakeholders and 10 national or/and European associations). 15 countries were represented in the CS larger group: Belgium, France, Germany, Italy, Norway, Sweden, United Kingdom, Bosnia and Herzegovina, Bulgaria, Czech Republic, Hungary, Poland, Slovakia, Slovenia, Ukraine.

The CS experts group was an intermediary between the EURAD participants as a whole and the CS larger group. It was involved in a selected number of activities of EURAD (strategic studies and technical WPs), in order to contribute to the work done by giving inputs from CS and to inform the CS larger group on the progress of this work. The CS experts group was composed of representatives of civil society having expertise in the RWM field, and were involved in EURAD through Nuclear Transparency Watch. Further details about the constitution of these two CS groups can be found in deliverable D1.13.

ICS activities were implemented in two strategic studies: ROUTES WP dealing with waste management routes in Europe from cradle to grave and UMAN WP dealing with understanding of uncertainty, risk and safety by different types of actors. CS experts also followed the results of R&D technical WPs in a generic way. After 2 years, one CS expert team was directly included in one R&D project, MODATS, that was dedicated to monitoring data. ICS activities also created links between WPs notably between the technical WP CORI and the strategic study UMAN with the implementation of the ICS-CORI-UMAN process.

During the five years of EURAD, an ICS workshop was implemented each year in order to present the results of the work done by the CS experts in the WPs and to collect views from the members of the CS larger group on these results.

The ways CS members interacted with the different activities of EURAD (through the implementation of the double wing model presented above) are summarised by the Figure 2 below:



<sup>3</sup> Dewoghélaëre J., Rey H., Hériard-Dubreuil G. (2020): List of members of the Civil Society group, Final version as of 09.03.2020 of deliverable D1.13 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

Figure 2 – Structure of ICS activities in EURAD

*CS experts were the bridge between activities in WPs and CSLG, notably through the organisation of annual ICS workshops.*

This document aims at delivering an evaluation of the whole experimental process of ICS through a heuristic evaluation of different events or processes that occurred within the three contexts of strategic studies, technical WPs and ICS workshops. This evaluation does not consist in a global theoretical review of the double-wing model, but is set in grounded theory<sup>4</sup> that aims at drawing general conclusions stemming from empirical field surveys. Indeed, this “methodologically dynamic”<sup>5</sup> framework that provides ways to navigate through the situations rather than being a complete methodology was considered very adapted to this study. It was thought of as an embedded process, by the constitution of an evaluation framework adapted to the objectives of fruitful interactions (see deliverable D1.14 “Mid-term evaluation of the ICS activities and experimental model of interaction between EURAD participants and Civil Society.”)<sup>6</sup> and then progressively evaluating the events from the inside, with a reflexive approach that helps reaching conclusions on the events at stake, thus enriching the global framework and on the evaluating model itself. By doing so, conclusions are reflexive, and the embedded evaluation specifies better the conceptual and epistemic frameworks while doing the evaluation itself.

The evaluations of these events are based on a set of criteria that were developed to try to grasp the context, the content and the spirit of the relevance, the importance and the impact of the ICS, under the framing concept of fruitful interactions. These criteria aim at making explicit the values and meanings coming into play in the background of such interactions.

This document will present the grid in question, the evaluations of different events and processes (ICS workshops, ICS within strategic studies, ICS in technical WPs) based on this grid, and some reflexive elements related to the grid itself and the interactions with civil society as a whole.

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<sup>4</sup> Glaser B., & Strauss, A. (1967): *The discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine.

<sup>5</sup> Ibid.

<sup>6</sup> Geisler-Roblin A., Lavelle S. (2022): Mid-term evaluation of the ICS activities and experimental model of interaction between EURAD participants and Civil Society. Final version as of 10.10.2022 of deliverable D1.14 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

## 1. Presentation of the evaluation grid

### 1.1 Conception and history

Interactions with Civil Society (ICS) were an innovative component of the EURAD European R&D programme that involved an active participation and collaboration between technical partners and civil society members. As those interactions constituted a set of experimental processes, it was foreseen in the preparation of the EURAD programme to implement a dedicated evaluation of this ICS process along the programme. In this perspective, the first task of this evaluation process was to make explicit the values and meanings coming into play in the background of such interactions.

This process finally led to the development of a method to try to measure the fruitfulness of the interactions with civil society. This method, finalised in a 2021 workshop, takes the form of a grid, composed of nine different criteria or indicators, that try to encapsulate what is important to ensure fruitful interactions. These nine elements can overlap, for the main goal is not to try to be exhaustive, but more to shed light on the same complex reality from different interesting points of view.

During the first years of EURAD, the PMO subtask 8.3 methodological team identified several general concepts that should appear in any evaluation grid. These concepts were:

- Representations of the society
- Conditions of interplay
- Ordering of the world
- Stances towards uncertainty
- Visions of the future and links to the past

Starting from this list of five major items, a series of semi-directive interviews was organised in the second half of the year 2020. These interviews gathered the views of a selected panel of 25 EURAD members (half from civil society experts or larger group, the other half from the three colleges).

The analysis of these interviews led to the identification of several key topics that were linked to the five presented. Among all these identified subjects, the methodological team selected nine of them that were considered as the most relevant and that could encapsulate the whole list of topics.

These nine key topics were associated with a short and longer description of what was supposed to be evaluated. These elements were the basis of discussion of a workshop, held in May 2021, dedicated to the elaboration of this grid.

The outcomes of this workshop indicated that the chosen subjects for EURAD were a good path towards fruitful interactions.

This process led to the current nine-criteria grid that is used in this deliverable. As this process of elaboration of the whole evaluation methodology was finalised in the second half of year 2021, meaning in the first half of EURAD third year, only events and processes of EURAD three last years have been evaluated.

More details about the elaboration of this grid can be found in deliverable D1.14 "Mid-term evaluation of the ICS activities and experimental model of interaction between EURAD participants and Civil Society"<sup>7</sup>.

<sup>7</sup> Geisler-Roblin A., Lavelle S. (2022): Mid-term evaluation of the ICS activities and experimental model of interaction between EURAD participants and Civil Society. Final version as of 10.10.2022 of deliverable D1.14 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.



## 1.2 Presentation of criteria

Fruitful interactions have to be evaluated upon considering the conditions for their existence and their implementation. The nine conditions here proposed form a continuity of related subjects that can sometimes overlap partly, and they combine several perspectives that shed some light according to different viewpoints on the same complex reality.

Here, the nine criteria are presented associated with a strong hypothesis and a synthetic statement. The more detailed statement and description of the understanding of the criteria can be found in deliverable D1.14.

**Criterion 1 - Legitimacy** : Fruitful interactions necessitate legitimate processes in which all actors can dialog on the same footing.

An interaction is fruitful if there is no permanent or recurrent questioning as to the legitimacy of the actors taking part in the cooperative process or research, on the ground that they are not trained or competent enough, or that they belong to an institution or an organisation that is supporting other different positions.

**Criterion 2 - Methodology** : Fruitful interactions require that a community is able to conduct a variety of inquiries (scientific, moral, social).

An interaction is fruitful if the inquiries or researches are conducted by a variety of actors, are not restricted in an exclusive manner to a single type of research (eg : scientific inquiry) and can open up to some other types of research (eg : moral and social inquiry) that are concerned not only with facts or models, but with values and norms.

**Criterion 3 - Postural changes** : Fruitful interactions depend on the capacity of all actors to encompass others' views and to enlarge their initial perspective.

An interaction is fruitful if, along the cooperative process or research, it can be shown that the actors are not keeping to their initial position without any reservation and are then capable of modifying their own perspective by taking into consideration the contributions of the other actors.

**Criterion 4 - Personal unity** : Fruitful interactions require from an actor that he or she takes into account the different dimensions of him/herself.

An interaction is fruitful if the actors does not view themselves or are not viewed by the other actors as individuals that are exclusively defined by their official or professional function or activity (eg : he or she is an expert of radio-nuclides working for the wastes agency ; he or she is an activist from an environmental association) and can then articulate several aspects of his/her personality or his/her social role (eg : a worker, a professional, a citizen, a parent...).

**Criterion 5 - Expertise function** : Fruitful interactions require a pluralistic expertise that therefore cannot be reduced to a sole scientific process.

An interaction is fruitful if the expertise is pluralistic in the sense that it is not only scientific, but also moral, legal, environmental or social, and subsequently, in the sense that it is not only special, but also general as regards the capacity of linking up the various aspects and dimensions of a complex problem.

**Criterion 6 - Meaning of the repository** : Fruitful interactions include exchanges on the meaning of the existence of repository in the concrete life of people.

An interaction is fruitful if the examination of a problem and the exchanges between the actors that it entails can, beyond the sole technical aspects of the building, the monitoring or the maintaining a wastes repository, address the crucial issue of its (existential, cultural...) meaning for/in the life of the people.

**Criterion 7 - Territory** : Fruitful interactions must take into account the deep impact of a geological disposal on the meaning people give to their life in a territory.

An interaction is fruitful if it is admitted by the actors that, far from being a neutral installation, a

repository has a deep impact on the meaning that the people give to a territory and then to the life they can experience on it (eg : modification of landscape, traffic and transportation of materials, security and safety measures...).

**Criterion 8 - Shared complexity** : Fruitful interactions necessitate to address the complexity of the issues (technical and non-technical) linked with geological disposal.

An interaction is fruitful if the actors are able to address the various aspects and dimensions of a complex problem (eg: scientific, legal, moral, environmental, social...) and are also able to share this understanding of the complexity so that it finally constitutes a common ground or background.

**Criterion 9 - Addressing the long term** : Fruitful interactions cannot be meaningfully achieved without an intergenerational perspective, given the extreme timescales.

An interaction is fruitful if, despite the urgent achievements or decisions that need to be made in the RWM in the present, it never neglects the core stakes of the long-term management, justice and responsibility towards future generations.

### 1.3 Evaluation grid through indicators

The protocol of evaluation for the different events and processes is practically grounded on a scattering method, which grid is given here. For each condition for fruitful interactions as discussed in the co-evaluation workshop from May 2021, some precise indicators (3 or 4) enable certain knowledge for the evaluation. This non-exhaustive grid of qualitative indicators was established in the deliverable D1.14 as a preparation tool in order to build the different evaluations.

Conditions	Indicators
<b>Legitimacy</b>	<p>Recognition -or not- of legitimacy (from one to another, by speech and statutes)</p> <p>Legitimacy affirmation -or not- (from someone for him/herself, affirmation or revendication)</p> <p>Symmetry/di-symmetry of actors (right to speak, time of speak, right to take the floor, to frame the debates, inclusivity, ...)</p>
<b>Methodology</b>	<p>Cooperative research, co-construction of interpretations and scenarios (contextualized cases)</p> <p>Degree of critical pluralism: Taking into account the variety of rationalities (scientific, moral and social views together)</p> <p>Consideration of safety case and safety assessment as dialectic places/dialogues</p> <p>Highlighting the specificity of long-term knowledge and management</p>
<b>Postural changes</b>	<p>Consideration of political and organizational tools for changes (Pathway Evaluation Process, special events, associations, commons, ...)</p> <p>Taking into account the role of socio-technical imaginaries (background assumptions: ontological, cosmological, epistemological, ethical, ...)</p>



	Changes in the opening and acceptance of other types of rationalities (not only scientific)
<b>Personal unity</b>	Personal dissonance/consonance with the institutional discourses/roles
	Personal expression markers : "off the record", I/we, self-censorship, ...
	Importance of professional and personal life shift: professional status and activity, socio-environmental activism, consciousness raising, ...
<b>Expertise function</b>	Role and cooperation with non-experts, non-scientific experts and counter-experts : co-expertise
	Evolution of the expertise function along the processes, recognition of this evolution by experts themselves
	Consideration of pluralistic dialogue and institutional integration for better apprehension of complexity
<b>Meaning of the repository</b>	Integration of plurality of meanings beyond the efficiency of technical concepts
	Appropriation of the site of repository by the population: activities and projects in addition to RWM
	Considering the significance of intergenerational safety
	Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)
<b>Territory</b>	Integration of the repository into landscapes and territory life
	Reference to local problematics, questionings and claims
	Recognition of legitimacy of local consensus and dissensus
	Scopes of the territory. Role of multiple organizations and scale : local, regional, European, associations, ...
<b>Shared complexity</b>	Multinational and intergenerational perspectives
	Considering institutions as dynamic structures towards apprehension of complexity
	Contribution and relevance of scientific expertise to safety issues. Development of safety culture.
<b>Addressing the long term</b>	Considerations about intergenerational governance and interactions (more than education)
	Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)
	Articulation of timescales (past, present, future) at the levels of reflexion and actions.

## 2. Evaluation of ICS workshops

### 2.1 ICS workshop n°4 – Fontainebleau, May 2023

#### 2.1.1 Introduction and context

The Interaction with Civil Society (ICS) workshop n°4 was organised in the frame of the interaction with civil society activities in EURAD under the PMO WP Task 8: coordination, organisation, and reporting on Interactions with CS.

#### Task 8 objectives and activities

Task 8 of the PMO WP was dedicated to the coordination of CS interactions within EURAD, i.e. selecting the members of the CS group, organising the interactions with the “experts” and evaluating these interactions. It aimed at organising the attendance of the CS members of the CS group to EURAD workshops and ensuring the integration of the results of the participants of the CS teams involved in the different scientific/technical WPs, as well as methodological support for interactions between CS and stakeholders.

Task 8 was also responsible for the organisation of a yearly workshop involving the participants of the CS group, the CS Experts together with a panel of WMOs, TSOs and REs participants in EURAD. To do so, Task 8 collected results from the work of the different scientific/technical WPs, ensured the translation of results to the CS group during the session and gathered CS advices and comments on the activities of the scientific and technical WPs. A small team of CS experts was dedicated to this task and worked together with representatives from WMOs, TSOs and REs from the different WPs. Five workshops occurred, in 2020, 2021, 2022, 2023 and 2024. A sixth additional workshop was held in April 2024.

Finally, Task 8 also carried the evaluation of the experimental model of Interaction between EURAD participants and Civil Society. This document is part of this duty.

#### Topic of workshop 4

These meetings gathered the civil society experts and the members of the CS larger group involved, in addition to some EURAD participants who had a specific interest with the ICS activities (mostly because they were involved in the same Work Packages - WPs). The ICS workshop n°4 was aiming at the fruitful participation of CS members within EURAD, by several means. Firstly, most of the workshop was the occasion to share information to the CS larger group members about the work done in EURAD, especially the work carried out by the CS experts. Secondly, the goal was also to collect the views of CS members, comments and suggestions on the results of the work done and for future EURAD activities. Thirdly, the workshop contributed to better stimulate and dynamize the interactions with Civil Society in EURAD with technical partners. The agenda is detailed in the appendix A.1.

These objectives were tackled through the 4 half-day sessions of the workshop, leading to consider various topics :

1. Technical WPs : Outcomes of MODATS workshop, Presentation of CORI-UMAN-ICS, Modelling the chemical evolution of geological disposal of nuclear waste (ACED), A coupled chemo-mechanical approach to model the appearance and propagation of cracks during the carbonation of cementitious materials (MAGIC).
2. UMAN WP session : Key messages of civil society in UMAN, Identified methodologies for pluralistic assessment of near-field related uncertainties (topic of UMAN seminar n°5), Brainstorming on recommendations on pluralistic management of uncertainties.
3. ROUTES WP session : Various national cases, Criteria for fruitful interactions between scientific experts and civil society, Shared safety culture.

4. Evaluation and dissemination of the results of EURAD : a) Dissemination: How do you intend to use EURAD results in your work in your countries? How should we disseminate EURAD results to the interested European public? b) Cooperation and fruitful interactions between civil society representatives and other EURAD colleges (following the outcomes of Task 8.3) : What are conditions for fruitful interactions in a research programme such as EURAD? c) Reflections on the participation of CS groups in EURAD: How can we attract CS experts to work in the EURAD project? How to engage more CS larger group members? What should we do differently in future collaborations? What are good practices in research in regard to EURAD results if we want to involve CS?

The remaining outcomes of the discussions are : The use of EURAD results through reports to politicians in the nuclear site municipalities, to national authorities and at university, the importance of postural changes, of giving meaning to research and of an effective inclusiveness of CS, the need for an improvement and better promotion of dissemination, and the extension of the double-wing model to a triple-wing model.

### 2.1.2 Synthetic evaluation

The details of the evaluation of this ICS workshop based on the 9 criteria evaluation grid can be found in Appendix A.1.

The Fontainebleau workshop was a very positive meeting regarding many aspects. The fruitfulness of all these interactions can be witnessed by the very good level of confidence between all participants that made it possible to produce common views and outcomes.

Indeed, a real symmetry between participants, who were all considered relevant, helps build a strong feeling of legitimacy.

The methodological aspect of the workshop was a real source of satisfaction regarding some aspects orientated towards pluralism. This “multi-party” workshop was also fruitful for it led to the elaboration of a renewed overall definition for Radioactive Waste Management, discussed as food for thoughts and research, based on the three pillars of safety culture, intergenerational stewardship culture and fruitful interactions.

Moreover, all the formal and informal conversations showed a real capacity to bridge institutional roles with personal history and consciousness. This personal utility that helped strengthen the links between participants, who came to know each other more and more, was very present in the ‘off the record’ conversations.

This confidence led to discussions on very transversal points on the use of some cross-cutting approaches. For instance, the issue of intergenerational safety was widely discussed, both in a sense of addressing the long-term and building a common meaning of the repository. These cross-cutting issues also made possible the development of a sense of shared complexity: for example, the framework of the UMAN management of uncertainties helped building bridges between different projects or WP.

However, what can be considered as the major point of fruitful interactions in this workshop is linked to the expertise function: the several-year long cooperation in these working groups helped build a genuine community of inquiry, whose expertise rely not only on scientific investigations, but also on moral, legal, environmental or social ones.

The Fontainebleau workshop did not directly deal with all the subjects of the 9 criteria, but the ones tackled were done in a very fruitful way. The ICS workshop n°4 organisation and the trust between all the participants helped avoid the usual pitfalls of dealing with different compartments of knowledge, action and experience, and created a very transversal community of expertise.

## 2.2 ICS Workshop n°5 – Brussels, October 2023

### 2.2.1 Introduction and context

The Interaction with Civil Society (ICS) workshop n°5 was organised in the frame of the interaction with civil society activities in EURAD under the PMO WP Task 8, whose objectives and activities have been described in the previous evaluation.

#### Topic of workshop n°5

The objective of this final ICS workshop was double:

- to step back and evaluate past ICS activities or results in EURAD and the contribution in terms of participation models,
- to discuss, with examples of pluralistic methodologies, this proposed definition of Radioactive Waste Management (RWM): a long-term complex decision-making process, in an uncertain environment, involving a plurality of stakeholders.

#### Agenda of ICS workshop n°5 - further details in appendix A.2

This workshop is constituted of 3 half-day sessions, covering the following pillars for RWM:

1. Shared Culture for Safety and Security
2. Intergenerational Stewardship Culture
3. Fruitful Interactions

#### Topics discussed in the workshop

##### Shared culture for safety and security

The main topics tackled in this session were : The definitions of safety culture and shared culture for safety and the links with defence-in-depth, the importance of having independent expertise (and the notion of independence itself) and the crucial importance of trust, the role of institutions, the importance of communication and dialogue, the German national case and the role of shared safety culture.

##### Intergenerational stewardship culture

Many topics related to intergenerational stewardship and long-term perspective were freely tackled here through a creative process that led to elaborate and discuss altogether different visual synthetic forms addressing this topic .

##### Fruitful interactions

- The new PEP monitoring created for MODATS workshop
- The core concept of confidence regarding monitoring issues.

### 2.2.2 Synthetic evaluation

The details of the evaluation of this ICS workshop based on the 9 criteria evaluation grid can be found in Appendix A.2.

The fifth ICS workshop was fruitful on many aspects for it was in the continuity of the building of a several-year long working group and for it used a new disruptive tool.

Indeed, the first point is especially relevant concerning the legitimacy criteria: the process of mutual recognition, after several years of exchanges and discussions, had then reached a degree of advancement that can be viewed as a mature stage.

This process of confidence-building that was developed through the successive events over the years also helped for the personal unity criteria: the participants at the workshop in Brussels addressed the event at this stage of the project in a more relaxed way if we compare it to the first meetings, for they knew each other quite well and felt more comfortable in the interactions with the other group members. Nevertheless the dividing line between the expert and the citizen remained at some point in some presentations. This is due to the fact that for some participants the underlying paradigm of the interactions with civil society was the pedagogical or didactical one.

The main innovation of this workshop was the use of creative drawings. Indeed, this new tool (that can be considered as a methodological input) gave all the actors the opportunity to use on a symmetric basis a means of expression that is not bound to the usual forms of reasoning or arguing in a discussion.

