



## **Deliverable 1.15: Integrated review of the ICS activities in EURAD**

Work Package 1, task 8

Programme Management Office (PMO)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847593.



<http://www.ejp-urad.eu/>

## Document information

Project Acronym	<b>EURAD</b>
Project Title	<b>European Joint Programme on Radioactive Waste Management</b>
Project Type	<b>European Joint Programme (EJP)</b>
EC grant agreement No.	<b>847593</b>
Project starting / end date	<b>1<sup>st</sup> June 2019 – 30 May 2024</b>
Work Package No.	<b>1, task 8.3</b>
Work Package Title	<b>Programme Management Office</b>
Work Package Acronym	<b>PMO</b>
Deliverable No.	<b>1.15</b>
Deliverable Title	<b>Integrated review of the ICS activities in EURAD</b>
Lead Beneficiary	<b>IRSN (NTW)</b>
Contractual Delivery Date	<b>March 2024</b>
Actual Delivery Date	<b>July 2024</b>
Type	<b>Report</b>
Dissemination level	<b>Public</b>
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### To be cited as:

Geisler-Roblin A., Fontaine G., Mraz G., Dewoghélaère J., de Butler M. (2024): Integrated review of the ICS activities in EURAD. Final version as of 30.05.2024 of deliverable D1.15 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

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### Acknowledgement

This document is a deliverable of the European Joint Programme on Radioactive Waste Management (EURAD). EURAD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 847593.

Status of deliverable		
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Approved (PMO)	ANDRA	25 July 2024
Submitted to EC (Coordinator)	ANDRA	25 July 2024

## Executive Summary

This deliverable presents an integrated review of all ICS activities carried out in EURAD. In accordance with the perspective of the Aarhus Convention that grounds the CS participation, the sustainable presence and engagement of the public in EURAD through the double-wing model was expected to reinforce the quality of the decision-making process in the context of Radioactive Waste Management.

The objective of the report is to provide a general overview of all these ICS activities, presenting a summary of the different results and giving links to adequate references where detailed information is available (part 2 of the report). The report also provides a proposal of integrated vision for future ICS activities in research context such as EURAD as well as recommendations coming from the different ICS activities carried out in EURAD (part 3 of the report).

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## Acronyms

CS	Civil Society
CSLG	Civil Society Larger Group
EC	European Commission
EURAD	European Joint Programme on Radioactive Waste Management
GD	Geological Disposal
GDF	Geological Disposal Facility
ICS	Interaction with Civil Society
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



## 1. Introduction

EURAD programme aims at supporting the implementation of the Waste Directive in EU Member-States, taking into account the various stages of advancement of national programmes. The goals are to:

- support Member-States in developing and implementing their national RD&D programmes for the safe long-term management of their full range of different types of radioactive waste through participation in the RWM Joint Programme;
- develop and consolidate existing knowledge for the safe start of operation of the first geological disposal facilities for spent fuel, high-level waste, and other long-lived radioactive waste, and supporting optimization linked with the stepwise implementation of geological disposal;
- enhance knowledge management and transfer between organisations, Member States and generations.

The successful implementation of RWM National Programmes relies on both scientific and technical aspects for a sound safety strategy and scientific and engineering excellence and societal (social, legal, ethical, political) aspects. Being activities of public interest and outcome, European programmes therefore undertake work to address these requirements through local and national stakeholder engagement activities, in order to enable Civil Society (representative organisations, e.g. Non-Government Organizations, Local Community Partnerships, etc.) to participate in defining terms of their national RD&D programmes and the evaluation of RD&D results in the perspective of safety. Interacting with Civil Society is important in this perspective and therefore one objective of EURAD was to foster interactions between WMOs, TSOs, REs and Civil Society Organisations to promote mutual benefit of the available knowledge, based on cooperation and sharing.