This tool also helped identify postural changes, for the use of a variety of tools, from the classical presentation and discussion to the use of creative drawings offered a wider range of means of expression and could free the participant's imaginary abilities.

Moreover, the creative drawings also helped tackle the issue of addressing the long-term: the long term was present during the exercises on imagination that consisted in sketching out several possible visions of the future.

However, the main contribution of this innovative tool to the fruitfulness of interactions concerned the meaning of the repository: The Brussels workshop was probably the first in the series of EURAD events that contributed in such a decisive way to sketching out a meaning for a repository. It did so in the shape of an experimental process that used the method of creative drawings as an artistic tool for opening up the participants' views and enhancing their capacities. The use of this tool drove the actors to take up a personal position, instead of keeping up to the more conventional corporate speech that is commonly a binding factor for the expression of thoughts.

Apart from these two main pillars, it can be mentioned that the issue of territory was also directly addressed, through the examination of several national cases. It gave the opportunity for some constructive interactions among the group of actors.

This fifth ICS workshop was a great opportunity to both capitalise on the confidence created among the group of actors and to innovate with this new creative tool. These two ingredients made this workshop particularly fruitful regarding many topics.

### 3. Evaluation of ICS in strategic studies

#### 3.1 UMAN Seminar n°3 – Fontenay-aux-Roses, June 2022

##### 3.1.1 Introduction and context

In the UMAN WP of EURAD, task 5 has the mission to build interactions between all actors of UMAN. In this context, this task organises pluralistic seminars structured around several key topics of uncertainties. One of these seminars occurred in Paris and online, on the 14th and 15th of June 2022.

##### Task 5 objectives

1 - Develop a common understanding or at least to share different viewpoints among the different categories of actors on: uncertainty management and how it relates to risk & safety, whether and why a safety case is robust vis-à-vis uncertainties.

2 - Share knowledge and discuss challenging issues on uncertainty management among a broader group of actors

3 - Identify methods for organising a regular and pluralistic dialogue on uncertainties during the development and review of the safety case

4 – Provide recommendations for future EURAD activities

##### Task 5 activities

- Organisation and animation of a set of pluralistic seminars to discuss UMAN results and broaden the scope of involved actors
- Involvement of a pluralistic stakeholder group including civil society actors, regulators and international organisations (FSC)
- Integrative process: each seminar constitutes one step of the pluralistic analysis of UMAN results and research of a methodology to organise regular dialogue around uncertainties

##### Topics of past seminars

Seminar 1: What uncertainty management involves for each type of actor? How is it related to risk, safety, and the safety case? Results of the discussion fed D10.13 “Understanding of uncertainty management by the various stakeholders.”<sup>8</sup>

Seminar 2: Focus on Site and Geosphere: Preferences of actors, evolutions of uncertainties throughout different phases, how the interactions with civil society could contribute to manage uncertainties. Results of the discussion fed D10.14 “Pluralistic analysis of site and geosphere uncertainty.”<sup>9</sup>

##### Topic of seminar 3

Focus on Human Aspects related uncertainties: Uncertainty management options, governance, and interactions between stakeholders.

##### Elaboration of seminar 3

In order to organise, the UMAN Task 5 prepared presentations of significance and available options for managing the main uncertainties related to so-called human uncertainties (see hereunder) based on:

1) The work performed in UMAN:

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<sup>8</sup> Röhlig K-J. (2023): UMAN - Understanding of uncertainty management by the various stakeholders. Final version as of 24.10.2023 of deliverable D10.13 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

<sup>9</sup> Rocher M. (2024): UMAN - Pluralistic analysis of site and geosphere uncertainty. Final version as of 24.01.2024 of deliverable D10.14 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.



- Views of WMOs, TSOs and REs on the identification, characterization, and potential significance of uncertainties on site human uncertainties (Task 3.3)
- The results of the Workshop (June 2021) on management options and preferences regarding human related uncertainties. (Task 4.3)

## 2) Other relevant references (IAEA, national programs, etc.)

In addition to this, the CS experts involved in UMAN (Task 5.2) reviewed the work performed by UMAN partners in Tasks 3.3 (Characterization and Significance of Uncertainties) and 4.3 (Uncertainty Management Options and Preferences). This review was presented and discussed within the UMAN session of the ICS Workshop n°3 (March 2022). The review was updated according to the results of these discussions.

### Topics discussed in the seminar

1. “Public Acceptance” uncertainty: uncertainties related to conditions for acceptance or non-acceptance of GD. Should it be viewed as an uncertainty or as an uncertainty management strategy?
2. “Schedule” Uncertainty: uncertainties caused by unplanned delays and postponements.
3. “New Knowledge” Uncertainty: uncertainties caused by appearance of new knowledge generated through RD&D activities, technology development, and monitoring aspects
4. Uncertainty related to adequacy of safety activities: uncertainties generated by human activities during the implementation of GD (Gap between theory and safety case VS concrete implementation)
5. Topic added by Task 5 – Security issues: uncertainties linked to security generated by human activities (intrusion, war, etc.)

### 3.1.2 Synthetic evaluation

The details of the evaluation of this seminar based on the 9 criteria evaluation grid can be found in Appendix B.1.

As a conclusion to this evaluation, this seminar n°3 of UMAN task 5 (14-15 June 2022) has demonstrated the existence of favourable conditions to produce fruitful interactions.

According to this evaluation, the strength of this seminar is the framework of UMAN on the pluralistic work about uncertainties regarding radioactive waste management . With this framework, and with a specific methodology putting every participant and institution on the same footing in the discussion on specific topics and cases, the seminar led to fruitful interactions.

However, some criteria of the evaluation do not apply directly to this event, such as the topics of Personal Unity, Territory and Meaning of the repository. Yet, the discussion of those three criteria produced opportunities to hold further discussions on them, later in the following steps of the UMAN seminars. For example, even if the local territory was not discussed, the structuring notion of national burden opened new conversations to be led. From this perspective, the interactions on these topics were not only directly fruitful, but also indirectly.

This evaluation led also to another critical conclusion for interactions on uncertainties: it was not always clear for all actors for whom the defined uncertainties were uncertain. This raises the need for clarification of the relevance of the considered uncertainties in the view of UMAN goals, ensuring that the considered uncertainties are effectively related to safety and not only uncertainties for a given category of actor.

This seminar, having an appropriate methodology and an orientation towards complex issues on uncertainties, enabled new structuration of discussions around the topic “Uncertainties related to human aspects”, with the participation of all actors: WMOs, TSOs, REs and CS.

In one sentence, this event was fruitfully participating in a reframing of the meaning of RWM : radioactive waste management as a long-term complex decision-making process, in an uncertain environment, involving a plurality of stakeholders.

The framework on uncertainties can be said to contribute to this reframing, by taking into account the complexity of related issues and enabling interactions on the same footing along with time.

In the view of the UMAN task 5 objectives, it should be noted that these interactions have reached the goal of producing a common understanding, beyond the sole sharing of different viewpoints.

## **3.2 UMAN Seminar n°4 – Brussels, December 2023**

### **3.2.1 Introduction and context**

In the UMAN WP of EURAD, task 5 has the mission to build interactions between all actors of UMAN. In this context, this task organises pluralistic seminars that gather a variety of stakeholders and are structured around several key topics of uncertainties. One of these seminars occurred in Brussels and online, on the 6th and 7th of December 2023.

The objectives and activities of task 5, as well as the topics of the two first UMAN seminars, were presented in the evaluation before.

#### Topics of the previous seminar

Seminar 3: Focused on uncertainties related to human aspects: Preferences of actors, evolutions of uncertainties throughout different phases and how could interactions with civil society contribute to managing these types of uncertainties?

#### Elaboration of seminar 4

In order to organise, the UMAN Task 5 prepared presentations of significance and available options.

The main objective of seminar 4 was to test the methodologies to organise and manage pluralistic assessment of uncertainties identified during the UMAN process. Pluralism here means diversity of actors and diversity of scientific disciplines (technical and non-technical).

#### Identified methodologies

The pluralistic methodologies identified during the previous UMAN seminars and in the frame of Task 5's work (including work performed by civil society experts involved in Task 5.2) are divided in two categories: the generic methodologies identified during discussions and methodologies that have been tested in the frame of EURAD research.

#### **A – Identified Generic methodologies**

- Development of a shared Safety culture and its intergenerational transmission
- Implementation of a stepwise approach including notably:
  - intergenerational safety case review
  - reversibility/Retrievability/ Recoverability principles
  - a continuous knowledge management
- Implementation of a Rolling Stewardship culture: it implies notably intergenerational transmission of information, empowerment of communities, cultural heritage, e.g., regular celebration around waste, and other similar processes.
- Reinforcement of an appropriate legal framework enabling pluralistic interaction with a variety of actors and on variety of topics :



- Aarhus Convention and its three pillars (access to information, effective public participation including report on ways public consultations are duly taken into consideration, access to justice if the two other pillars are denied)
- Access to resources for enabling effective public participation as indicated in the BEPPER report<sup>10</sup>
- Prescriptive EU directives (e.g., Article 10 Transparency of RWM directive, promotion, and enhancement of public participation)
- International recommendations and guidance (e.g., Nuclear Energy Agency working groups such as FSC and IGSC)

#### B – Methodologies tested in the frame of EURAD research

- Double Wing in the frame of research
  - for translating technical knowledge to enable a larger public to understand it and make up their own minds on the topic,
  - for problematising socio-technical issues
  - Could the double wing model be extended to other situations? (e.g., follow-up of Geological Disposal implementation for instance) On what conditions?
- PEP approach: concrete cases to organise pluralistic discussions on uncertainties on the same footing. For further details and reflexive elements about PEP, see part 5.1 of this present document

#### Organisation of working groups

Discussions were organised around a specific board of a PEP game dedicated to the phase of “Authorization and qualification” of the geological disposal. There were 3 Working Groups with a moderator and a rapporteur. Each WG discussed 4 “concrete cases” illustrating challenging situations where multiple actors engage in dialogue and pluralistic methodologies could help manage uncertainties and ensure safety. For each concrete case, there was the same following set of questions:

- Among the methodologies identified, do you see one (or more) that can be used to manage
- the situation? If so, which ones and how can they contribute to managing the situation?
- Do you see other methods for managing the situation?
- What are the conditions for the successful implementation of these methods?
- In your opinion, how do these methods contribute to the safety of waste management or to the development of mutual understanding between all stakeholders?

The four concrete cases presented and discussed were about:

- The uncertainties about the performances of the seals (Degree of acceptable remaining uncertainties - uncertainties about the performance of seals): the permeability of the sealing material is higher than expected. Civil society is informed about the situation. What to do? What level of uncertainty is acceptable?
- The integration of new results regarding radionuclide transport (Integration of new knowledge – new results on radionuclides transport modelling): How to integrate new research results in the implementation of a geological disposal?
- Monitoring data that drifts from what is expected (Operational monitoring data deviating from expectation – monitoring uncertainties and need for waste retrieval): there is a suspicious

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<sup>10</sup> The BEPPER report: Transparency in Radioactive Waste Management, Nuclear Transparency Watch (NTW), December 2015

discrepancy between different sensors and it might be important to check if there is a leakage or not. This concrete case raises the question of the interpretation of monitoring data, how to take a decision based on monitoring data, and it challenges the concrete implementation of waste retrievability.

- The post-closure phase and the institutional memory (Role of Institutional control and site memory – abandonment by government of the initially planned institutional control after closure): After closure of the disposal facility, institutional control of the site has been planned for 150 years. Just before closure, this form of oversight is no longer seen as a priority by the government of the day due to the cost and it is envisioned not to implement it. What to do? This case tackles the issues of trust, the role of the institution and the memory.

#### Topics discussed in the seminar

Many topics were tackled during this seminar, that can be gathered in five different themes:

1. The possible evolution and safety significance of uncertainties related to site & geosphere; possible options to represent these uncertainties in a safety assessment, to reduce, avoid or mitigate them.
2. The degree of acceptable remaining uncertainties
3. The integration of new knowledge
4. The uncertainties linked to operational monitoring data deviating from expectation
5. The role of institutional control and site memory.

#### 3.2.2 Synthetic evaluation

The details of the evaluation of this seminar based on the 9 criteria evaluation grid can be found in Appendix B.2.

This seminar being the fourth of the series of the UMAN seminar, many evaluation criteria must be understood in the dynamics of this series. This dynamic especially concerns the legitimacy, the methodology, the postural changes, the meaning of the repository, the shared complexity and the addressing the long term criteria. Indeed, all these criteria rely on shared vision of a “new” way to tackle transversal or sociotechnical issues: the series of UMAN seminars allowed for the development and sharpening of such vision among all actors and the debate on their implications and the way to implement them. Some effects should be examined in the long-run, since the investigated topics concern more the whole process of the UMAN seminars than this specific one.

The UMAN Seminar 4 led to the recognition by all parties of the interest and the added value of the 4-step UMAN process, which allows to identify methodologies that were validated collectively (and even by consensus). However, this consensus does not apply to the specific actual implementations of these methodologies and the dialogue regarding them still needs to be developed.

Among the different evaluation criteria, the one linked to the territory can be considered as holding a specific role: it might be considered as the less directly fulfilled, however being the most important and the most specific regarding the UMAN Seminar 4. Indeed, the UMAN seminars allow the participants to discuss the difficulties that occur in the national cases. The discussions being held at the European scale helps soothing considerations that can be blocked at the national scale. Going back and forth between these different levels allows participants to take advantage of the diversity of national case studies, while overcoming barriers by adopting an international approach.

### 3.3 ROUTES process of contribution to deliverables D9.16, D9.17 and D9.18

#### 3.3.1 Introduction and context

Conversely to other evaluations, this one does not concern a specific event but the whole process of contribution to several ROUTES deliverables.

Task 7 of the ROUTES WP created an approach that aimed at foreseeing continuous follow up of the activities in ROUTES technical tasks (2-6 and 8) and further orientation on the specific topic identified as most interesting in the perspective of developing interactions between CS and EURAD partners along the course of the WP. This Task organised several workshops to gather and discuss CS views, with the objective of focusing on scoping the objectives and actions in ROUTES tasks 2-6 in order to identify issues that are deemed of more specific interest in the perspective of developing interactions between civil society and EURAD partners along the course of the WP.

Based on the outcomes of the Task 7 investigation of tasks 2-6 in the ROUTES WP and additional feedback from EURAD participants and interaction with the EURAD CS larger group, an action plan for the Task 7 work with interaction with civil society for years 2-4 of the project has been developed, and was revised each year to include the development of the work done and results produced in tasks 2-6 in the ROUTES WP and in interaction activities with CS larger group or other EURAD participants.

The results of these investigations are presented in three deliverables that are here presented: the D9.16 “Implementation of ROUTES action plan first phase”<sup>11</sup>, D9.17 “Implementation of ROUTES action plan second phase”<sup>12</sup> and D9.18 “Implementation of ROUTES action plan third phase”<sup>13</sup> (later called D9.16, D9.17 and D9.18 for easier reading). These documents include comments, suggestions, questions and other observations collected in interaction with EURAD participants and CS larger group. Each of these yearly deliverables develops a special focus on specific issues. More specifically, the D9.16 has a special focus on Ethical and legal issues, good transparency, public concerns on shared solutions and case studies; the D9.17 on Transparency in establishment of national radioactive waste facilities (with criteria for good transparency, national case studies and recommendations); the D9.18 on Short-term and long-term public participation in RWM technical topics.

The CS experts in Task 7 also actively followed during the whole project the development of deliverables by all the Tasks 2-6 and gave inputs suggested by both the CS experts group and the CS larger group. The suggestions from the CS experts were meant to be discussed with ROUTES participants to also define R&D activities in the different tasks.

It is the whole process on redaction of these three deliverables with CS contribution that is here evaluated, for it is unique in EURAD.

#### 3.3.2 Synthetic evaluation

The details of the evaluation of this collaboration process based on the 9 criteria evaluation grid can be found in Appendix B.3.

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<sup>11</sup> Zeleznik N., Swahn J., Haverkamp J., Hooge N.H., Rey H., Daniska M. (2021): Implementation of ROUTES action plan first phase. Final version as of 04/05/2022 of deliverable D9.16 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

<sup>12</sup> Zeleznik N., Swahn J., Daniška M., Haverkamp J., Hooge N.H., de Butler M, Wales C., (2022): Implementation of ROUTES action plan second phase. Final version as of 22/08/2023 of deliverable D9.17 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

<sup>13</sup> Zeleznik N., Swahn J., Daniska M., Haverkamp J., Hooge N.H., de Butler M, Wales C., (2023): Implementation of ROUTES action plan third phase. Final version as of 03/05/2024 of deliverable D9.18 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

## EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

The ROUTES process of contribution to deliverables is a unique object and evaluating it through this grid is very valuable, for it allows to highlight its specificity, its strengths and its weaknesses.

Many evaluation criteria are linked to topics that were directly tackled in the ROUTES deliverables, making them de facto relevant. This is notably the case for the postural changes, for which the evolution of some of the views of the different actors have been included in the reports; for the shared complexity, that have been developed and deepened in the three deliverables D9.16, D9.17 and D9.18; and for addressing the long term, which was directly addressed in chapters of D9.17 and D9.18.

Other criteria are linked to the framework and the process of the elaboration of these deliverables.

For instance, legitimacy can be considered as one of the pillars of the process, for it is linked with the Aarhus convention and the BEPPER report<sup>14</sup> which create room for such processes.

In the same way, the expertise function can be considered central, as the whole ROUTES deliverable process revolved around the cooperation between different types of experts. This pluralistic expertise made the ROUTES deliverables very substantive and original.

The meaning of the repository can also be considered as central in the process. The fact that some CS members come from communities impacted by planned repositories has led to integration of concrete views on the significance of repositories and on concepts associated with them, such as intergenerational safety and flexibility of the sociotechnical process.

The methodology of this process can be considered original and fruitful: the double wing model was “transcended”, because members of the CSLG contributed to deliverables themselves by providing case studies and answering questionnaires, and also participated in workshops and seminars.

It is interesting to notice that the 5-year process led to real postural changes. Not only CS members who researched, learned and evolved in their views but also other actors in the ROUTES WP have learned more about national cases, CSI and even about legal frameworks at the national and European levels. In general, a positive evolution towards more trust, more understanding, and more collaboration has been observed from all sides.

This process also strengthened the personal unity among participants. It implies dialogue to enable trust and less self-censorship, and the deliverables tended to coherently reflect their views as individuals as well as a group.

And finally, what can be considered as the most important point both for the framework of the process and its results is the territory criteria. Indeed, every ROUTES deliverable is based on interactions between national cases and generic reflections. Territories are not only important in the ROUTES process – they are the starting point on which the work can be developed.

The ROUTES deliverable process is very prolific and the diversity of views that composed it led to very fruitful interactions and deliverables. However, to make it even more efficient, more coordination among members and other WPs would have been needed.

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<sup>14</sup> The BEPPER report: Transparency in Radioactive Waste Management, Nuclear Transparency Watch (NTW), December 2015.

## 4. Evaluation of ICS in technical WPs

### 4.1 ICS-CORI-UMAN session, EURAD annual event – Fontenay-aux-Roses, March 2022

#### 4.1.1 Introduction and context

##### Session during the second EURAD annual event

The second EURAD annual event took place in Paris from the 28th to the 30th of March 2022. During this annual event, a specific plenary session of 2h30 was dedicated to this ongoing dialogue between CORI, UMAN, and ICS, on Tuesday the 29th afternoon.

This session was organised in three parts:

- A general introduction to the ICS in EURAD, and introduction about the different safety visions and relevance of organic matter for safety
- A part focusing more on the relationships between organic matter and uncertainties, including
  - a dialogue between CORI and UMAN, with a presentation of their respective recent results regarding uncertainties on organic matter
  - an open discussion about connecting technical research and uncertainty assessment and management, with an active participation of around 15- 20 persons, animated by a EURAD PMO member
- A subject-broadening part, structured on the topic of safety culture, with a presentation of safety culture by CS member and an open active discussion animated by the Chief Scientific Officer of EURAD and fostered by the following question: What kind of interactions in EURAD can contribute to further develop safety culture?

##### The CORI-UMAN-ICS dialogue

Starting from October 2021, a dialogue took place in EURAD between a technical Work Package (WP), CORI, focusing on organic matter and cement reactions in a geological disposal, a strategic study WP, UMAN, focusing on characterization and management of uncertainties regarding radioactive waste management, and the Civil Society (CS, organised following the double-wing model).

This dialogue led to several meetings between the three entities, almost one per month. This process progressively structured an active conversation about the uncertainties regarding organic matter, and the importance to structure both works, on organic matter and on uncertainties, in the perspective of safety, being therefore more meaningful to civil society.

#### 4.1.2 Synthetic evaluation

The details of the evaluation of this event based on the 9 criteria evaluation grid can be found in Appendix C.1.

As a conclusion to this evaluation of the event, this CORI-UMAN-ICS session during the EURAD annual event (29th March 2022) occurred in favourable conditions for fruitful interactions.

In the details of the evaluation, it can be said that several conditions for fruitful interactions were directly reached: Legitimacy, Methodology, Postural changes, Personal unity, Expertise function, Shared complexity.

Yet the conditions of addressing the long-term, Territory and Meaning of the repository cannot be said to be fulfilled in the evaluated event, as those topics were not reached, or merely, or only indirectly.



Thanks to the perspective of orientation towards safety, the interactions were held on the same footing for the different actors: WMOs, TSOs, REs and CS.

The new and experimental methodology, experimented within the CORI-UMAN-ICS process and made visible during the session, enlightened the possibility of an appropriate participation of CS in the making of scientific and technical R&D with a specific role of steering research and interactions towards safety. However, a more institutional framework for these exchanges could have been more beneficial to deliver a position paper. A balance between the flexibility of such a process - that enables fruitful exchanges - and a more formal framework - that could guarantee a budget for quantified objectives - is to be found.

An important point raised during the evaluated session is the necessity of an active safety culture for scientific research, enabling new and fruitful interactions on the scientific aspects of RWM.

## **4.2 MODATS Workshop – Nancy, April 2023**

### **4.2.1 Introduction and context**

In the MODATS WP of EURAD, subtask 2.5 tries to create the conditions for a sound and fair “3+1 parties” dialogue and mutual understanding between the three EURAD categories of organisation (WMO, TSO and RE) and the EURAD civil society group, to address the question of how to approach the link between measurement and the installation of the safety case. In this context, this subtask organises pluralistic interactive workshops for which each of the “3+1 categories” of actors prepares beforehand a keynote point of view on the topics selected in the common platform, which leads to an interaction of the different actors. One of these workshops occurred in Nancy, France and online, on the 18th and 19th of April 2023.

#### Subtask 2.5 objectives

The main objectives of subtask 2.5 are:

- The development of mutual understanding and common views on the key challenges and topics identified in the platform, based on the preliminary development of Task 2;
- Further gathering information on the MODATS Task 2 and Task 3 developments in year 2 and their potential contribution to meet the identified challenges;
- Compiling the first MODATS “3+1 Dialogue Workshop” results into a 2nd Sub-Task 2.5 milestone report.

#### Elaboration of the workshop

The workshop relied on two major presentations – one for a technical introduction on monitoring issues and the other one on the link between monitoring and the safety case – and the creation of seven concrete cases for the group work.

These concrete cases, composed by a concrete situation challenging the monitoring strategy and questions orientating the discussion on a specific theme, were created by CS experts and IRSN members on four topics:

- Two on “data delivered by sensors”;
- Two on “systems that allow to collect, view, analyse and understand the transferred data”;
- Two on “traceability of knowledge”;
- one on governance and more specifically on “technical innovation for post-closure monitoring”.

These four topics were presented to a pluralist panel of task 2.5 actors who validated them.

The groups were constituted to ensure a balanced representation of members of each College.

The organisation of this workshop was also made to create a link with the WP UMAN, the monitoring here being encapsulated in the broader issues of uncertainty to address the question of safety.

#### Topics discussed in the seminar

The presentations, the discussions and the group work on concrete cases were framed by three global questions:

- What are the views of the different actors on what the monitoring strategy should be?
- What is the contribution of a pluralistic surveillance strategy to safety over time?
- What are the satisfactory conditions for monitoring?

These questions led to discussions about various topics such as : the definition of monitoring, the link between monitoring and safety, the monitoring strategy design and adaptation, the link between data and models, the digitalization of the monitoring system, the methods of data management, the technological evolution, the institutional and social change, knowledge management, uncertainties and confidence, pluralism in the process, transparency and public participation, the link with civil society, and the issues of time scales.

#### 4.2.2 Synthetic evaluation

The details of the evaluation of this workshop based on the 9 criteria evaluation grid can be found in Appendix C.2.

As a conclusion to this evaluation of the event, this MODATS “3+1 dialogue” occurred in favourable conditions for fruitful interactions.

In the details of the evaluation, it can be said that most conditions for fruitful interactions were directly reached.

Yet, the condition of Territory cannot be considered as fully reached, since the workshop was at the same time rooted in its territory and addressing questions at a generic, de-contextualized (not context-based) and “deterritorialized” (not territory-based) scale.

The Personal unity condition was merely fulfilled as participants to the workshop mainly stayed in their institutional roles.

The condition of Postural changes was indirectly reached, as this workshop rather paved the way for a better future possibility of postural change.

Three transversal points can be raised:

- There was a good methodological balance between concrete cases, discussions and the technical visit. These three parts of the workshop were complementary in many ways.
- The workshop allowed participants to create a safe space to facilitate dialogue, but some tensions remained on the dichotomy expert/non-expert and the technical difficulties to address some topics.
- Safety was a core concept that structured all the discussions throughout the workshop and even after.

This seminar, having set up an appropriate methodology to create a dialog on the same footing between TSOs, WMOs, Res and CS, was a good basis to develop a mutual understanding and common views on key challenges about the link between monitoring, uncertainty, and safety.

## 4.3 MODATS Workshop – Paris, October 2023

### 4.3.1 Introduction and context

In the MODATS WP, the subtask 2.5 organises pluralistic interactive workshops for which each of the “3+1 categories” of actors prepares beforehand a keynote point of view on the topics selected in the common platform, which leads to an interaction of the different actors. The second of these workshops occurred in Paris, France and online, on the 24th and 25th of October 2023.

#### Elaboration of the workshop

From past involvement of CS experts in MODATS, it has been considered that a fruitful path for building transparency and trust on digitalisation and monitoring topics crosses several points, including capabilities of pluralistic expertise (gathering different perspective and still respecting technicity of the issues) and the organic articulation of data, actions and safety. These points have been addressed in this second workshop with the implementation of four pillars:

- The technical visit of T       Remote Monitoring Network, an IRSN facility located in Le V       (France) dealing with environmental monitoring, provided to the participants an interesting example of a surveillance system as a digital twin<sup>15</sup>.
- A test of the PEP<sup>15</sup> game dedicated to monitoring issues, aiming at facilitating pluralistic discussion on this topic. This tool has been developed by Sub-task 2.5 as a way to help build a mutual understanding of the complex issue that is GD monitoring.
- A panorama of monitoring and /igitalisation key aspects. A session was dedicated to presentations of each type of actors' views on digitalisation of monitoring topics and the way it can help in decision making. A roundtable was then organised to exchange views between the different actors' visions.
- A discussion dedicated to the link between confidence, trust and monitoring, based on a presentation prepared by Subtask 2.5 gathering elements coming from IAEA TECDOC 1208, the sociologist Niklas Luhmann's theory and two other workshops: ICS workshop n  4 held in Fontainebleau (near Paris) on 24-25 May 2023 and ICS workshop n  5 held in Brussels on 18-19 October 2023. These two workshops were organised in the frame of EURAD ICS activities and have gathered views from members of civil society on this specific topic.

Agenda of the workshop - further details in appendix C.3

First Half Day: Technical visit of T       monitoring system

Second Half Day: PEP game session

Third Half Day:

- Panorama of monitoring & digitalisation key aspects
- Presentation of each type of actors' views
- Presentation of an interactive monitoring tool

Fourth Half Day :

- Monitoring, digitalisation and trust building conditions
- PEP restitution
- Presentation on trust-building
- Discussion and conclusion

#### Topics discussed in the seminar

The presentations, the discussions and the PEP game were framed by one global question:

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<sup>15</sup> For further details and reflexive elements about PEP, see part 5.1 of this present document.



How digitalisation and monitoring systems in the different contexts of DGR projects can contribute to a larger strategy of uncertainty management enabling trust-building processes in all phases?

These questions led to discussions about various topics such as : the meaning of the repository, the link with safety, the link between data and models, the issues and methods of data and knowledge management, knowledge management, uncertainties and confidence, pluralism in the process, transparency and public participation, the link with civil society, and the dynamics of the repository with the different phases and the issues of time scales.

#### 4.3.2 Synthetic evaluation

The details of the evaluation of this workshop based on the 9 criteria evaluation grid can be found in Appendix C.3.

This workshop was organised to enhance the exchanges between all actors (“3+1”). In a sense, the methodology used, based on four elements to conduct a variety of inquiries, helped achieve this objective through a sociotechnical approach of monitoring issues:

- The technical visit that started the workshop, that was oriented through the safety of the national territory, was a great opportunity to both entrench the workshop in concrete territorial issues and to openly discuss hot topics;
- The specific PEP game that was created for this event created a safe space to discuss specific topics regarding monitoring and digitalisation;
- The pluralistic discussion with a common framework, based on a simple method of a round table, enabled open exchanges between all participants;
- The issues of confidence and trust and the presentation of the visualisation tool created a concern about common issues that led to fruitful discussions.

Moreover, all the transversal discussions that took place concerning the issues of confidence, intergenerational transmission, transparency, democratic and social issues, etc. were settled on an equal footing and helped go beyond the institutional gap between experts and non-experts.

Having a specific PEP was really fruitful: many precise and global issues were tackled during and after the game session. For this reason, creating specific cards and boards should be envisaged more often in the future workshops or seminars.

However, even if the exchanges that occurred in this workshop can be considered fruitful, the proposed common framework of uncertainty management did not play a crucial role, as the different visions of this might not have been as shared as expected.

Compared to the previous “3+1” dialogue workshop (Nancy, 2023), two improvements can be noticed:

- Starting the workshop with a technical visit helps entrench the discussion in concrete issues and orientates the whole workshop towards a more fruitful path.
- Not frontally framing the workshop with the safety case reduces the dichotomy between experts and non-experts. This workshop was organised with a variety of sessions that were less based on institutional distinctions thanks to a less “expert” framework.

## 5. Reflexive elements

### 5.1 Pathway Evaluation Process

#### 5.1.1 What is the PEP?

The PEP methodology is the core instrument that was used for implementing the multi-party dialogue in MODATS workshops and UMAN seminars. This methodology has been developed within the SITEX II project (2015-2017). It is based on a “serious game” enabling a multi-stakeholder discussion on radioactive waste management issues. The main goal of the PEP is not to identify one solution as better than another. The PEP objective is to identify and discuss issues that are important to the various stakeholders (including civil society), in the context of the investigated RWM “Pathways” over a timescale of several generations.

The PEP tools are composed of cards and boards, representing different types of strategies or “pathways” to manage the waste until a “safe terminus”: a safe situation that does not require human intervention. There are two sets of cards: the events cards describing events or/and uncertainties that could challenge the pathways and the evaluation criteria cards that are questions enabling to orient the discussions. The PEP methodology invites the participants to frame the discussion by building their own practical cases (using one event card and two criteria cards). The discussion around a practical case is structured in two rounds of discussions. After the first round, the participant that suggested the practical case synthesised what he/she heard from the others. A second round of discussion is organised to give the possibility to all the participants to add additional comments and react to what they heard from the other participants. During the two rounds of discussions, every participant is invited to speak, one after the other, without being interrupted. The facilitator ensures an equal speaking time for each participant. As it is a quite demanding methodology (participants have to listen carefully to what the others say and wait their turn to be able to express their views and react to the other viewpoints), the PEP methodology needs to be applied in small groups of 4-6 participants and animated by a facilitator accustomed with the methodology.

Specific PEP tools were developed for specific events, such as the MODATS workshop in Paris, evaluated here in section 4.3. Developing these specific boards and cards is crucial: it gives all participants a common basis on which they can rely to discuss issues they identified before or during the game. Several PEP tools exist and are disseminated under the frame of the SITEX network. A comprehensive presentation of this methodology is also available on the EURAD website: <https://euradschool.eu/event/II15/>

#### 5.1.2 A tool for fruitful interaction

The PEP was designed as a tool to enhance dialogue. Since its beginning, it was developed, specified, improved, following this simple rule: it must be used to create fruitful interactions on specific issues. The evaluation of the workshops and seminar during which this tool was used and a global reflection on the role of the PEP through the five years of EURAD showed that this goal seems to have been reached, through several guidelines: building a safe place for dialogue; co-constructing the dialogue frame; ensuring the “global picture”; creating a real legitimacy of the ability to express different views, expression on the same footing; collecting views of the different actors and presenting results in a dynamic format.

##### 5.1.2.1 Building a safe place for dialogue

To ensure good exchanges during a multi-party dialogue, it is needed to elaborate a space where the participants can exchange safely, with respect towards the other participants and without pressure of any kind.

The use of the PEP during workshops and seminars is based on rules that ensure a safe space. As it was described in the PEP methodology (see above), each participant has to listen to the others and has to express his/her views. It is quite demanding because some participants are at ease to express their views and share their knowledge and others are more reluctant or uncomfortable orally. It is why the role of mediator is essential in the PEP session. In EURAD, the double-wing model was used to generate this safe space: the CS experts were mediators between the researchers and civil society participants and helped facilitate the discussion. The different actors trusted them to ensure the safe space and they were accustomed with the PEP methodology.

It is also important to note that during the different PEP sessions, the actors were invited to speak freely, not as a member of an organisation but rather as a person concerned by the topics addressed. The results of PEP sessions cannot be transferred to global or generic statements of what must be done, but they provide an input that helps the participants to better understand the other participants. It is also the reason why the collection of results of the multi-party dialogue do not bring verbatim with names associated to opinions that have been expressed. It ensures the anonymity of the data collected.

#### 5.1.2.2 Co-constructing of the dialogue frame

A second important element is the co-construction of the dialogue frame. If the topics that could or could not be discussed are chosen before the discussion, it would lead to frustrations and risk failure to build fruitful interactions. It is also not a way to ensure a fruitful contribution of civil society and multi-party dialogue to the research. It is important to let range for different views to be expressed and duly considered. The PEP sessions during workshops and seminars were driven by this consideration: for instance, the specific PEP tools that were created for specific events were designed by previously collecting the views of all actors.

#### 5.1.2.3 Ensuring the “global picture”

The PEP is a tool that helps participants keep the global picture of geological disposals and not focus on very specific points. It helps decompartmentalise the technical discussions and to have a permanent link with safety (that is the goal of GDF). It forces participants to put technical results of research in this more generic context of safety. To ensure this global picture, the PEP cards are designed with a socio-technical perspective, including non-technical considerations (governance, financial, ethical, political issues) into the technical decisions. To consider GD monitoring in all dimensions (and not only in silo of technical perspectives), to have embedded discussions is the better way to build a mutual understanding of the issues at stake. It is also a way to improve the quality of the results by giving a real added value to the multi-party dialogue.

#### 5.1.2.4 Creating a real legitimacy of the ability to express different views, expression on the same footing

Considering GDF in a global perspective requires establishing the legitimacy of expressing the different perspectives involved in the process. The PEP methodology allows participants to frame the discussion with the perspective to have expressions of different perspectives on the same footing. It does not mean that non-technicians are as well qualified as researchers in their field of research but that the different views are legitimate to be expressed. This rule is important to ensure the quality of dialogue. Having experts presenting their results from a podium is a passive way to exchange information. ICS methodology in EURAD and notably in MODATS tried to develop a more active and dynamic way, notably through the use of the PEP tool. In addition to that, pluralism of views can let participants have new perspectives they did not have thought of before.

#### 5.1.2.5 Collecting views of the different actors and presenting results in a dynamic format

The PEP tool seems to be a way to collect views of diversity of issues. The different events and processes evaluated in this deliverable showed that it is helpful to go beyond unilateral interactions: having a technical presentation given by an expert to an audience sitting and listening and asking questions at the end. The PEP follows a more dynamic approach having exchanges on the same footing,

each participant being invited to bring an input to the discussion. Civil society cannot have a similar contribution to the technical topics as the technical experts have. However, civil society always has elements to give regarding conditions for trust and to bring complementary views to technical expertise that could improve the quality of results. Members of the public can bring a different way of thinking that would be useful to consider in a comprehensive approach, by including members of the public in face-to-face discussions trust can be built, and it may lead to technical experts improving the way that they explain their concepts. This demands a certain reflexivity on governance, in the spirit of a shared safety culture and mutual understanding.

### 5.1.3 An embodiment of the evaluation grid

These five synthetic elements that were extracted as global guidelines that have led the development of the PEP through EURAD are closely linked to the nine criteria of the evaluation grid. Indeed, the legitimacy, the methodology, the personal unity and the postural changes criteria can be linked to the “building a safe space for dialogue” and “creating a real legitimacy of the ability to express different views on the same footing” guideline; methodology and expertise function with co-constructing the dialogue frame; meaning of the repository, territory, shared complexity and addressing the long-term with ensuring the global picture; etc.

These two sets of elements are not isomorphic and are not supposed to be. However, it is crucial to notice the strong links that exist, for the PEP was developed for fruitful interactions by creating a safe place to let everyone express their views on the same footing on global or specific complex issues. The PEP embodies the spirit of the grid. It is no coincidence that the PEP and the evaluation grid are so close: they influence each other, with the same concerns of having to create and capture fruitful interactions.

## 5.2 Overall assessment of the evaluation grid

The evaluation of the interactions between the scientific experts and the civil society’s actors is not an easy task if one seeks to go beyond the standard quantitative assessment and thus to take into consideration some more qualitative aspects.

In the quantitative approach, it is common for the evaluation to account for several points: the number of interactions and participants, the frequency and duration of speech for each actor, the recurrence or reiteration of such or such word or topic in his or her speech. This kind of method is certainly useful to get a precise view on the level of deliberation and participation of the actors within a group. But we assumed since the very beginning in the EURAD project that the operations of counting, though possibly informative, were not sufficient for the sake of evaluation of the dynamics of interactions. For instance, the importance and the relevance of a speech content is not necessarily proportionate with the speech frequency or duration: one actor can speak for an hour and say nothing special ; conversely, he or she can speak five minutes and provide some very essential remarks, comments and suggestions.

The team in charge of evaluating the interactions was concerned above all with the objective of providing a more elaborated account of several aspects of the interactions that relates to some thematic key points in the RWM. The focus on the qualitative approach led us to define a series of criteria of evaluation that have grown in accuracy and consistency gradually as they were put to the test through several actual interactions. It must be said that, in our methodological frame, the EURAD programme was an opportunity to evaluate the quality of the Experts-Society interactions in the field of RWM. But it was also an opportunity to get feedback on the criteria themselves, and especially on their relevance as levers for drawing attention to some meaningful critical issues for the various actors.

In this respect, it was interesting and useful to consider the gradual nature of the processes and of the experts-civil society interactions they allow for. Several tools have been proposed to characterise the

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degree of dialogue and democracy of a policy, among which is the interesting track of a dialogical gradient and a democratic gradient. They were supplemented by a gradient of the commons which indicates the degree of sharing and cooperation in the interaction relationship between expertise and society.

Thus, dialogue is distributed according to a “gradient of dialogue”, which goes from non-dialogical to “practical” and “theoretical” dialogue, or if one prefers it, from dispute to investigation.<sup>16</sup> This can be illustrated by the following Table 2:

Non-dialogical (with or without common code)			'Practical' Dialogue (concertation)			'Theoretical' Dialogue (discussion)		
Disagreement	Dispute	Contradictory Discussion	Directed Interview	Negotiation	Deliberation	Debate	Controversy	Inquiry

*Table 2 – Gradient of dialogue*

We can add the ‘gradient of democracy’ which highlights the degree of participation of citizens in power, moving from non-democratic to ‘weak’ and then ‘strong’ democracy, i.e. from manipulation to citizen control<sup>17</sup>. This can be illustrated by the following Table 3:

Non-democratic (absence of participation)		'Weak' Democracy (symbolic cooperation)			'Strong' Democracy (citizen power)		
Manipulation	Education	Information	Consultation	Implication	Partnership	Delegation	Citizen Control

<sup>16</sup> Corroyer, G. (2016): Le dialogisme avant le dialogue, in Lavelle S., Lefevre R., & Legris M., *Critiques du dialogue*. Lille, Presses Universitaires du Septentrion.

<sup>17</sup> Arnstein, S. (1969): A ladder of citizen participation, *Journal of the American Institute of Planners*, vol. 35, n°4.

*Table 3 - Gradient of democracy*

Finally, it can be supplemented by a 'gradient of the common' which indicates, beyond discussion and participation, the degree of sharing and cooperation of the various actors, from the non-common to syntony, synergy and symbiosis.<sup>18</sup> This can be illustrated by the following Table 4:

Non-common (no sharing, no cooperation)		Syntony (mutual agreement)		Synergy (cooperative work)		Symbiosis (daily life)	
Conflict of interests	Difference of views	Understanding of others	Sharing of positions	Coordination	Cooperation	Community of existence	Friendliness

*Table 4 - Gradient of the common*

All these criteria (dialogue, democracy, common) made it possible to give an overview of the degree of depth in the work of common inquiry (or cooperative research) as achieved by experts and civil society members. But it remained a general qualification aimed at spotting the degree of interactivity in the relationship, and we needed to give a kind of thematic content to the actual interactions that occurred within the specific field of RWM.

We also elaborated several criteria that we focused on for the sake of evaluation of what we termed 'fruitful interactions'. These criteria were the following:

- Legitimacy
- Methodology
- Postural changes
- Personal unity
- Expertise function
- Meaning of the repository
- Territory
- Shared complexity
- Addressing the long term

During the study, we were asked by the actors themselves to provide a sort of translation of these criteria that would allow them an easier access to the evaluation of the interactions. We attempted to sketch out

<sup>18</sup> Lavelle, S. (2021): Les communs à l'épreuve du Système, in Bourcier D. et al., *Dynamiques du Commun*, Paris, Editions de la Sorbonne.



in a more applied way the overall picture of what fruitful expert-civil society interactions would imply and then emphasised the following points and conditions. This more applied understanding of the criteria can be found in this present document in part 1.2.

This grid of criteria endeavours to make the implicit focal points of what fruitful interactions in the field of RWM are as explicit as possible. But its application to several work packages (ROUTES, MODATS, UMAN...) and to several meetings (especially ICS meetings) has driven us to raise some interesting questions relating to the effects and the uses of that method for the study of interactions.

The first remark concerns the criteria themselves and suggests that they should be used as a set of potential indexes, the relevance of which would depend on the event and its context. It appeared quite clearly indeed that not all the criteria were equivalent for the evaluation of interactions and that they functioned as a sort of 'Geiger counter'. They were like a revealer of the level of interactivity of one given meeting, to be compared with that of another meeting, thus enabling to specify the profile of an interaction as fruitful to some extent. Thus, the grid of criteria can be viewed in retrospect as a kind of both generic and specific canvass for the study of the interactions with the civil society in the field of RWM. This point means that it cannot be used or applied blindly regardless of the complexities of situations, and its evaluative power lies precisely in its ability to grasp the always singular profile of one interaction.

The second remark concerns the facilitation tools used during the meetings and the way they took into consideration the specific context of interaction for each case. It can be stated that the facilitation tools covered a wide range of options, from the rather classical academic presentations to the less classical sessions based on the serious games and the Word Café. An interesting point that can be drawn from these experiences is the necessity for adapting the tool and for always keeping in mind the function or the aim of using a certain tool in a certain context. That was the case, as an example, for one of the ICS sessions when the organisers in charge of fixing the rules of the World Café (a dynamic method based on permutation of working groups on such or such topic in short time slots) introduced some changes in its design. They thus decided to modify the procedure of the session not long before it starts for it to be more in tune with the actors' way of functioning in an on-line participation. Another example is the use of a quite innovative tool for an interactive process in the field of RWM that highlighted the possibility of another means of expression, namely an artistic creation. It was not obvious that this challenging option would be successful, but it happened that the actors appropriated it rather easily, probably because this creative instrument was more adapted in the context to experiment on the imagination of the future.

The third remark concerns the role of time in the dialogue-building process, which is also linked to the other stake of the community-building. It appeared that the time factor has been essential all along the process of interactions for the building of trust among the different actors of the community of inquiry. The interactions between the scientific experts and the civil society representatives were not continuous, but the quality of interactions at each meeting would shape the overall trend of the five years process. In this respect, it is certainly useless to place too many expectations or hopes in a one-off event if the trust between the actors is not confirmed regularly over a long period. What happened in EURAD throughout the project lends credence to the common adage that "trust is long and hard to build" (one could add: "and quick and easy to destroy") all the more so if the interactions between the actors are not continuous and their quality is not satisfying.

The fourth remark concerns the need for translation to be understood in a broad sense that goes beyond the mere linguistic operation of transferring one language into another one. It can be drawn from the interactive processes during the meetings that for the use of criteria to be successful among the community of actors, a common language is needed. This need is not about speaking the same idiom (English, or French, or German, and so on) but about sharing a common "frame of meaning" that opens possibilities for mutual understanding and further for mutual acceptance (which is not the same thing). It can be shown that an initial or inaugural translation at the outset of the project, though a useful input, is certainly a necessary condition, but not a sufficient one. In fact, the process of translation in the broad

sense is called for being multifaceted, demand-adaptive and context-sensitive in order to produce the common ground on which to build up some fruitful interactions. The translating operations proceed from a hermeneutical work of co-construction of some shared meanings, both linguistic and social-cultural, that requires, beyond the “displacement of concepts”<sup>19</sup>, a displacement of stances and frames.

The fifth remark concerns the evolution of the community of inquiry that has moved from an epistemic community (a community of scientific-cognitive agents) to a kind of ethical community (a community of moral-normative agents). The notion of epistemic community that goes along with that of “epistemic culture”<sup>20</sup> is so to say the natural stance of a common work out on the production of knowledge. Any group of actors, whether in the field of RWM or in any other field, the members of which take part in a cooperative research form an epistemic community and aims at producing an enhanced knowledge whether about scientific facts or models. In the EURAD process, through reiterate interactions and translations, an ethical community emerged gradually and took over some related issues implying moral values and norms. As compared to the epistemic community that was rather explicit in its mission, the ethical community remained implicit. It is fair to say that some presentations during the meetings were openly of an ethical nature, but it is another thing for one group of actors to be able to share some common values.

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<sup>19</sup> Schon, D.A. (Ed.). (1963): *Displacement of Concepts* (1st ed.). Routledge. <https://doi.org/10.4324/9781315014111>

<sup>20</sup> Cetina, K. K. (1999): *Epistemic Cultures: How the Sciences Make Knowledge*. Harvard University Press. <https://doi.org/10.2307/j.ctvxw3q7f>



## Conclusion

The experimental model of interactions between EURAD participants and civil society, based on the double-wing model, is not an easy object to evaluate. A quantitative assessment, that would only account for numbers of participants of workshops, would miss the crucial details of the quality of exchanges in these human interactions that are so difficult to grasp. Conversely, specific qualitative descriptions of each event could miss the opportunity to easily compare different ones.

The creation of this evaluation grid aimed at going beyond this dichotomy, providing a systematic elaborated account of several aspects of the interactions that relates to some thematic key points in the RWM. The developed criteria aim at providing a synthesis between different methods of evaluations, with a special focus on the quality and the dynamics of interactions, under the common name of “fruitful interactions”. This grid relies on nine elements or criteria: Legitimacy, Methodology, Postural changes, Personal unity, Expertise function, Meaning of the repository, Territory, Shared complexity, and Addressing the long term.

Evaluating the ICS workshops, the ICS within strategic studies and within technical WPs with this grid has shown very positive results regarding the fruitfulness of interactions. This grid also makes it possible to have a basis on which comparing these events or processes, and comparing them, based on the criteria that were filled the most or were not, helps understand the differences between these events and grasp the dynamics of ICS in EURAD. It reveals the level of interactivity of the evaluated item, to be compared with that of another one, thus enabling to specify the profile of an interaction as fruitful to some extent.

However, these evaluation criteria do not aim at creating a formal objective grid and should not be used regardless of the complexity of each situation: their evaluative power lies precisely in their ability to grasp the always singular profile of the evaluated interaction. This grid, whose different elements are neither equivalent in importance, nor independent, nor exhaustive, offers a framework that intertwines generic and specific aspects. It tries to make explicit the implicit key aspects on which rely the possibility of fruitful interactions. And by doing so, this grid has an autopoietic (self-generating) goal of changing the mental and material frameworks of future interactions.

These evaluations showed the importance of trust between participants: evaluating elements all along the EURAD programme illustrate the dynamics of the constitution of stronger links between members, the better understanding of each other, and the creation of shared frameworks, that pave the way for more fruitful interactions between them.

Evaluating the fruitfulness of interactions with civil society has also revealed that this fruitfulness often relies on some key elements that were developed in this deliverables: the facilitation tools, and especially the PEP; the long-term perspective of interactions, in which it is possible to observe a real dynamics of interactions and the constitution of a community; the need for a mutual understanding and the linked work to “translate” the issues in all their complexity.

## Appendix A. Detailed evaluation of ICS workshops

### 1. Application of the evaluation grid to ICS workshop n°4

#### Agenda of the workshop

Wednesday, 24 May 2023

**Beginning at 9h30 :** Welcoming and feedback from EURAD annual event - Nadja Železnik, NTW/EIMV

**Morning : Technical WPs session - 9h45 to 12h30 with a break**

- MODATS : outcomes from last workshop and perspectives on the next one - by task 2.5 team
- CORI-UMAN-ICS : Position paper and works - Alexis Geisler-Roblin
- ACED by Laurent de Windt, Ecole des Mines
- MAGIC by Nicolas Seigneur, Ecole des Mines

**Lunch : 12h30 to 14h**

**Afternoon : UMAN session - 14h to 17h30**

Part 1 - Deliverable D10.17 on pluralistic methods for uncertainty assessment describes the lessons learned in the UMAN process. We will present key messages, conclusions and recommendations from the points of views of the CS UMAN experts.

- Presentation of the results (20 to 30 minutes) - Julien Dewoghélaëre, Gabriele Mraz, Niels Henrik Hooge
- Structured panel discussion (40 minutes)

Part 2 - Outlook on near-field uncertainties (topic for Seminar 5). - Animation by Julien Dewoghélaëre

- Presentation on the identified methodologies for pluralistic assessment of near-field - Gauthier Fontaine (15 minutes -20 minutes)
- Brainstorming discussion + Discussion on two questions (40 minutes)

Thursday, 25 May 2023

**Morning : ROUTES session – 9h to 12h**

- D9.17 : Short overview of main outcomes from the report devoted to transparency in establishment of national radioactive waste facilities. - Animation by Malcolm de Butler and Nadja Zelenik
- D9.18 : focus on how to assure T&PP in RWM technical issues, and how to assure long-term governance. Ongoing ideas, should be a draft at that time.

Method : discuss cases. This is described in the detailed agenda of this session, other document.

**Lunch: 12h to 14h00**

**Afternoon: Special session on disseminating and using the EURAD results**

In this session, we invite the participants to reflect on further use of the EURAD results that have been presented in the last 1.5 days.

Method : World Café: participants will have the possibility to visit every table/station and give their thoughts and react to inputs of others in an open discussion. For participants taking part online, separate stations/tables will be offered.

- Table 1: Dissemination. - Niels Henrik Hooge  
How do you intend to use EURAD results in your work in your countries? How should we disseminate

## EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

EURAD results to the interested European public?

- Table 2: Cooperation and fruitful interactions with other colleges. - Alexis Geisler-Roblin  
What are conditions for fruitful interactions in a research programme such as EURAD ? Following the outcomes of task 8.3.
- Table 3: Reflections on the participation of CS groups in EURAD. - Julien Dewoghélaère  
How can we attract CS experts to work in the EURAD project? How to engage more CS larger group members ? What should we do differently in future collaborations? What are good practices in research in regard to EURAD results if we want to involve CS ?

A short summary of main topics that have been discussed at each station/table will be presented and discussed.

17h00 **Conclusions and next steps**

17:30 **End of the ICS workshop**

### a. Legitimacy

Statement :

**Fruitful interactions necessitate legitimate processes in which all actors can dialog on the same footing.**

Indicators :

- Recognition -or not- of legitimacy (from one to another, by speech and statutes)
- Legitimacy affirmation -or not- (from someone for him/herself, affirmation or revendication)
- Symmetry/di-symmetry of actors (right to speak, time of speak, right to take the floor, to frame the debates, inclusivity, ...)

Evaluation :

The Fontainebleau ICS meeting was a satisfying event as regards the position of legitimacy of the multiple actors who took part in the expert-civil society interactions. The salient point in that meeting is that legitimacy of the cooperative approach was no longer needed to be shown to each of the technical WP's. Then it allowed for developing more encompassing views that would result, through a reflexive process of bridging the various processes, in some insightful cross-cutting interpretations. The limited size of the audience was adapted for closer interactions, nevertheless there was a variety of professional, social and cultural profiles in the sessions that fostered the quality and the relevance of the dialogue. All the participants without any exception were recognized as full partners of the discussions, whether they are scientists, engineers, activists or citizens. This can be shown by the multiple opportunities given to any of them to present their works or to voice their claims through many accounts, comments and suggestions. That was the case for the people who were present in the room as well as for the people who were attending the meeting on-line and could interfere in the discussions. It can be noted that the scientific experts who hosted that event at the School of Mines and presented their work in several projects (eg : ACED, MAGIC) appropriated the cooperative functioning of the meeting without any difficulty. Another point is the variety of the modalities of interactions (academic presentations, 'world café'...) that offered several occasions for the contributors to express their views in the most appropriate way. In this respect, there was a real symmetry between the participants as to the right to speak, the time allocated for it, the ability to frame the debate, and so on. One can then state that there was no permanent or recurrent questioning as to the legitimacy of the actors taking part in the cooperative process or research. There was no accusation or reproach that some of them are not

trained or not competent enough, or that they belong to an institution or an organisation that is supporting other different positions.

## **b. Methodology**

### Statement :

**Fruitful interactions require that a community is able to conduct a variety of inquiries (scientific, moral, social).**

### Indicators :

- Cooperative research, co-construction of interpretations and scenarios (contextualised cases)
- Degree of critical pluralism: Taking into account the variety of rationalities (scientific, moral, and social views together)
- Consideration of safety case and safety assessment as dialectic places/dialogues
- Highlighting the specificity of long-term knowledge and management

### Evaluation :

The sessions in Fontainebleau were also a source of satisfaction regarding some aspects of the methodology of research that seeks to meet the requirement of pluralism. A variety of inquiries were conducted and achieved during the sessions dedicated to the projects (UMAN, ROUTES, ACED, MAGIC). It can be said that they successfully bridged the gap between some descriptive and some more prescriptive research ('from presentations to recommendations'). Firstly, the presentations focused on some scientific aspects of the problem, then the discussions with the audience enabled participants to make the link with some moral or societal aspects of it. Secondly, in parallel sessions with the participants present in the room and the others present online, the inquiry moved to investigating and elaborating a set of recommendations, from the generic ones to the more specific ones. Some of them were addressed to the general audience, some other ones to the EU institutions, to some international organisations, to the decision-makers, and so on. The requirement of pluralism in the methodology was also met in the outcome of the inquiries since they resulted in the elaboration of a new general framework for Radioactive Waste Management in the future. This kind of common achievement calling for a re-shaping of the methodological approach to the nuclear wastes is surely the most satisfying outcome that one can expect ever from a process of cooperative research. So it can be said that the inquiries and researches were conducted by a variety of actors and were not restricted in an exclusive manner to a single type of research (eg : scientific inquiry). They gave room and could open up to some other types of research (eg : moral and social inquiry) that are concerned not only with facts or models, but with values and norms.

## **c. Postural changes**

### Statement :

**Fruitful interactions depend on the capacity of all actors to encompass others' views and to enlarge their initial perspective.**

Indicators :

- Consideration of political and organisational tools for changes (Pathway Evaluation Process, special events, associations, commons, ...)
- Taking into account the role of socio-technical imaginaries (background assumptions: ontological, cosmological, epistemological, ethical, ...)
- Changes in the opening and acceptance of other types of rationalities (not only scientific)

Evaluation :

In the sessions, we noted several postural changes of the actors that were probably encouraged by the type of interaction settings and tools. Nevertheless, we can also assume that the switching of some actors to another position is also due to their individual and collective ability to stand in a different perspective. On this point, it can be noted that the scientific experts showed an attitude of genuine open-mindedness that was very encouraging and stimulating for the other participants from the civil society. One can be reluctant to mention some too trivial explanations for a successful event, but it can hardly be denied that the pleasant environment of the School of Mines could favour that feeling of personal ease and of mutual trust. The use of a variety of tools, from the classical presentation and discussion to the ‘World Café’ session, offered a wider range of means of expression. But the ‘World Café’ session also showed its limits, especially for the organisers who could not sufficiently stimulate the participants and then capture the whole scope of their insights and inputs. The good point is the actors taking part in the discussions could reach the stage of a common framework for a mutual understanding of the issues at stake. This mutual understanding could not be reached without an effort from each of the partners that would require from him or her to embrace a different way of approaching or framing a problem. That was quite conspicuous for the issue of the long-term management of radioactive wastes that entailed a raising interest on the ground that it appeared as a strategic stake to be tackled by the RWM. It can then be said that along the cooperative process or research the actors were not keeping to their initial position without any reservation and were able to modify their own perspective by taking into consideration the contributions of the other actors.

#### d. Personal unity

Statement :

**Fruitful interactions require from an actor that he or she takes into account the different dimensions of him/herself.**

Indicators :

- Personal dissonance/consonance with the institutional discourses/roles
- Personal expression markers: "off the record", I/we, self-censorship, ...
- Importance of professional and personal life shift: professional status and activity, socio-environmental activism, consciousness raising, ...

Evaluation :

The condition of personal unity appeared differently in the context of formal presentations or more informal conversations. In both cases, a certain balance was found between several status, functions and roles, and it demonstrated

almost no gap between institutional and personal roles. There was clearly an ability of the actors to come out of the professional / social status or label that is commonly associated with an individual or an institution. Several situations occurred, depending on the groups and persons: from the oral feedback after the working groups, the participations to the discussions were enriched with personal discourse and role. It showed a real capacity to bridge institutional roles with personal history and consciousness, although that was sometimes more tangible in some ‘off the record’ conversations. That was the case, for example, during some informal conversations with several scientific experts about the balance of power in the nuclear sector between the expertise agency and the safety agency. The scientists could in this context express their concern for the independence of the RWM expertise and their wish as citizens that this independence should be preserved in the future. It also appeared, perhaps in a more salient way, that the tools used to foster the interactions between the experts and the civil society are not magic devices and depend for them to be effective on the ‘good will’ of the participants. One can state that the actors did not view themselves or were not viewed by the other actors as individuals that are exclusively defined by their official or professional function or activity. They showed that they could articulate several aspects of his/her personality or his/her social role (eg : a worker, a professional, a citizen, a parent...).

#### **e. Expertise function**

##### Statement :

**Fruitful interactions require a pluralistic expertise that therefore cannot be reduced to a sole scientific process.**

##### Indicators :

- Role and cooperation with non-experts, non-scientific experts, and counter-experts: co-expertise
- Evolution of the expertise function along the processes, recognition of this evolution by experts themselves
- Consideration of pluralistic dialogue and institutional integration for better apprehension of complexity

##### Evaluation :

The expertise was fairly pluralistic during the ICS meeting sessions beyond the scientific inputs and it gave rise to an important range of interactions. It can be said that the expertise in the various projects (UMAN, ROUTES) as well as in the ICS process itself has now become more visible and has reached a mature stage. One can state that the sessions raised a high level of interactivity among the actors, notably in the ROUTES project and also during the World Café session. The expertise went through a significant development on the key issue of the uncertainties, but beyond the socio-technical aspects, another type of interactive expertise also developed in terms of common reflexivity of the actors. This development merges with the process of bridging the multiple WP's in view of sustaining a cross-cutting understanding of the processes at stake. It is not an exaggeration to pretend that the working groups in a several years-long cooperation were successful in building a genuine community of inquiry. It is not doubtful that the interactions were fruitful thanks to the pluralistic expertise that produced not only scientific, but also moral, legal, environmental or social investigations. It was also fruitful in the sense that the expertise was not only special, but also general as regards the capacity of linking up the various aspects and dimensions of a complex problem.

## f. Meaning of the repository

### Statement :

**Fruitful interactions include exchanges on the meaning of the existence of repository in the concrete life of people.**

### Indicators :

- Integration of plurality of meanings beyond the efficiency of technical concepts
- Appropriation of the site of repository by the population: activities and projects in addition to RWM
- Considering the significance of intergenerational safety
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)

### Evaluation :

It appeared that, during the Fontainebleau workshop, the interactions developed in an interesting and constructive way about the meaning of a repository. The discussion on the monitoring turned out to be a discussion on the meaning of the monitoring, which did not preclude any difference in the judgement. Indeed, you may not share the same vision, but still have the same will to discuss the meaning and to cooperate with other actors in order to give a meaning to a repository, like in MODATS. The ICS meeting precisely offered the opportunity to raise this issue, but its fair evaluation implies that one pays attention to the scope of meanings that were then expressed.

In the light of the discussions, it is also fair to admit that the process is in fact a set of paths, rather than a mere ‘one best way’, and that it can lead by means of some almost ‘mechanical’ evolutions to providing several meanings. The important point is that the discussion on the meaning of a repository led to a sort of ‘meta-framing’ that could give room for the examination of some cross-cutting issues. One of them, that particularly drew attention of the group members, is that of intergenerational safety. On the whole, the interactions were fruitful insofar as, beyond the sole technical aspects of the building, the monitoring or the maintaining a waste repository, they also addressed the crucial issue of its (existential, cultural...) meaning for/in the life of the people.

## g. Territory

### Statement :

**Fruitful interactions must take into account the deep impact of a geological disposal on the meaning people give to their life in a territory.**

### Indicators :

- Integration of the repository into landscapes and territory life
- Reference to local problematics, questionings, and claims
- Recognition of legitimacy of local consensus and dissensus
- Scopes of the territory. Role of multiple organisations and scale: local, regional, European, associations, ...

### Evaluation :



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An important outcome of the Fontainebleau meeting was the actual implementation of the Triple Wing model of interactions that differs from the Double Wing in its attention to the territory and the population. The Triple Wing model was referred to within the World Café sessions, and the issue of the territory was tackled in several cases in ROUTES. The important point is that, if compared to some other speculative exercises, the cases examined by the group of actors during the sessions were a set of territorial cases. The interactions were fruitful for it was admitted by the actors that, far from being a neutral installation, a repository has a deep impact on the meaning that the people give to a territory. And as an installation, it also impacts the life that the inhabitants and the local residents can experience in relation to it, due to the modification of the landscape, the traffic and the transportation of materials, or the security and safety measures.

### h. Shared complexity

#### Statement :

**Fruitful interactions necessitate to address the complexity of the issues (technical and non-technical) linked with geological disposal.**

#### Indicators :

- Multinational and intergenerational perspectives
- Considering institutions as dynamic structures towards apprehension of complexity
- Contribution and relevance of scientific expertise to safety issues. Development of safety culture.

#### Evaluation :

The Fontainebleau meeting brought about several progresses or achievements relating to the notion of shared complexity. Among them, the management of uncertainties was given special attention in the discussions, and it was related to the examination of several national cases. But, certainly, one of the important achievements on this point was the ability of the participants to bridge the different projects in view of reaching an overall understanding of them. In addition to that, some elements of the two further PEP (Pathway Evaluation Process - serious games for interaction) were considered and finally led to the elaboration of two serious games: the first one occurred in October 2023, and the second one occurred in December 2023. More precisely, the meeting in Fontainebleau was the moment that enabled the production of the PEP maps for the achievement of the serious game. So, it can be said that the interactions were fruitful for the actors were able to address the various aspects and dimensions of a complex problem, even if, while providing a common understanding, it didn't lead immediately to a common ground or background.

### i. Addressing the long term

#### Statement :

**Fruitful interactions cannot be meaningfully achieved without an intergenerational perspective, given the extreme timescales.**

#### Indicators :

- Considerations about intergenerational governance and interactions (more than education)
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)
- Articulation of timescales (past, present, future) at the levels of reflection and actions.

Evaluation :

The issue of the long term is always discussed in the ICS meetings, but it was given less attention in Fontainebleau (if compared with the further ICS meeting in Brussels). The intergenerational governance could be interpreted as putting in question the governance of the nuclear wastes in the future.

The Fontainebleau workshop didn't deal with all the subjects, but at least, there was no wrong note, and one can state that there was even a kind of positive seesaw as far as stakeholder's interactions are concerned. Indeed, we could notice the actor's relationship had reached a good level of mutual confidence, and this made them feel at ease in the production of common outcomes. On the one hand, it allowed them to step over the usual pitfalls of dealing with different compartments of knowledge, action and experience; on the other hand, that meeting could meet the requirements of the EU Commission which expects the projects to build relationships between the different Work Packages. Thus, the interactions were fruitful insofar as, while not putting at the centre the question of the long term, it did not neglect the core stakes of the long-term management, of justice and the responsibility towards future generations.

## **2. Application of the evaluation grid to ICS workshop n°5**

### Agenda of the workshop

Wednesday, 18th October 2023

#### **Introduction on ICS in EURAD - 14h to 14h30**

- Welcoming - Nadja Železnik (NTW/EIMV)
- What has been done in EURAD-1 related to ICS? - Nadja Železnik (NTW/EIMV), Julien Dewoghélaëre (NTW) and Alexis Geisler-Roblin (NTW)

#### **First session: Shared Culture for Safety and Security - 14h30 to 17h00**

- Introduction
- Elements on the concept based on UMAN results- Julien Dewoghélaëre (NTW) and Gabriele Mraz (NTW, Österreichisches Ökologie-Institut)

20 minutes Break

- SITEX.Network's vision on the topic - Maryna Surkova (FANC)
- Example of the German national case based on ROUTES results- Jan Haverkamp (NTW, Wise, Greenpeace) (tbc)
- Interactive room discussion, animated by Gabriele Mraz

Thursday, 19th October 2023

#### **Second session: Intergenerational Stewardship Culture - 9h30 to 12h15**

- Introduction to the topic and explanation of the creative process that will be implemented during this session – Alexis Geisler-Roblin and Gabriele Mraz
- ROUTES and UMAN fresh inputs on long-term engagement processes - Niels Henrik Hooge (NTW, NOAH)
- Finalization of creations by participants

20 minutes Break

- ROUTES presentations of Belgian and Swiss national cases – Malcolm de Butler (NTW)

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- Discussion on creations of participants

### Third session: Fruitful Interactions - 14h to 16h30

- Introduction on the topic
- How can the PEP be renewed and linked to new topics, as a continuous creation of an adequate framework? Recent work in MODATS and PEP cards creation - Julien Dewoghélaëre (NTW)
- How can the core concept of confidence structure the discussion in a technical WP? MODATS recent outcomes - Gauthier Fontaine (NTW)

20 minutes Break

- Evaluating the work done in EURAD. Presentation of methodologies and actions - Alexis Geisler-Roblin (NTW)
- Interactive co-evaluation discussion, structured by questions - Alexis Geisler-Roblin

### Conclusion session - 16h30 to 17h00

Conclusions and outcomes proposed - Nadja Zeleznik (EIMV/NTW)

#### a. Legitimacy

##### Statement :

**Fruitful interactions necessitate legitimate processes in which all actors can dialog on the same footing.**

##### Indicators :

- Recognition -or not- of legitimacy (from one to another, by speech and statutes)
- Legitimacy affirmation -or not- (from someone for him/herself, affirmation or claim)
- Symmetry/di-symmetry of actors (right to speak, time of speak, right to take the floor, to frame the debates, inclusivity, ...)

##### Evaluation :

During the Brussels's ICS meeting, the interactions among the group of actors were very satisfying as far as expressions of legitimacy are concerned. It appeared that the process of mutual recognition, after several years of exchanges and discussions, has now reached a degree of advancement that can be viewed as a mature stage. It can be said that this multi-actor interactive process developed over time and resulted in shaping a confidence-based community that can function in an almost optimal way. During the interactions in Brussels, there was indeed no questioning as to the legitimacy of the various actors who could then discuss freely about some complex issues. As an example, that was the case for the GEOSAF concept of safety envelope<sup>21</sup> that could be discussed through by the scientific experts and the civil society's representatives in a balanced relevant way. The only occasion for questioning the legitimacy was for one of them to present a narrative on a national case on behalf of the author of it who could not attend the meeting. Then despite mutual trust among the group of actors, there was still a reflex of fact-checking in the audience that led to questioning the validity of some facts and of some fact-sensitive interpretations. This attitude evidenced for the community's ability to keep a

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<sup>21</sup> During the period 2008-2011/7 the GEOSAF projects on the demonstration of safety of geological disposal were organized in the frame of IAEA. Notably in GEOSAF II was tackled the integration of operational safety and post-closure safety in the frame of an integrated safety case, and this project developed the concept of safety envelope. Further details at <https://www.iaea.org/sites/default/files/19/02/geosaf-3-draft-tor.pdf>

rigorous standard of assessment, while that event was perceived as a mere mistake, and not as a kind of intentional manipulation. In other words, the development of interactions occurring in the sessions showed that the common process equals in fact a continuous validation of legitimacy. One can state that the interactions were fruitful, for there was no permanent or recurrent questioning as to the legitimacy of the actors taking part in the cooperative process or research. There was no reproach that some of them are not trained or competent enough, or that they belong to an institution or an organisation that is supporting other different positions.

## **b. Methodology**

### Statement :

**Fruitful interactions require that a community is able to conduct a variety of inquiries (scientific, moral, social).**

### Indicators :

- Cooperative research, co-construction of interpretations and scenarios (contextualised cases)
- Degree of critical pluralism: Taking into account the variety of rationalities (scientific, moral, and social views together)
- Consideration of safety case and safety assessment as dialectic places/dialogues
- Highlighting the specificity of long-term knowledge and management

### Evaluation :

It is requested in a more comprehensive view on the methodology that it can give room for expression of several types of rationalities. This encompassing approach to the making of research enabled it to meet the requirement of critical pluralism and demonstrated its potential on several occasions that the actors could take up. The idea of an innovative tool based on creative drawings gave all the actors the opportunity to use on a symmetric basis a means of expression that is not bound to the usual forms of reasoning or arguing in a discussion. It enabled with help of imagination or fiction to picture the personal vision of the future (in the long term) as well as the path (with possibly the successive stages) leading to a certain state or situation. The exercise was much appreciated by the participants who praised this alternative creative way of dealing with the hardship of giving a more concrete account of what the future can be. The workshop was also a good example of how a safety culture can be implemented and of what can be suggested as to the appropriate method for tackling the issue of intergenerational relations in the future. The question of safety was dealt with in a dialectic way, through a pluralistic discussion, and it appeared that, while the partners don't necessarily give the same meaning to the concept of safety culture, they nevertheless have some commonalities. However, in terms of methodology, the discussion did not follow a well-defined plan, as shown by the developments that occurred the days after, sometimes outside the workshop. The important point that came out of this workshop is the necessity to work to bring together the different rationalities at stake. For the sake of it, it is not sufficient to present the research outcomes to all the attendees, for it also requires that they join (and jump, so to say, into) the community of inquiry. It remains that the interactions were fruitful insofar as the inquiries and researches were conducted by a variety of actors and were not restricted in an exclusive manner to a single type of research (eg : scientific inquiry). They gave room and could open up to some other types of research (eg : moral and social inquiry) that are concerned not only with facts or models, but with values and norms.

### c. Postural changes

#### Statement :

**Fruitful interactions depend on the capacity of all actors to encompass others' views and to enlarge their initial perspective.**

#### Indicators :

- Consideration of political and organisational tools for changes (Pathway Evaluation Process, special events, associations, commons, ...)
- Taking into account the role of socio-technical imaginaries (background assumptions: ontological, cosmological, epistemological, ethical, ...)
- Changes in the opening and acceptance of other types of rationalities (not only scientific)

#### Evaluation :

In the sessions, we noted several postural changes of the actors that were probably encouraged by the type of interaction settings and tools. The use of a variety of tools, from the classical presentation and discussion to the use of creative drawings offered a wider range of means of expression and could free the participant's imaginary abilities. The discussion as achieved on the basis of the MODATS' PEP was productive, and it can be stated that it brought about some interesting materials for a further framing of the problems. However, the postural change was particularly conspicuous through the examination of the rolling stewardship issue, with the switch from the rational to the imaginary approach encouraged by the using of a creative tool. It remains that some of the partners were not fully comfortable with this tool, and after a while, it was decided that an exhibition of the drawings should be set up. The good point is the actors taking part in the discussions could reach the stage of a common framework for a mutual understanding of the issues at stake. For several actors, it appeared along the interactive process that the issue of the safety is not only a national matter of concern, but also a genuine common (or commonality) that several countries can share. It can then be said that along the cooperative process or research the actors were not keeping to their initial position without any reservation and were able of modifying their own perspective by taking into consideration the contributions of the other actors.

### d. Personal unity

#### Statement :

**Fruitful interactions require from an actor that he or she takes into account the different dimensions of him/herself.**

#### Indicators :

- Personal dissonance/consonance with the institutional discourses/roles
- Personal expression markers: "off the record", I/we, self-censorship, ...
- Importance of professional and personal life shift: professional status and activity, socio-environmental activism, consciousness raising, ...

#### Evaluation :

## EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

It is not doubtful that the participants at the workshop in Brussels addressed the event at this stage of the project in a more relaxed way if we compare it to the first meetings. They could benefit from the process of confidence-building that has developed through the successive events over the years and then feel more comfortable in the interactions with the other group members. However, it was less easy for the observers during the sessions to evaluate the personal unity of the participants, for there was no obvious manifestation of coherence or incoherence in their behaviour. It can be noted that for the case presentations, some experts did not react by highlighting their professional identity, but also as concerned citizens. Nevertheless, the dividing line between the expert and the citizen remained for the ones who felt the obligation to behave in the case presentation according to a certain professional stance. That was the case for the issue of the safety culture in which the main argument line pushed the idea, very classical within the didactical paradigm (learning process framework), of a need for educating the civil society. The objection to that statement would elaborate on the complementary idea that an effort on education is also requested in the other way, from the citizens to the experts. In this respect, it was not salient that the interaction was fruitful in the sense that the actors did not view themselves or were not viewed by the other actors as individuals that are exclusively defined by their official or professional function or activity. And it was not the case for all of the participants that they could articulate several aspects of their personality or their social role.

### e. Expertise function

#### Statement :

**Fruitful interactions require a pluralistic expertise that therefore cannot be reduced to a sole scientific process.**

#### Indicators :

- Role and cooperation with non-experts, non-scientific experts, and counter-experts: co-expertise
- Evolution of the expertise function along the processes, recognition of this evolution by experts themselves
- Consideration of pluralistic dialogue and institutional integration for better apprehension of complexity

#### Evaluation :

During the workshop, the thematic choices and the frame of the meeting enabled to modify the expertise function so that it would not bind to a scientific approach to the problems. The examination of the national cases paid justice to the different actors and allowed for sharing a common story of the events that they have gone through. The issue of the rolling stewardship could be discussed through in a pluralistic way in Brussels, which gave the actors the opportunity to re-examine some ('cold') cases. That was quite salient also on the question of the intergenerational transfer and to a lesser extent on that of the safety culture. It appeared more clearly that the three topics (intergenerational governance, safety culture and rolling stewardship) could not be tackled but through a dynamic approach that can mirror their evolutionary process. This approach is precisely what will enable the research community at the end to conceive of the Radioactive Wastes Management itself in a more dynamic way. The combination of the socio-technical approach together with the dynamic approach provides an overall contribution that gives a different reflective view on the work of expertise. In this respect, it can be said that the interactions were fruitful insofar as the expertise was pluralistic and could link up the various aspects and dimensions of a complex problem.

### f. Meaning of the repository

#### Statement :

**Fruitful interactions include exchanges on the meaning of the existence of repository in the concrete life of people.**



Indicators :

- Integration of plurality of meanings beyond the efficiency of technical concepts
- Appropriation of the site of repository by the population: activities and projects in addition to RWM
- Considering the significance of intergenerational safety
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)

Evaluation :

The Brussels workshop was probably the first in the series of Eurad events that contributed in so decisive a way to sketching out a meaning for a repository. And it did so in the shape of an experimental process that used the method of creative drawings as an artistic tool for opening up the participants' views and enhancing their capacities. The use of this tool drove the actors to taking up a personal position, instead of keeping up to the more conventional corporate speech that is commonly a binding factor for the expression of thoughts. This standard speech is a fierce drawback if the individual and collective thought exercise revolves around the stake of building a meaning, which implies to combine some rational accounts and some more sensitive or existential stances.

It can be noted that the creation of a visual imaginary frame in order to question the meaning of a material device in a technical sector, such as that of the RWM, is not so common. But it is no doubt a powerful lever for breaking up the common frame and then contribute to conceive of some other socio-technical options grounded on an alternative imagination. It is somewhat a paradox that this exercise on imagination, so essential for whoever wishes to question the meaning of things, actually produced a 'reality effect' and draw the attention towards the 'lifeworld' of the people. In this respect, the interactions were fruitful in the examination of a problem and the exchanges between the actors that it entails can. Indeed, beyond the sole technical aspects of the building, the monitoring or the maintaining a wastes repository, they enabled to address the crucial issue of its (existential, cultural...) meaning for/in the life of the people.

## g. Territory

Statement :

**Fruitful interactions must take into account the deep impact of a geological disposal on the meaning people give to their life in a territory.**

Indicators :

- Integration of the repository into landscapes and territory life
- Reference to local problematics, questionings, and claims
- Recognition of legitimacy of local consensus and dissensus
- Scopes of the territory. Role of multiple organisations and scale: local, regional, European, associations, ...

Evaluation :

The question of the territory was addressed during the workshop through the examination of several national cases, and it gave the opportunity for some constructive interactions among the group of actors. The territory is a complex space-time entity that combines physical and political aspects and that raises some serious problems in the RWM. During the interactions, the issues at stake were integrated into a shared story, and the discussions did not restrict to the geological disposal but expanded to a more general view on the territory. This broader scope in the debate enabled to increase the level of confidence in the relationship with the civil society's actors who usually have high expectations on this topic. It remains that the success of interactions is certainly due to the change of scale (from the global to the local) and to the constitution of an 'ethical common' dealing with values and norms (in addition to the 'epistemic common' dealing with facts and models). In this respect, the 'evaluation' was rather oriented to the elaboration of a base of shared values, from which a possibility of common norms can then emerge. So it can be said that the interaction were fruitful since it was admitted by the actors that, far from being a neutral installation, a repository has a deep impact on the meaning that the people give to a territory and then to the life they can experience on it.

#### **h. Shared complexity**

Statement :

**Fruitful interactions necessitate to address the complexity of the issues (technical and non-technical) linked with geological disposal.**

Indicators :

- Multinational and intergenerational perspectives
- Considering institutions as dynamic structures towards apprehension of complexity
- Contribution and relevance of scientific expertise to safety issues. Development of safety culture.

Evaluation :

It was clear during the workshop in Brussels that the way the issues were addressed by the various actors remained faithful to the requirements of a complexity approach. This meant that the process of examination of the problems showed an ability to combine a variety of dimensions and could then link up the technical aspects with the non-technical aspects. Another important point was the emergence, in the wake of an epistemic community/culture, of an ethical community/culture that brought about some moral and social considerations into the discussions. In fact, these two communities are not separate according to a criterion of specialty, for the added value of having a heterogeneous group is precisely to facilitate the interactions between them. And if some of their respective members would rather locate themselves in one of the communities, they could also produce relevant contributions within the other one.

The kind of culture that emerged from the interactions can be termed a 'complex culture' (or culture of complexity) and the latter can be now regarded as a normal development of this institutional functioning. It encouraged the participants to consider the achievement of a safety culture as a topic that the scientific experts can contribute to through cooperation with the other actors. It can then be said that the interactions were fruitful insofar as the actors were able to address the various aspects and dimensions of a complex problem (eg: scientific, legal, moral, environmental, social...). They were also able to share this understanding of the complexity so that it finally constitutes a common ground or background.

i. Addressing the long term

Statement :

**Fruitful interactions cannot be meaningfully achieved without an intergenerational perspective, given the extreme timescales.**

Indicators :

- Considerations about intergenerational governance and interactions (more than education)
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)
- Articulation of timescales (past, present, future) at the levels of reflexion and actions.

Evaluation :

The question of the Long Term, and especially that of intergenerational transfer, were not the core of the interactions during the workshop in Brussels. It is correct to state that the theme of the long term was present during the exercises on imagination that consisted in sketching out several possible visions of the future. Moreover, though the question of the long term is often tackled through the lens of a technical perspective, some presentations in the workshop proposed another perspective by investigating the notion of rolling stewardship. Thus, one presentation worked out the differences between the concepts and the processes based respectively on the retrievability, the recoverability and the reversibility. One of the main stakes that came out of the interactions as far as we are concerned with the intergenerational transfer was about how the option of rolling stewardship can be concretely implemented. On the whole, the interactions were fruitful, for, despite the urging achievements or decisions that need to be made in the RWM in the present, it does not neglect the core stakes of the long-term management, of the justice and the responsibility towards future generations.

## Appendix B. Detailed evaluation of ICS in strategic studies

### 1. Application of the evaluation grid to UMAN seminar n°3

#### Agenda of seminar 3

First Half Day: Presentation of the 3 topics (June 14th am).

Second Half Day: Working group sessions to discuss concrete cases (June 14th pm)

Concrete cases on 4 topics related to UMAN uncertainties + 1 additional theme

Third Half Day: Presentation of the results of working groups and plenary discussion (June 15<sup>th</sup> am).

Restitution session of WG + opening discussion in plenary + recommendations for future EURAD research on human uncertainties

#### a. Legitimacy

##### Statement :

**Fruitful interactions necessitate legitimate processes in which all actors can dialog on the same footing.**

##### Indicators :

- Recognition -or not- of legitimacy (from one to another, by speech and statutes)
- Legitimacy affirmation -or not- (from someone for him/herself, affirmation or revendication)
- Symmetry/di-symmetry of actors (right to speak, time of speak, right to take the floor, to frame the debates, inclusivity, ...)

##### Evaluation :

The UMAN task 5 seminar 3 grounded on two core methodologies:

- bringing the 3+1 (WMOs, TSOs, RE, CS) perspectives on the subject
- building discussions on contextual concrete cases.

These two methodologies brought all actors on the same footing, from an institutional point of view (representation) and from a personal point of view in multiparty groups.

In each of the two modes, a symmetry of actors was proposed, with indicative facts as the same right to speak, to take the floor. In the 3+1 presentations, a similar amount of time was guaranteed for each type of actor. In the group discussion, legitimacy was distributed by the main animator, and the roles of animators were held by each type of actor also.

Thus, the process presented during the UMAN task 5 seminar 3 gathers enough structuring points regarding the legitimacy condition for fruitful interactions

## **b. Methodology**

### Statement :

**Fruitful interactions require that a community is able to conduct a variety of inquiries (scientific, moral, social).**

### Indicators :

- Cooperative research, co-construction of interpretations and scenarios (contextualised cases)
- Degree of pluralism : Taking into account the variety of rationalities (scientific, moral, and social views together)
- Consideration of safety case and safety assessment as dialectic places/dialogues
- Highlighting the specificity of long-term knowledge and management

### Evaluation :

As indicated at the beginning of the seminar, the perspective of identification and management of uncertainties highlights the complexity of the subjects to be handled, thus a certain methodology was needed and presented. The methodology of the UMAN task 5 seminar was grounded on an inclusive multi-stakeholder statement, considering that each actor can have a possible interesting epistemic value regarding the subject discussed.

For this specific seminar n°3, three levels of this methodology were shown:

- The deliberative 3+1 presentations led to a critical pluralism, and to fruitful discussions thereafter. In these discussions, the Safety assessment process was directly considered as a key for a dialogue along time for safety.
- The discussions about concrete cases were based on a variety of rationalities, as the cases were co-built between different actors (WMOs, TSOs, RS and CS), and as the discussions were enabling different reactions and visions about the cases in the discussion groups. This variety of rationalities was illustrated by the span of different orientations of arguments : safety, operability, democratic processes, performances.
- The topic itself “Uncertainties related to human aspects” underlined the crucial role of pluralistic stakeholder engagement (including CS) over time and societies.

UMAN seminar 3 thus shows a good framework for variable fruitful inquiries. This shall go further however, as planned for the next seminars.

## **c. Postural changes**

### Statement :

**Fruitful interactions depend on the capacity of all actors to encompass others' views and to enlarge their initial perspective.**

### Indicators :

- Consideration of political and organisational tools for changes (Pathway Evaluation Process, special events, associations, commons, ...)

## EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

- Taking into account the role of socio-technical imaginaries (background assumptions: ontological, cosmological, epistemological, ethical, ...)
- Changes in the opening and acceptance of other types of rationalities (not only scientific)

### Evaluation :

Two different kinds of postural changes were noticed during this seminar.

The first one is an awaited consequence of the discussion methodology in small groups about cases: during the restitutions, a better enlarged comprehension was noticed for most actors. Not only a better understanding of the problems at stake, but also a kind of empathy for other actors, and a better understanding of how the situation can be complex for others. These changes were noticed in all groups, as the raising of the common will to propose thoughts and outcomes regarding the case studies.

The second one was a significant conclusion during the 3+1 presentations: REs represented here bearing a new view regarding the significance of uncertainties related to human actions. As an example, from the REs viewpoint, the notion of acceptance is not appropriate because it implies the implicit view that the facilities are to be first designed by engineers and scientists and then accepted by people. Instead, a process shall be developed that looks for public consensus fully integrated in the repository project and attributes some power to key actors and stakeholders from the early stage of the development of the project. In addition to this, the need for humility (of institutional actors) was underlined as essential in the presentations, as the safety significance of the uncertainties arising from the public may not necessarily decrease over time.

In conclusion, this seminar was an important occasion to enlighten structural changes in the discourses.

### d. Personal unity

#### Statement :

**Fruitful interactions require from an actor that he or she takes into account the different dimensions of him/herself.**

#### Indicators :

- Personal dissonance/consonance with the institutional discourses/roles
- Personal expression markers: "off the record", I/we, self-censorship, ...
- Importance of professional and personal life shift: professional status and activity, socio-environmental activism, consciousness raising, ...

### Evaluation :

The condition of personal unity appeared differently in the context of formal presentation, or small group discussions. In both cases, a certain equilibrium was found, and therefore demonstrating almost no gap between institutional and personal roles.

In the 3+1 dialogue (3 Eurad colleges + civil society), some actors were sharing personal insights within their representative presentation: notably TSOs, REs and some CS members.



## **EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society**

In the exercise of concrete cases, several situations occurred, depending on the groups and persons: from the oral feedback after the working groups, almost half of the participations to the discussions were enriched with personal discourse and role, showing a real capacity to bridge institutional roles with personal history and consciousness.

The condition of personal unity was a noticeable result of this seminar, thanks to the different framing of interactions. It was not a discussed topic in itself.

### **e. Expertise function**

#### Statement :

**Fruitful interactions require a pluralistic expertise that therefore cannot be reduced to a sole scientific process.**

#### Indicators :

- Role and cooperation with non-experts, non-scientific experts, and counter-experts: co-expertise
- Evolution of the expertise function along the processes, recognition of this evolution by experts themselves
- Consideration of pluralistic dialogue and institutional integration for better apprehension of complexity

#### Evaluation :

The UMAN task 5 seminar 3 was organised to fruitfully cross different kinds of expertise, this dimension is therefore central in this event.

The whole 3+1 dialogue, with its formal presentations on the four topics debated, was based on a model of co-expertise regarding the overall object of this seminar, namely the uncertainties related to human aspects. The complexity of such topics was underlined many times, as well as the need to cross various points of views and forms of expertise to significantly offer epistemic value (added value of knowledge) to proposals and recommendations.

The exercise of concrete cases was also the occasion to genuinely share different views on the debated topic, and therefore to acknowledge the consideration of pluralistic dialogue.

Therefore, this seminar made the sharing of different visions of expertise real, and enlightened it as a good condition for fruitful interactions.

### **f. Meaning of the repository**

#### Statement :

**Fruitful interactions include exchanges on the meaning of the existence of repository in the concrete life of people.**

#### Indicators :

- Integration of plurality of meanings beyond the efficiency of technical concepts
- Appropriation of the site of repository by the population: activities and projects in addition to RWM
- Considering the significance of intergenerational safety

## EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)

### Evaluation :

For both exercises, 3+1 dialogue and concrete cases discussed, the main direct added value regarding a better evolution of the meaning of the repository was coming more from certain topics studied than others.

To illustrate this, the topic discussed about security and conflict between two countries led to highly active conversations regarding the intergenerational safety, the retrievability concepts, the links to local activities, and so on. The topic of public acceptance, by framing, also directly touched the question of the meaning, more than New Knowledge and Scheduling issues.

The discussions on safety provisions barely raised outcomes regarding the meaning of repository.

In the overall framework of the UMAN seminar, the main gain regarding the meaning of the repository is the perspective of uncertainties, helping the discussed objects to be considered in a dynamic and constructive context, oriented towards safety.

This event was participating in a reframing of the meaning of the development and implementation of the repository, as a long-term complex decision-making process, in an uncertain environment, involving a plurality of stakeholders.

The framework on uncertainties is helping to this reframing, by taking into account the complexity of related issues and enabling interactions on the same footing along with time.

In conclusion, the positive impact of this seminar on the progress of meaning is partly depending on the topics discussed, and always attached to the uncertainty's framework of UMAN.

### g. Territory

#### Statement :

**Fruitful interactions must take into account the deep impact of a geological disposal on the meaning people give to their life in a territory.**

#### Indicators :

- Integration of the repository into landscapes and territory life
- Reference to local problematics, questionings, and claims
- Recognition of legitimacy of local consensus and dissensus
- Scopes of the territory. Role of multiple organisations and scale: local, regional, European, associations, ...

### Evaluation :

This question of territory was not directly touched by this seminar on uncertainties related to human aspects.

However, it was a central topic in some concrete cases proposed to discussions: conflict between two countries, public acceptance and local political life, safety provisions for implementation and links with the regional firms of civil engineering, for example.

In the discussions after restitutions, the notion of community volunteering was also enlightened as an effort to solve a problem of society at large, as a kind of contribution to a national burden.

#### h. Shared complexity

Statement :

**Fruitful interactions necessitate to address the complexity of the issues (technical and non-technical) linked with geological disposal.**

Indicators :

- Multinational and intergenerational perspectives
- Considering institutions as dynamic structures towards apprehension of complexity
- Contribution and relevance of scientific expertise to safety issues. Development of safety culture.

Evaluation :

The notion of shared complexity was at the core of the methodology and topics of this seminar on uncertainties related to human aspects. Oriented towards intergenerational safety, all concrete cases and discussions were enhancing the need to better assume and share complexity of such socio-technical objects.

The intergenerational perspective was central, both in the 3+1 presentations and the concrete cases discussed. As an illustration and a good horizon for this perspective, the notion of rolling stewardship has been thoroughly discussed.

In addition to this, the subject of safety culture has been discussed in different concrete cases, in the 3+1 presentations, during the restitutions, and in the plenary discussions, notably about the integration of civil society in the safety culture.

Yet, a point was observed during this seminar regarding uncertainties related to human aspects: it was sometimes not clear, during the 3+1 presentations, for whom the facts presented were uncertain. This point raises the need to clearly define uncertainties as uncertainties for safety, not for actors.

Thus, the process presented during the UMAN seminar 3 gathered enough structuring points regarding the shared complexity condition for fruitful interactions and demanded more vigilance on the orientation of uncertainties towards safety.

#### i. Addressing the long term

Statement :

**Fruitful interactions cannot be meaningfully achieved without an intergenerational perspective, given the extreme timescales.**

Indicators :

- Considerations about intergenerational governance and interactions (more than education)
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)
- Articulation of timescales (past, present, future) at the levels of reflection and actions.

Evaluation :

Intergenerational governance was at the core of this multi-stakeholder seminar of UMAN: the discussed topics of uncertainties related to human aspects was naturally aiming the conversations towards long term governance. Therefore, in all the 3+1 presentations and the concrete cases, a long-term perspective was given for discussions and thoughts.

The different common aspects of long-term governance were discussed in plenary discussions and concrete cases: retrievability concepts, actions at different timescales, safety provisions, monitoring, post-closure, length of implementation, scheduling, links with political life, and so on.

In addition to these points, an important part of the discussion aimed at elaborating more around the concept of Rolling Stewardship, as an interesting way to consider future governance of uncertainties. This shall be further developed in the next UMAN task 5 seminars.

As a conclusion, the perspective of uncertainties related to human aspects and the specific pluralistic methodology, led this seminar to fulfil the conditions of addressing the long term.

## **2. Application of the evaluation grid to UMAN seminar n°4**

Agenda of seminar 4

The seminar was divided into three half-days.

1st session: presentations of views of the different colleges and civil society organisations

2nd session: PEP working groups

3rd session: restitution of the PEP game and synthetic conclusion.

**a. Legitimacy**

Statement :

**Fruitful interactions necessitate legitimate processes in which all actors can dialog on the same footing.**

Indicators :

- Recognition -or not- of legitimacy (from one to another, by speech and statutes)
- Legitimacy affirmation -or not- (from someone for him/herself, affirmation or revendication)
- Symmetry/di-symmetry of actors (right to speak, time of speak, right to take the floor, to frame the debates, inclusivity, ...)

Evaluation :

Legitimacy can be assessed on two different points: the preparation of this seminar and its implementation.

Concerning the preparation, it is important to note that it was the fourth UMAN seminar and thus the links between the technical actors and civil society were well established. The recognition of the legitimacy of all actors was assured since people knew each other well and had already worked efficiently together before.

This trust among other actors of the UMAN seminar can be illustrated by an actual situation: since there was an unexpected problem of conflicting schedules, all actors could not participate and present their views. It was decided that one representative of the TSO college could endorse the role of the three colleges and presented their views alone. This would not have been possible without a strong trust link based on mutual recognition.

As this seminar was the fourth one, all the presented methodologies were validated and considered as useful and meaningful. The PEP game, the double-wing model or the rolling/intergenerational stewardship were considered relevant and were not challenged in themselves but only on the way to implement them.

Concerning the implementation of this seminar, the PEP methodology enabled discussions on the same footing on actual scenarios. The PEP methodology applied in small pluralistic working groups (“3+1”+ regulatory bodies) creates a safe space in which all participants can express their views and in which no one takes the lead and imposes a single point of view. This recognition of the legitimacy of all participants can be seen in the presentation of the results of the PEP working groups, as consensus was not systematically reached. The synthesis can contain contradictory elements, which illustrate the fact that all views were considered equal.

Moreover, during the keynote presentation, the right to speak was quite symmetric as all participants could freely and easily intervene.

However, a dissymmetry was created by the hybrid format of the seminar: it was less easy for participants online to speak and their views might not have been accurately represented.

## **b. Methodology**

Statement :

**Fruitful interactions require that a community is able to conduct a variety of inquiries (scientific, moral, social).**

Indicators :

- Cooperative research, co-construction of interpretations and scenarios (contextualised cases)
- Degree of critical pluralism: Taking into account the variety of rationalities (scientific, moral, and social views together)
- Consideration of safety case and safety assessment as dialectic places/dialogues
- Highlighting the specificity of long-term knowledge and management

Evaluation :

Part of the workshop focused on the long term, the difficulties for a pluralistic dialogue to be sustained over time and across generations, other challenges of intergenerational transmission, and particularly the question of rolling stewardship as a solution.

Upstream, the scenarios used in the discussion based on PEP methodology were co-constructed: the CS group proposed and discussed them with the other colleges, who corrected and added content to them. The scenarios were designed to make it necessary to cross rationalities (scientific, moral, political, etc.). The ones on the performance of the sealing materials or the possible implementation of new knowledge were a good mix of technical and social aspects, of human and technical uncertainties.

No new methodologies were identified during the seminar. This may or may not mean that the methodologies identified were already sufficient.

This seminar confirmed the importance of the pluralistic management of uncertainties as a central methodology. Moreover, the case study method and the role of civil society in these issues were not questioned. More specifically, there was no questioning of the need to discuss with civil society, although the importance of how to do so may or the respective weight to give to different stakeholders were discussed.

**c. Postural changes**

Statement :

**Fruitful interactions depend on the capacity of all actors to encompass others' views and to enlarge their initial perspective.**

Indicators :

- Consideration of political and organisational tools for changes (Pathway Evaluation Process, special events, associations, commons, ...)
- Taking into account the role of socio-technical imaginaries (background assumptions: ontological, cosmological, epistemological, ethical, ...)
- Changes in the opening and acceptance of other types of rationalities (not only scientific)

Evaluation :

As written hereinabove, this seminar was the fourth UMAN seminar. Compared to the first one, there was much more consensus on the importance of having civil society as part of the dialogue in a research project and of the relevance of the double-wing model. The PEP game was also confirmed as an interesting tool to enable fruitful dialogues and possible postural changes. Moreover, the importance given to the concept of rolling/intergenerational stewardship evolved a lot, however some participants still found it too conceptual and not operational enough.

In conclusion, this seminar was an important occasion to enlighten structural changes in the discourses.

**d. Personal unity**

Statement :



**Fruitful interactions require from an actor that he or she takes into account the different dimensions of him/herself.**

Indicators :

- Personal dissonance/consonance with the institutional discourses/roles
- Personal expression markers: "off the record", I/we, self-censorship, ...
- Importance of professional and personal life shift: professional status and activity, socio-environmental activism, consciousness raising, ...

Evaluation :

The PEP-like methodology (discussion based on scenarios) that was used during this seminar was designed to allow expression of more personal views of participants: during the discussions, the personal roles were more important than the institutional ones, and are often enriched with personal views or experiences.

However, this condition appeared differently in the rest of the workshop, and especially the formal presentations: the two presentations following the institutional dichotomy of experts/non-experts made the different actors mainly stay in their formal role.

**e. Expertise function**

Statement :

**Fruitful interactions require a pluralistic expertise that therefore cannot be reduced to a sole scientific process.**

Indicators :

- Role and cooperation with non-experts, non-scientific experts, and counter-experts: co-expertise
- Evolution of the expertise function along the processes, recognition of this evolution by experts themselves
- Consideration of pluralistic dialogue and institutional integration for better apprehension of complexity

Evaluation :

One of the main results of this seminar was the recognition of the crucial importance of independent expertise. This independence - from decision-making, from conflicts of interest, etc. - helps build confidence in the ability of the system to manage uncertainties. The concept of expertise was central during all the discussions.

Concerning the pluralism of expertise, this seminar was an interesting illustration of what can be done: the discussed scenarios presented global issues more than technical ones, and thus called for a more pluralistic approach of expertise.

As written hereinabove, the whole seminar was rooted in the importance of fruitfully crossing different expertises.

f. Meaning of the repository

Statement :

**Fruitful interactions include exchanges on the meaning of the existence of repository in the concrete life of people.**

Indicators :

- Integration of plurality of meanings beyond the efficiency of technical concepts
- Appropriation of the site of repository by the population: activities and projects in addition to RWM
- Considering the significance of intergenerational safety
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)

Evaluation :

The discussed scenarios highlighted the fact that the repository is not just a technical object, but also a social and political one. Human uncertainties and their impact on technical aspects were also discussed, taking into account the different dimensions of the repository.

Among these scenarios, one led to many reflections on the meaning of the monitoring and showed that there was no clear common understanding on this topic.

Through the presentations and the discussions based on scenarios, the uncertainty management issues were tackled at all the different steps of the repository, as it is different at every step. More specifically, discussion occurred on the concepts of retrievability and the stepwise approach, and how important it was to have a pluralistic approach to make them efficient.

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Evaluation :

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Through the presentations and the discussions based on scenarios, the uncertainty management issues were tackled at all the different steps of the repository, as it is different at every step. More specifically, discussion occurred on the concepts of retrievability and the stepwise approach, and how important it was to have a pluralistic approach to make them efficient.

## h. Territory

Statement :

**Fruitful interactions must take into account the deep impact of a geological disposal on the meaning people give to their life in a territory.**

Indicators :

- Integration of the repository into landscapes and territory life
- Reference to local problematics, questionings, and claims
- Recognition of legitimacy of local consensus and dissensus
- Scopes of the territory. Role of multiple organisations and scale: local, regional, European, associations, ...

Evaluation :

This question of territory was not directly touched by this seminar, for the UMAN seminars do not focus on a specific territory but stay at a very generic scale.

However, during the case study, participants often bring experience from their own countries. This generic scale helps to overcome the divisions that can exist within a single country. Discussions are held at an upper level, which means that concepts can be developed on the basis of existing national cases and the impasses that can exist at the national scale can be overcome because they are being discussed at another level, a European scale.

UMAN seminars always use this dialectics between the different scales. Concepts and solutions are discussed at an international level and will have national and local implications. The research programme framework makes it possible to go beyond the territorial impasses.

The question of dialogue with civil society is a problem in every national case. However, it is easier to discuss it calmly at the European scale, to potentially find solutions that can then be applied to national cases.

## i. Shared complexity

Statement :

**Fruitful interactions necessitate to address the complexity of the issues (technical and non-technical) linked with geological disposal.**

Indicators :

- Multinational and intergenerational perspectives
- Considering institutions as dynamic structures towards apprehension of complexity
- Contribution and relevance of scientific expertise to safety issues. Development of safety culture.

Evaluation :

Shared complexity is the very reason for this seminar. The repository is here considered as a socio-technical object and all participants now have this shared framework. All the pluralistic discussions allow us to consider the repository with all its complexity.

This criteria is more the basis on which all the UMAN seminars are rooted.

However, to go even further, political representatives could be invited to future seminars.

j. Addressing the long term

Statement :

**Fruitful interactions cannot be meaningfully achieved without an intergenerational perspective, given the extreme timescales.**

Indicators :

- Considerations about intergenerational governance and interactions (more than education)
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)
- Articulation of timescales (past, present, future) at the levels of reflection and actions.

Evaluation :

Addressing the long term was both the main theme and the main difficulty of this seminar. The framework of the discussions on management of uncertainties was clarified at the beginning of the seminar, as the definition of “long-term” may vary. It was then decided to focus on the operational uncertainty management within the frame of decades/centuries, for pluralistic assessment for higher time scales seems difficult to implement. However, the long-term perspective was kept in mind within the frame of the safety case.

The intergenerational dimension - through the rolling and intergenerational stewardship - were a major point of discussion. These concepts are a way to address the long-term issues in an operational way. Some other reflections about the articulation between the institutional control phase and the very long-term occurred.

An actual scenario tackled the issue of site memory, how to enforce and ensure this memory. It led to discussions about the articulation between the key role of institutions regarding the long-term issues, the articulation between the institutional control phases and the long term, the importance or not to have a surveillance without a planned end, the legal framework and the role of civil society.

### 3. Application of the evaluation grid to ROUTES process of contribution to deliverables D9.16, D9.17 and D9.18

#### a. Legitimacy

##### Statement :

**Fruitful interactions necessitate legitimate processes in which all actors can dialog on the same footing.**

##### Indicators :

- Recognition -or not- of legitimacy (from one to another, by speech and statutes)
- Legitimacy affirmation -or not- (from someone for him/herself, affirmation or revendication)
- Symmetry/di-symmetry of actors (right to speak, time of speak, right to take the floor, to frame the debates, inclusivity, ...)

##### Evaluation :

The deliverables were all based on a framework both ethical (D9.16, 2.1; D9.17, 2.3; D9.18, 2.2) and legal (D9.16, 2.1; D9.17, 2.1, 2.2; D9.18, 2.1) with as general framework the Aarhus Convention and the BEPPER report produced by NTW (2015). This framework helped evaluate legitimacy through various case studies (access to information, access to public participation, institutional frameworks, process of decision-making and interactions, etc...) and through questionnaires sent to the different actors of ROUTES (WMOs, TSOs, REs and CSOs). Those results give some qualitative indicators on the evolution of civil society participation.

This can be also related to the ethical framework developed within UMAN WP in the D10.17 “Synthesis report of WP UMAN outcomes from a civil society point of view”.

If some criteria were clearly developed and agreed on in the D1.13 “List of members of the Civil Society group” of the PMO WP regarding civil society representativeness within EURAD, some questions from other actors remained about the legitimacy of the CS experts and of the CSLG members participating. However, despite some intensive review from all actors, the work produced by the CS experts, supported by serious references, was approved, and recognized. The content of the ROUTES deliverables has further manifested itself in scientific articles and lectures in particular on the national cases, which have generated significant public interest. Even a book offer regarding one of the deliverables has been presented to the CS experts.

#### b. Methodology

##### Statement :

**Fruitful interactions require that a community is able to conduct a variety of inquiries (scientific, moral, social).**

##### Indicators :

- Cooperative research, co-construction (building in common) of interpretations and scenarios (contextualised cases)
- Degree of critical pluralism: Taking into account the variety of rationalities (scientific, moral, and social views together)

## EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

- Consideration of safety case and safety assessment as dialectic places/dialogues
- Highlighting the specificity of long-term knowledge and management

### Evaluation :

The CS members were divided in two groups following the so-called double wing model, a methodology allowing a wing of experts working closely within some WPs, and a larger wing of CS members involved in ICS events to evaluate the outcomes and make comments or proposals.

However, in ROUTES Task 7, the double wing model was transcended, because members of the CSLG contributed to deliverables themselves by providing case studies and answering questionnaires, and also participated in workshops and seminars.

This methodology has enabled a degree of critical pluralism as well as inputs from various types of rationalities (scientific, ethical, legal and social): using case studies has helped approach subject-matters in a historical perspective, bringing together different perspectives (technical, social, economic, environmental, politic, etc). Also, in some cases so-called “citizen-science” has been applied, which involves use of different views and rationalities.

### c. Postural changes

#### Statement :

**Fruitful interactions depend on the capacity of all actors to encompass others’ views and to enlarge their initial perspective.**

#### Indicators :

- Consideration of political and organisational tools for changes (Pathway Evaluation Process, special events, associations, commons, ...)
- Taking into account the role of socio-technical imaginaries (background assumptions: ontological, cosmological, epistemological, ethical, ...)
- Changes in the opening and acceptance of other types of rationalities (not only scientific)

### Evaluation :

Throughout the 5 years of duration of ROUTES, postural changes have definitely been observed: on one hand, CS members who researched, learned and evolved in their views; on the other hand, other actors in the ROUTES WP have learned more about national cases, CSI and even about legal frameworks at the national and European levels.

In general, a positive evolution towards more trust, more understanding, and more collaboration has been observed from all sides. This evolution of some of the views has been included in the periodic reports.

The methodology used for cooperative research with questionnaires, workshops and reviews of deliverables has helped in discussions and caused mutual added value. In fact, on occasion, it has felt like CS members were almost considered on the same footing as the three colleges in EURAD, although the CS experts do not constitute a college themselves.

### d. Personal unity

#### Statement :

**Fruitful interactions require from an actor that he or she takes into account the different dimensions of him/herself.**

Indicators :

- Personal dissonance/consonance with the institutional discourses/roles
- Personal expression markers: "off the record", I/we, self-censorship, ...
- Importance of professional and personal life shift: professional status and activity, socio-environmental activism, consciousness raising, ...

Evaluation :

Postural changes did not stop ROUTES Task 7 members from feeling and acting in coherence with their status as members of civil society and in the process reaching a satisfactory level of personal unity. Obviously, the learning process also implied dialogue to enable trust and less self-censorship, and in particular the deliverables tended to coherently reflect their views as individuals as well as a group.

In fact, the selection process described in D1.13 "List of members of the Civil Society group"<sup>22</sup> of the PMO WP regarding civil society representativeness within EURAD, managed to bring together different experts, belonging to different countries, from different organisations, and with different backgrounds (e.g., academic or socio-environmental activism). However, this didn't impede exchanges - on the contrary, it helped raise consciousness followed by more precise methodology and focused outcomes.

**e. Expertise function**

Statement :

**Fruitful interactions require a pluralistic expertise that therefore cannot be reduced to a sole scientific process.**

Indicators :

- Role and cooperation with non-experts, non-scientific experts, and counter-experts: co-expertise
- Evolution of the expertise function along the processes, recognition of this evolution by experts themselves
- Consideration of pluralistic dialogue and institutional integration for better apprehension of complexity

Evaluation :

As previously described, the development of a citizen science involving different fields (legal, political, environmental, etc.) helped CS members as well as other actors embrace the complexity of fruitful interactions between experts and non-experts and scientific and non-scientific ways of working.

The whole ROUTES deliverable process revolved around the cooperation between different types of experts. This pluralistic expertise made the ROUTES deliverables very rich and original.

**f. Meaning of the repository**

Statement :



**Fruitful interactions include exchanges on the meaning of the existence of repository in the concrete life of people.**

Indicators :

- Integration of plurality of meanings beyond the efficiency of technical concepts
- Appropriation of the site of repository by the population: activities and projects in addition to RWM
- Considering the significance of intergenerational safety
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)

Evaluation :

The fact that some CS members come from communities impacted by planned repositories has led to integration of concrete views on the significance of repositories and on concepts associated with them, such as intergenerational safety and flexibility of the sociotechnical process.

Moreover, the different ROUTES (and other connected WPs) workshops taking place at facility sites (e.g., La Hague, France; Nieuwdorp, Netherlands) have also helped deepen the exchanges on the meaning of the repositories. Organising events in “nuclear territories” entrenches the content of the workshops in actual real situations and allows to deepen the discussions on the meaning of such facilities.

## g. Territory

Statement :

**Fruitful interactions must take into account the deep impact of a geological disposal on the meaning people give to their life in a territory.**

Indicators :

- Integration of the repository into landscapes and territory life
- Reference to local problematics, questionings, and claims
- Recognition of legitimacy of local consensus and dissensus
- Scopes of the territory. Role of multiple organisations and scale: local, regional, European, associations, ...

Evaluation :

The numerous national case studies (3 in D9.16, 9 in D9.17 and 8 in D9.18) have reflected on the specific approaches by the CS members in ROUTES. While the overall ethical and legal framework has a European scope, the national cases have brought views on the integration of repositories in the life within the territories and their landscapes, addressing local problematics, questionings, and claims.

Hence, the approach of the deliverables can be described as bottom-up, because they start with an analysis of the territories themselves (process of participation, history, organisations...). However, some general conclusions and recommendations have been emphasised, despite differences between the countries in terms of public participation, maturity and advancement in the siting selection process. Territories are not only important in the ROUTES process – they are the starting point on which the work can be developed.

#### h. Shared complexity

Statement :

**Fruitful interactions necessitate to address the complexity of the issues (technical and non-technical) linked with geological disposal.**

Indicators :

- Multinational and intergenerational perspectives
- Considering institutions as dynamic structures towards apprehension of complexity
- Contribution and relevance of scientific expertise to safety issues. Development of safety culture.

Evaluation :

In addition to what has already been reported, we consider here more specifically what is related to the concept of “shared complexity” in the different deliverables.

In D9.16, the question of shared complexity was quite explicitly expressed, because it focused on shared solutions for Small Inventory Member States (SIMS) and Large Inventory Member States (LIMS). Considering that RWM in a given country or territory is already complex and even if sharing complexity could help in terms of knowledge and costs, this could also mean sharing of more complexity.

In D9.17, the topic that was addressed was rather intergenerational than multinational in nature, and the historical approach that was applied for the national cases, considered and assessed the dynamism of institutions as well as the development or lack thereof of the safety culture.

Finally, in D9.18, the shared complexity was evaluated from the angle of socio-technical dialogue, involving interactions of citizens with the scientific expertise and its relevance in order to address safety issues in the mid- and long-term.

#### i. Addressing the long term

Statement :

**Fruitful interactions cannot be meaningfully achieved without an intergenerational perspective, given the extreme timescales.**

Indicators :

- Considerations about intergenerational governance and interactions (more than education)
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)
- Articulation of timescales (past, present, future) at the levels of reflection and actions.

Evaluation :

RWM involves very long periods of time and D9.17 contained articulations of timescales at the levels of reflexion and actions- Furthermore the question of long-term was addressed in chapter 6 of D9.18.

The chapter in question constituted a first attempt to define short- and long-term in the context of CSI in RWM, not least based on the outcomes of UMAN seminars on long-term engagement, from which some of the principles expressed there were emphasised. Finally, a section was dedicated to the concept of rolling stewardship as a way to consider intergenerational governance and interactions at a deeper level than solely educational.

## Appendix C. Detailed evaluation of ICS in technical WPs

### 1. Application of the evaluation grid to CORI-UMAN-ICS session at EURAD annual event

#### a. Legitimacy

##### Statement :

**Fruitful interactions necessitate legitimate processes in which all actors can dialog on the same footing.**

##### Indicators :

- Recognition -or not- of legitimacy (from one to another, by speech and statutes)
- Legitimacy affirmation -or not- (from someone for him/herself, affirmation or revendication)
- Symmetry/asymmetry of actors (right to speak, time of speak, right to take the floor, to frame the debates, inclusivity, ...)

##### Evaluation :

The CORI-UMAN-ICS dialogue is based on scientific interactions oriented towards safety, steered by CS. This dialogue treats the topic of uncertainties related to organic matter, which is more directly linked to the works of the WPs CORI and UMAN, but the role of CS is also central, by giving the overall orientations of this inter-WPs work.

During the specific EURAD annual event session, it was the occasion for all three parties to present on the same footing some elements:

- perspective of CORI on the uncertainties related to organic matter, and responses to UMAN
- perspective of UMAN on the same subject, and responses to CORI
- perspective of CS on the link between technical research and uncertainties, with CORI-UMAN as an example. This also led to open discussions regarding safety culture.

In the construction of this dialogue, as well as in the presentations of the session and in the open discussions, the evidence indicates interactions based on a real comprehensive condition of legitimacy for all actors.

CS played a strong role in proposing a new framework orientated towards safety and shared culture to discuss technical issues and thus managed to create a link between the different WPs.

This strong interactions on the same footing were materialised during one EURAD annual event, when a special session dedicated to the CORI-UMAN-ICS process was held and during which all the presentations were all considered legitimate as they were done on a same footing.

#### b. Methodology

##### Statement :

**Fruitful interactions require that a community is able to conduct a variety of inquiries (scientific, moral, social).**

##### Indicators :

## EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

- Cooperative research, co-construction of interpretations and scenarios (contextualised cases)
- Degree of critical pluralism: Taking into account the variety of rationalities (scientific, moral, and social views together)
- Consideration of safety case and safety assessment as dialectic places/dialogues
- Highlighting the specificity of long-term knowledge and management

### Evaluation :

The session here evaluated was resulting from a long dialogue process regarding scientific results on uncertainties associated with organic matter. The direct object of focus and discussion was therefore mainly scientific and epistemic.

Yet, this session was also an opportunity to largely discuss the context of scientific inquiries towards safety, and this was steered up by several presentations: the introductory presentation of a member of the EURAD PMO, a talk by the EURAD Chief Scientific Officer, and a presentation by a PMO member about safety culture. These different contributions grounded fruitful discussions in the session, thanks to a dedicated amount of time.

It can therefore be said that this session was the occasion to open and conduct other forms of inquiries, with a broader perspective than the strict scientific research, because of the safety orientation.

Moreover, the whole process was the result of a real co-construction, since all the meetings were held with all participants, at every step of the process. These meetings were organised and led by CS, who orientated the discussions towards the generic level of safety, shared by all.

### c. Postural changes

#### Statement :

**Fruitful interactions depend on the capacity of all actors to encompass others' views and to enlarge their initial perspective.**

#### Indicators :

- Consideration of political and organisational tools for changes (Pathway Evaluation Process, special events, associations, commons, ...)
- Taking into account the role of socio-technical imaginaries (background assumptions: ontological, cosmological, epistemological, ethical, ...)
- Changes in the opening and acceptance of other types of rationalities (not only scientific)

### Evaluation :

The perspective of uncertainties was presented during this session as an interesting framework for new considerations on science. Participants of CORI acknowledged it was a refreshing and important manner for them to conduct their research.

An additional element indicating the structuration of works by uncertainty and safety is the persistence, during the discussions of the session, of the specific topic of “Black Swan”, being an *unknown unknown* or *ignored unknown*. This topic came up several times in the discussion, underlining the necessity to have good conditions for thinking such possibilities and objects, thanks to participative pluralistic fruitful works. Thus, for the greater need of safety, a possibility of black swan was described in this discussion as a cause to open the way to postural changes.

## **EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society**

In addition to these points, the debate occurred during the session enhanced the growing need for structural changes in the organisation of scientific research, from the points of view of several actors present during the session: a greater openness of scientific research to critics, accepting that mistakes can happen, and the importance to take history into account, especially failure.

These postural changes depict well the ones that occurred during the whole process, with the gradual recognition of the importance of the ICS and the fruitfulness of the notion of shared safety culture.

### **d. Personal unity**

#### Statement :

**Fruitful interactions require from an actor that he or she takes into account the different dimensions of him/herself.**

#### Indicators :

- Personal dissonance/consonance with the institutional discourses/roles
- Personal expression markers: "off the record", I/we, self-censorship, ...
- Importance of professional and personal life shift: professional status and activity, socio-environmental activism, consciousness raising, ...

#### Evaluation :

The condition of personal unity appeared to be a central notion in this session, as it is deeply linked to the scientific work on safety. This point was confirmed by the discussion on safety culture, stating that safety culture needs to be organised and thought on both institutional and personal dimensions. The specific topic of whistleblowers was raised during the discussions in plenary, enlightening the importance for each institution to create conditions for whistleblowing (ensuring the protection of whistleblowers) when safety demands it.

The session itself was the occasion for several partners presenting to share scientific insights while assuming a personal vision on the orientation of these results towards safety.

### **e. Expertise function**

#### Statement :

**Fruitful interactions require a pluralistic expertise that therefore cannot be reduced to a sole scientific process.**

#### Indicators :

- Role and cooperation with non-experts, non-scientific experts, and counter-experts: co-expertise
- Evolution of the expertise function along the processes, recognition of this evolution by experts themselves
- Consideration of pluralistic dialogue and institutional integration for better apprehension of complexity

#### Evaluation :

## **EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society**

In the specific methodological context of the CORI-UMAN-ICS dialogue, the roles of the different categories of expertise are quite clear and open to more than just scientific and technical expertise. It could be said that the scientific expertise is more attributed to CORI, the epistemological expertise more to UMAN, and the reflexive expertise (on the meaning of procedures and processes) more to CS, and that these three branches contribute to the orientation of all works towards safety. The framework in which occurred these exchanges was that interactions with civil society have a role to play in the expertise function.

This vision was illustrated during the session, where scientific results, regarding impact of organic matter on radionuclides mobility and thus on safety, were discussed as ongoing contributions to the resolution of complex uncertain issues (and not only as simple facts), with a certain step back allowing, for all actors, coordination of research in the perspective of improving safety.

With this framing, the whole dialogue can help to conceive scientific research for the near and far future, as it was said in the conclusive point of the EURAD Chief Scientific Officer. This kind of innovative process fulfils one of the main goals of the EURAD platform; creating link between different WPs and thus enhancing expertise.

### **f. Meaning of the repository**

#### Statement :

**Fruitful interactions include exchanges on the meaning of the existence of repository in the concrete life of people.**

#### Indicators :

- Integration of plurality of meanings beyond the efficiency of technical concepts
- Appropriation of the site of repository by the population: activities and projects in addition to RWM
- Considering the significance of intergenerational safety
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)

#### Evaluation :

Even if the global process of CORI-UMAN-ICS is to put research results in a more global framework that gives sense to all actors, this present session did not really raise classical political questions regarding the meaning of the repository, either on local or national scales.

Instead, the event was mainly about the meaning of appropriate scientific research in the making of intergenerational orientation to safety.

### **g. Territory**

#### Statement :

**Fruitful interactions must take into account the deep impact of a geological disposal on the meaning people give to their life in a territory.**

#### Indicators :

- Integration of the repository into landscapes and territory life



## EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

- Reference to local problematics, questionings, and claims
- Recognition of legitimacy of local consensus and dissensus
- Scopes of the territory. Role of multiple organisations and scale: local, regional, European, associations, ...

### Evaluation :

The topic of territory was not directly addressed by the session, and it was not raised during discussions.

### h. Shared complexity

#### Statement :

**Fruitful interactions necessitate to address the complexity of the issues (technical and non-technical) linked with geological disposal.**

#### Indicators :

- Multinational and intergenerational perspectives
- Considering institutions as dynamic structures towards apprehension of complexity
- Contribution and relevance of scientific expertise to safety issues. Development of safety culture.

### Evaluation :

The notion of shared complexity is at the core of the dialogue between CORI, UMAN and ICS. The main aim of this dialogue is the orientation of scientific research results towards safety through the perspective of uncertainty. The interactions have contributed to better explicit and clarify the expected contribution of R&D (here CORI) to safety in the EURAD Program.

This raises the fact that scientific research shall not be understood as the sole “bridging the gap of knowledge” solution. It should be rather viewed as a complex long-term process, with a shared responsibility to understand the safety goals. This conclusion of the dialogue brings out the comprehension of a sustained living and continuously updated (refreshed) safety culture.

### i. Addressing the long term

#### Statement :

**Fruitful interactions cannot be meaningfully achieved without an intergenerational perspective, given the extreme timescales.**

#### Indicators :

- Considerations about intergenerational governance and interactions (more than education)
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)
- Articulation of timescales (past, present, future) at the levels of reflexion and actions.

### Evaluation :

## **EURAD** Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

This dialogue does not bring out direct outcomes regarding long-term perspective, as it focuses on the cooperation between WPs on a topic such as the link between uncertainties related to organic matter and safety.

Yet, this was widely discussed in a long-term perspective, knowing that the framing of this dialogue can contribute to a framing of future scientific research, and framing of future safety culture.

## **2. Application of the evaluation grid to MODATS workshop in Nancy**

### Agenda of the workshop

First Half Day:

- Technical introduction on monitoring
- Group work on concrete cases

Second Half Day:

- Restitution of group work on concrete cases
- Presentation of the monitoring and the safety case

Third Half Day:

- Discussion about the monitoring and the safety case
- Conclusion
- Presentation of Cigéo project

Fourth Half Day :

- Technical visit of Cigéo

### **a. Legitimacy**

#### Statement :

**Fruitful interactions necessitate legitimate processes in which all actors can dialog on the same footing.**

#### Indicators :

- Recognition -or not- of legitimacy (from one to another, by speech and statutes)
- Legitimacy affirmation -or not- (from someone for him/herself, affirmation or revendication)
- Symmetry/di-symmetry of actors (right to speak, time of speak, right to take the floor, to frame the debates, inclusivity, ...)

Evaluation :

The whole workshop was designed in a way to ensure an equal footing for all participants.

The group work session on concrete cases was based on the PEP methodology which tries to enable multi-actors' discussions in the field of radioactive waste management. Such a framework guaranteed a symmetry in the distribution of speech. Moreover, the groups were composed of a balanced number of members of each college to ensure a diversity of points of view.

The discussion about the safety case was also structured in order to ensure a balanced distribution of speech: participants were invited to speak one college after another. This methodology was set up to ensure that no college would confiscate speech and that everyone could speak. However, this process was not followed when discussion became more vivid.

Even if the set up methodology tried to ensure an equal footing for everyone, the legitimacy of civil society in the process of a repository was discussed in a heated discussion. Different paradigms of interactions with civil society rose, one insisting on the hierarchy in the specialised knowledge between experts and citizens and thus the obvious unequal footing regarding decisions for a repository, the other on the diversity of points of views and inquiries brought by civil society that could challenge this specialised knowledge.

What was considered as the main obstacle in a full recognition of legitimacy of the diversity of participants was debated during the workshop: the framework was given by technical leaders and especially TSOs. It was considered too narrow and uneven to impose a unique framework in a pluralistic methodology.

## **b. Methodology**

Statement :

**Fruitful interactions require that a community is able to conduct a variety of inquiries (scientific, moral, social).**

Indicators :

- Cooperative research, co-construction of interpretations and scenarios (contextualised cases)
- Degree of critical pluralism: Taking into account the variety of rationalities (scientific, moral, and social views together)
- Consideration of safety case and safety assessment as dialectic places/dialogues
- Highlighting the specificity of long-term knowledge and management

Evaluation :

The concrete cases scenarios and especially the one on governance allowed to enlarge the considerations beyond the only scientific aspect. The questions of post-closure and long-term also brought considerations on social and moral aspects, especially through the decision-making and the knowledge management issues.

These concrete cases were co-designed by civil society experts and TSO members to ensure the relevance of questions on scientific, moral, and social aspects. The PEP methodology allowed to co-construct conclusions about these concrete cases, agglomerating a variety of points of view.

## **EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society**

The presentation about the safety case and the following discussion showed that a safety assessment was a process in which monitoring held the role of support to safety and decision-making, especially for the operational and closure phases. Through monitoring, the safety case appeared as a dynamic process and a tool for dialogue.

Throughout the workshop, participants discussed the relevance or the necessity to have fruitful interactions with civil society, not only with a scientific prism.

### **c. Postural changes**

#### Statement :

**Fruitful interactions depend on the capacity of all actors to encompass others' views and to enlarge their initial perspective.**

#### Indicators :

- Consideration of political and organisational tools for changes (Pathway Evaluation Process, special events, associations, commons, ...)
- Taking into account the role of socio-technical imaginaries (background assumptions: ontological, cosmological, epistemological, ethical, ...)
- Changes in the opening and acceptance of other types of rationalities (not only scientific)

#### Evaluation :

The concrete case on governance was designed as a new way to approach monitoring by broadening the scope. Indeed, it is a new way to envisage monitoring and the question of closure and long term forced experts to enlarge their perspective to discuss possible options.

Remarks regarding the framework of the workshop were raised: some considered that the presentations only showed the view of technical experts. This remark led to the conclusion that the next workshop should be designed to enable better the view of civil society to be expressed.

The divergence of posture regarding civil society expertise and participation led to a vivid discussion. This discussion was a good opportunity to explain or remind the different “paradigms” regarding this topic and led several people to make up their minds on this subject. This discussion might have led expert to a future possible postural change regarding civil society's views.

### **d. Personal unity**

#### Statement :

**Fruitful interactions require from an actor that he or she takes into account the different dimensions of him/herself.**

#### Indicators :

- Personal dissonance/consonance with the institutional discourses/roles
- Personal expression markers: "off the record", I/we, self-censorship, ...

## EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

- Importance of professional and personal life shift: professional status and activity, socio-environmental activism, consciousness raising, ...

### Evaluation :

The concrete cases were designed to go beyond the mere role of the expert. However, the experts mainly stayed in their institutional roles, some of them even jokingly calling each other by the name of their institution to explain the divergence in their points of view.

It is however interesting to note that one interesting discussion on the role of civil society started with one participant describing her personal relationship with her students and comparing it with the interactions between experts and civil society.

Participants of this workshop mainly stayed in their institutional role they were supposed to embody.

### e. Expertise function

#### Statement :

**Fruitful interactions require a pluralistic expertise that therefore cannot be reduced to a sole scientific process.**

#### Indicators :

- Role and cooperation with non-experts, non-scientific experts, and counter-experts (experts who can produce a different expertise) : co-expertise
- Evolution of the expertise function along the processes, recognition of this evolution by experts themselves
- Consideration of pluralistic dialogue and institutional integration for better apprehension of complexity

### Evaluation :

The link with civil society and the need for a pluralistic dialogue on such a project were the very essence of this workshop. The workshop was organised to fruitfully cross different kinds of expertise, this dimension is therefore central in this event.

The whole 3+1 dialogue was based on a model of co-expertise regarding the overall object of this seminar, to try to develop a mutual understanding and common views on the key challenges and topics. The complexity of such topics was underlined many times, as well as the need to cross various points of views and forms of expertise to significantly offer epistemic value to proposals and recommendations, to enable a better public participation to broaden the framework and to institutionalise the diversity of expertise.

The exercise of concrete cases and the structured discussion about the safety case were also the occasion to genuinely share different views on the debated topic, and therefore to acknowledge the consideration of pluralistic dialogue.

Therefore, this workshop made real the crossing of different visions of expertise and enlightened it as a good condition for fruitful interactions.

### f. Meaning of the repository

#### Statement :

**Fruitful interactions include exchanges on the meaning of the existence of repository in the concrete life of people.**

Indicators :

- Integration of plurality of meanings beyond the efficiency of technical concepts
- Appropriation of the site of repository by the population: activities and projects in addition to RWM
- Considering the significance of intergenerational safety
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)

Evaluation :

The meaning of the repository was addressed through several points:

- In the concrete case on governance, with the question of the post-closure and the knowledge management to keep the memory and the meaning of the repository for future generations
- In the safety case presentation, with the link between monitoring and safety and the broader image of safety of a repository and how to assess it
- During the Cigéo visit, that helped understand better what is at stake.

The questions of what to measure and why, leading to the question of the meaning of the repository, were tackled all along the workshop. The common concern about the meaning of the monitoring and its purpose in the global repository system can help question and develop the meaning of the repository.

## g. Territory

Statement :

**Fruitful interactions must take into account the deep impact of a geological disposal on the meaning people give to their life in a territory.**

Indicators :

- Integration of the repository into landscapes and territory life
- Reference to local problematics, questionings, and claims
- Recognition of legitimacy of local consensus and dissensus
- Scopes of the territory. Role of multiple organisations and scale: local, regional, European, associations, ...

Evaluation :

## EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

The workshop was organised in Nancy specifically to allow a visit to Cigéo after the event. This was a great opportunity to link the reflections of the two first days to the specificity of a real repository integrated in a territory. Moreover, students from a university in Nancy who worked on the subject could come and present their work, which would not have been possible if the workshop had been held elsewhere. The workshop itself was integrated in the territory in which it took place.

However, in this research project, the concrete cases need to be transnational so everyone can relate to them. This “de-territorialisation” was debated, since it was considered that for public participation, the reference to real local problems is crucial and that the context of the repository matters.

The workshop could therefore be considered as both integrated and non-integrated in a territory.

### h. Shared complexity

#### Statement :

**Fruitful interactions necessitate to address the complexity of the issues (technical and non-technical) linked with geological disposal.**

#### Indicators :

- Multinational and intergenerational perspectives
- Considering institutions as dynamic structures towards apprehension of complexity
- Contribution and relevance of scientific expertise to safety issues. Development of safety culture.

#### Evaluation :

Although the concept of shared safety culture has not been discussed directly in the workshop, the notion of shared complexity was central in the construction of the dialogue.

The concrete cases led to discussions mixing technical and non-technical issues, considering for example that the question of closure and post-closure monitoring were deeply complex.

Acknowledging the complex entanglement of technical and non-technical issues was not a result but rather a starting point of this “3+1 dialogue”. These considerations were reinforced by the context of the French possible sudden institutional change, reminding that the institutional framework is dynamic and has a real impact on the disposal.



i. Addressing the long term

Statement :

**Fruitful interactions cannot be meaningfully achieved without an intergenerational perspective, given the extreme timescales.**

Indicators :

- Considerations about intergenerational governance and interactions (more than education)
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)
- Articulation of timescales (past, present, future) at the levels of reflexion and actions.

Evaluation :

The question of the long term was addressed many times during this workshop.

The concrete case about the traceability of data and the one on governance directly tackled this issue. However, even if they were not specifically designed for this, the other cases led to discussion about closure and the post-closure phase, the possible retrievability and the decisions of the future generations.

One of the conclusions of the workshop was that the monitoring strategy for safety should be envisaged as a dynamic process, for it depends on the phase of the project considered. The questions about the monitoring strategy will not be the same if it is in the design phase, the pilot phase, the operational phase or after closure.

Many remarks on the long-term knowledge management arose, considering it as one of the main key issues of a repository. The prism of monitoring and data was particularly rich to explore the extreme timescales since it mixed technical, social, and institutional issues to conserve data, knowledge, and the meaning of the repository.

The questions of timescales were at the heart of this workshop.

### **3. Application of the evaluation grid to MODATS workshop in Paris**

Agenda of the workshop

**24 October 2023** – Meet at 08:30 at RER A station Le Vésinet – Centre

Technical visit – 8:45-12:00 : “the Télecay monitoring network”.

**First session – PEP game session** – 14:00-17:30

14:00-14:30 PEP game introduction – Julien Dewoghélaère & Alexis Geisler-Roblin, NTW

14:30-17:30 PEP game on digitalisation and monitoring

**Second session – Panorama of monitoring & digitalisation key aspects** – 09:30-12:45

The session consists in presenting different types of actors' views on the key challenges of digitalization in relation to monitoring and uncertainty management.

**EURAD** Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

09:30-09:50 Example of a WMO's digital twin through the perspective of uncertainty management – Johan Bertrand, Andra

09:50-10:10 Discussion

10:10-10:30 TSO views on digitalisation through the perspective of uncertainty management – IRSN

10:30-10:50 Discussion

10:50-11:10 Break

11:10-11:30 Example of a RE's digital twin through the perspective of uncertainty management – Wilfried Pfingsten, PSI

11:30-11:50 Discussion

11:50-12:10 CS views on digitalisation through the perspective of uncertainty management – Alexis Geisler-Roblin, NTW

12:10-12:30 Discussion

12:30-12:50 Discovering an interactive monitoring tool – Nico Graebing, UFZ

12:50-14:00 Lunch Break

### **Third Session – Monitoring, digitalisation and trust building conditions – 14:00-17:30**

14:00-14:30 PEP restitution by the different groups

14:30-14:50 Discussion

14:50-15:10 IAEA TECDOC 1208 and trust building – Gauthier Fontaine, NTW

15:10-15:50 Discussion

15:50-16:20 Break

16:20-17:20 Synthetic discussion

17:20-17:30 General conclusion

**a. Legitimacy**

Statement :

**Fruitful interactions necessitate legitimate processes in which all actors can dialog on the same footing.**

Indicators :

- Recognition -or not- of legitimacy (from one to another, by speech and statutes)
- Legitimacy affirmation -or not- (from someone for him/herself, affirmation or revendication)
- Symmetry/di-symmetry of actors (right to speak, time of speak, right to take the floor, to frame the debates, inclusivity, ...)

Evaluation :

The presentation and the discussion were designed to be on an equal footing: presentations were equally long and a pluralistic round table was organised after the presentations.

The first important point about legitimacy was the fact that the PEP game was organised in a way to ensure a diversity of actors in each group: in each one were members of WMOs, TSOs, REs, CSOs and even regulatory bodies. This PEP game can be considered as a success in terms of legitimacy, since all actors were able to discuss cards-based topics on the same footing.

A second interesting point occurred during the presentation of the interactive monitoring tool by the technical partner from RE Helmholtz Centre for Environmental Research - UFZ: it was a great occasion to openly discuss both technical and non-technical topics, with questions from CS members that were considered relevant and challenging.

To sum up, during the whole workshop, the legitimacy of all actors was designed to be guaranteed by:

- the technical visit that was a great occasion to have open discussion about a common object (safety of the territory)
- The ad-hoc PEP, created for this workshop
- The pluralistic discussion
- The concern about common topics, such as visualisation, trust and confidence issues.

## b. Methodology

### Statement :

**Fruitful interactions require that a community is able to conduct a variety of inquiries (scientific, moral, social).**

### Indicators :

- Cooperative research, co-construction of interpretations and scenarios (contextualised cases)
- Degree of critical pluralism: Taking into account the variety of rationalities (scientific, moral, and social views together)
- Consideration of safety case and safety assessment as dialectic places/dialogues
- Highlighting the specificity of long-term knowledge and management

### Evaluation :

The whole workshop relied on a pluralistic methodology to discuss common issues. The four pillars of the workshop presented hereinabove helped having a variety of inquiries.

More specifically, the PEP game session was a time of cooperative research and co-construction of interpretations and scenarios. The variety of actors and the specific scenarios allowed to create a common space to integrate a variety of concerns.

It is interesting to note that some ad-hoc propositions (round table, global discussion) helped consider and integrate the different points of view.

## c. Postural changes

### Statement :

**Fruitful interactions depend on the capacity of all actors to encompass others' views and to enlarge their initial perspective.**

### Indicators :

- Consideration of political and organisational tools for changes (Pathway Evaluation Process, special events, associations, commons, ...)
- Taking into account the role of socio-technical imaginaries (background assumptions: ontological, cosmological, epistemological, ethical, ...)
- Changes in the opening and acceptance of other types of rationalities (not only scientific)

### Evaluation :

It is difficult to notice radical postural change in a workshop, as the sociotechnical (both social and technical) problematizing of monitoring issues is a slow process. Despite good legitimacy dynamics and a pluralist methodology, more workshops on these topics should be organised to observe postural changes over a longer period.

However, several postural changes were observed during the PEP game session, as this serious game enables a more global and personnel approach.

## **EURAD** Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

The discussions about trust and confidence showed that these two concepts are considered as central for all actors, leading to an acceptance of non-scientific rationalities. The final discussion about transparency and “black-box” models also led to the importance of pluralism and dialogue with civil society.

### **d. Personal unity**

#### Statement :

**Fruitful interactions require from an actor that he or she takes into account the different dimensions of him/herself.**

#### Indicators :

- Personal dissonance/consonance with the institutional discourses/roles
- Personal expression markers: "off the record", I/we, self-censorship, ...
- Importance of professional and personal life shift: professional status and activity, socio-environmental activism, consciousness raising, ...

#### Evaluation :

The PEP game is central regarding this criteria, as it is designed to enable a more personal approach on global or precise issues. During the game sessions of this workshop, participants were more concerned individuals than representatives of one college.

Moreover, the discussions on confidence and trust showed the will - and the importance - to integrate other dimensions of the experts than the technical and institutional ones.

The final discussion also led to remarks integrating the personal situation of some of the participants regarding the disposals, living nearby one or being part of a local community concerned by these projects.

However, as the workshop was both structured by college (presentations of each type of actors, round tables) and offering half days during which actors could be “less institutional” (PEP, technical visit), the results regarding this criteria are mixed (and weaker than in UMAN seminars for example). The dichotomy experts/non-experts and the lack of common issues remained all along the workshop.

e. Expertise function

Statement :

**Fruitful interactions require a pluralistic expertise that therefore cannot be reduced to a sole scientific process.**

Indicators :

- Role and cooperation with non-experts, non-scientific experts, and counter-experts: co-expertise
- Evolution of the expertise function along the processes, recognition of this evolution by experts themselves
- Consideration of pluralistic dialogue and institutional integration for better apprehension of complexity

Evaluation :

The discussions about transparency, communication with civil society, trust-building process etc., helped go beyond the sole expertise issues. This was made possible thanks to the use of many different methods in this workshop that allowed to go beyond the expert/non-expert dichotomy: the technical visit, showing the materiality of the issues at stake; the PEP game, allowing to look ahead in the distant future; the pluralist open discussions; the visualisation tool and the following discussion on knowledge management and transmission; etc.

f. Meaning of the repository

Statement :

**Fruitful interactions include exchanges on the meaning of the existence of repository in the concrete life of people.**

Indicators :

- Integration of plurality of meanings beyond the efficiency of technical concepts
- Appropriation of the site of repository by the population: activities and projects in addition to RWM
- Considering the significance of intergenerational safety
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)

Evaluation :

This workshop led to many considerations about the meaning of the monitoring, and the meaning of the repository itself.

The framework allowed to integrate monitoring and digitalisation issues in contexts that give them a real meaning:

- Safety and security of the territory;
- Projections on long time scales and strategies;
- Uncertainty management;
- Trust, confidence and transparency.

## **EURAD** Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

A lot of issues about intergenerational transmission, pluralism, the meaning of the monitoring in the global system, etc., were tackled during the PEP game session and the final discussion.

### **g. Territory**

#### Statement :

**Fruitful interactions must take into account the deep impact of a geological disposal on the meaning people give to their life in a territory.**

#### Indicators :

- Integration of the repository into landscapes and territory life
- Reference to local problematics, questionings, and claims
- Recognition of legitimacy of local consensus and dissensus
- Scopes of the territory. Role of multiple organisations and scale: local, regional, European, associations, ...

#### Evaluation :

The technical visit of the T  l  ray network in the first half day was an incredible opportunity to entrench the whole workshop in a more territorial approach. Indeed, the T  l  ray is a tool to monitor radiation in the French territory and the monitoring issues that were discussed in the previous MODATS workshop - and that were about to be discussed in this one - found an echo in this concrete application. Thanks to this real-life technical introduction, the links with the national territories were very central in this workshop.

This methodology of starting the workshop with a concrete application is very fruitful and should be envisaged more often.

Moreover, the final discussion of this workshop was about the importance of the trust and confidence issues within the local communities and led to the sharing of personal local experiences.

### **h. Shared complexity**

#### Statement :

**Fruitful interactions necessitate addressing the complexity of the issues (technical and non-technical) linked with geological disposal.**

#### Indicators :

- Multinational and intergenerational perspectives
- Considering institutions as dynamic structures towards apprehension of complexity
- Contribution and relevance of scientific expertise to safety issues. Development of safety culture.

#### Evaluation :



## EURAD Deliverable 1.16 – Evaluation of the experimental model of interaction between EURAD participants and Civil Society

Shared complexity is one of the pillars of the creation of this workshop. Indeed, the “3+1” organisation aims at creating a shared vision for some critical issues. The discussions were then a great opportunity to create this shared complexity on the topics of monitoring and digitalisation.

The main tool for the development of this shared complexity might be the PEP, that allowed very fruitful exchanges of different points of views on plausible scenarios. Finding a consensus was not the main goal: the PEP is made to create a safe space to enable exchanges in order to share different visions.

Complexity was also tackled during the trust/confidence discussions, as these two concepts were presented (and debated) as a way to address and manage complexity.

However, the uncertainty management framework that was supposed to enhance this shared understanding of complex issues might have been less efficient than expected. This framework was probably not previously shared enough by all participants for it to be efficient.

### i. Addressing the long term

#### Statement :

**Fruitful interactions cannot be meaningfully achieved without an intergenerational perspective, given the extreme timescales.**

#### Indicators :

- Considerations about intergenerational governance and interactions (more than education)
- Flexibility of the sociotechnical process (retrievability, reversibility, recoverability, ...)
- Articulation of timescales (past, present, future) at the levels of reflexion and actions.

#### Evaluation :

A lot of issues about intergenerational knowledge and data management issues were raised during these two days, addressed both directly, through the concept of intergenerational stewardship for instance, and indirectly, through the questions of obsolescence, technological innovation or data management. Indeed, digitalisation (that was the key topic of this workshop) is a recent solution to old problems, and it was considered crucial to be sure that a correct transition through the year can be achieved in this fast-changing world.

This workshop also highlighted the fact that local communities and all stakeholders have a crucial role to play regarding the questions of the long term regarding monitoring and digitalisation. Trust, confidence, transparency, involvement of all actors, etc.: all these concepts were discussed linked to the issue of intergenerational transmission, all along the process.

The PEP game was a great tool to help discuss these long term issues, as it offers the possibility to “play” a scenario in the near or distant future. Discussions that rose from the PEP game sessions led to common interrogations on long term issues.

However, reversibility/retrievability/recoverability were not directly tackled in this workshop, as the digitalisation issues are not closely linked to these concepts compared to more general issues on monitoring as presented in the 1208 TECDOC.

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