### 1.1 Model for ICS in Eurad

The EURAD programme includes interactions with Civil Society (CS) based on a so-called “double-wing” model that have been settled on and tested throughout European research programmes SITEX II<sup>1</sup> and JOPRAD<sup>2</sup> projects, notably in the perspective of the EURAD programme.

The double wing model is built on some important basis:

- As foreseen by the Aarhus Convention and indicated in EURAD Vision and EURAD deployment plan<sup>3</sup>, the sustainable presence and engagement of the public in EURAD is expected to reinforce the quality of the decision-making process in the context of Radioactive Waste Management (RWM) R&D, i.e EURAD governance.
- It is also an opportunity for CS representatives<sup>4</sup> to collect information of the EURAD outputs that will impact (directly or indirectly) decision-making processes in RWM at national level. As indicated in the EURAD vision<sup>5</sup>, “EURAD will generate and manage knowledge to support EU Member-States with their implementation of the Directive 2011/70/Euratom (Waste Directive), and more specifically with the development and implementation of their national R&D

<sup>1</sup> SITEX-II is the acronym for “Sustainable network for Independent Technical Expertise of Radioactive Waste Disposal – Interactions and Implementation” (2015-2017). Its overall objective is the practical implementation of the sets of activities issued by the previous European research program SITEX (2012-2013). See: <http://sitexproject.eu/>

<sup>2</sup> JOPRAD is the acronym for « Joint Programming on Radioactive Waste Disposal” (2015-2017) The objective was to prepare a proposal for setting up of a Joint Programming that bring together at the European level, aspects of R&D activities implemented within national research programmes where synergy is identified. See: <http://www.joprad.eu/about-joprad/rationale-objectives.html>

<sup>3</sup> The EURAD vision (<https://www.ejp-eurad.eu/eurad-vision>) and EURAD deployment plan (<https://www.ejp-eurad.eu/deployment-plan>) are two of the founding documents of EURAD.

<sup>4</sup> CS larger group members and CS experts.

<sup>5</sup> The quotation is extracted from p.7 of EURAD vision that describe the objectives and rationale of the EURAD programme.

programmes for the safe long-term management (including disposal) of their full range of different types of radioactive waste”.

- For that purpose, close interactions between experts from Waste Management Organisations (WMOs), Technical Support Organisations (TSOs), Research Entities (REs) and Civil Society (CS) were foreseen and required innovative ways of collaborative work to foster the mutual understanding of key processes of RWM on the basis of R&D outcomes and uncertainty management.

The goal of the double-wing model is also to ensure that, given the scientific and technical dimensions of the issues at stake in EURAD, the Civil Society participants are comprehensively documented so that they could form their own views on the R&D performed. The double wing model involves two categories of CS participants: the Civil Society larger group, on the one hand, the Civil Society experts group, on the other hand. The following figure 1 illustrates the functioning of the double wing model in EURAD:

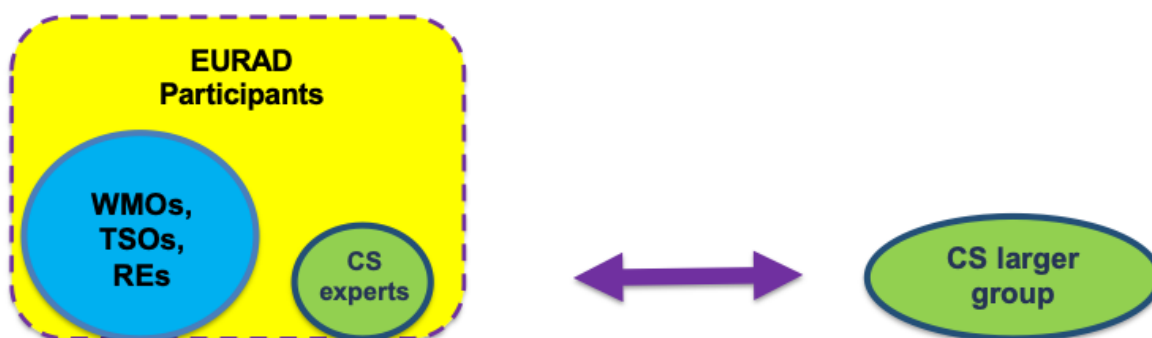


Figure 1 — Double Wing model of interactions with civil society in EURAD

### 1.1.1 The CS larger group

In EURAD, the CS larger group involves on a voluntary basis, local, national and European representatives from the CS. In order to compose the CS larger group, 2 categories have been defined to represent different types of actors and organisations from civil society concerned by Radioactive Waste Management:

- European and national associations,
- local stakeholders (individuals and representatives of local communities having an interest in RWM, partnerships, local associations).

An equilibrium between the two categories was sought for the constitution of the group. According to the available resources, 22 persons in total were invited to attend the interactions with civil society (ICS) activities (workshops, seminars and meetings).

To represent different views on Radioactive Waste Management, it was sought to have in the CS larger group the inclusion of:

- members of European countries with less and more advanced RWM programmes,
- citizens from Western and Eastern Europe countries,
- people with various interests in different fields related to RWM (health, environment, science, energy...),
- persons of diversified genders and generations.

In order to have a good balance of representation, the CS larger group did not include more than 2 persons from the same organisation and 3 persons from the same country. Nevertheless, the final composition of the CS larger group depended on the availability of the invited potential members.

To be part of the CS larger group, the interested actors had to fulfil the following prerequisites:

- standing past or present engagement in the follow-up of RWM activities with potential exceptions for youth,
- experience and/or interest in the field of RWM,
- personal commitment to participate in the whole EURAD-1 ICS activities (2019-2024), meaning to participate at least at one workshop per year during 5 years<sup>6</sup>,
- being supportive with the EURAD vision and commit to contribute constructively in the exchanges that will take place in EURAD, respecting the goals of EURAD,
- fluent English speaking and writing<sup>7</sup>.

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>8</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 larger group had the opportunity to bring its views and exchange with EURAD participants (WMOs, TSOs, REs) along the programme through the CS experts group. It was informed on a regular basis and participated in a yearly workshop involving a panel of the different colleges of EURAD participants.

Along the ICS activities, it has been noticed that some members of the CS larger group were not able to stay involved as much as planned during the 5 years of the EURAD programme. This situation raised the diagnosis of the absence of a replacement procedure, as it had not been envisaged at the beginning of the programme.

### 1.1.2. The CS experts group

The CS experts group is an intermediary between the EURAD participants as a whole and the CS larger group. The term “CS expert” should be understood in the wider sense of “knowledgeable person” or “person recognized as such” typically ranging from academics and non-institutional experts with a scientific background to people “spending significantly more time than the average population” on the issues raised by RWM. CS experts are not necessarily scientists but people who developed a capacity to enter technical or strategic issues and to express knowledgeable views in a refutable way (logical argumentation based on reliable data, etc.). The CS experts are involved in EURAD through the channel of the European network Nuclear Transparency Watch (NTW)<sup>9</sup> which is a Linked Third Party (LTP) of the French Institute for radiation protection and Nuclear Safety (IRSN). The list of the members of the CS experts group is available in D1.13 **List of members of the Civil Society group**<sup>10</sup>.

The CS experts group is involved in a selected number of activities of EURAD: the CS experts group contributes to the two WPs of strategic studies, follows up the technical activities of the program and is

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<sup>6</sup> At the end, some participants left the CS larger group before the end of the five years and that raised the question of the renewal of the members of the group, as no procedure of this type was planned.

<sup>7</sup> Regarding this last criteria, it was decided not to be too strict: a capacity to follow discussions in English and to understand basic writing documents could be sufficient. Without these basic skills, it would not be interesting to be a member of the CS larger group because the discussions and the materials for the meetings are in English.

<sup>8</sup> Dewoghélaère Julien, Rey Honorine, Hériard-Dubreuil Gilles. (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.

<sup>9</sup> NTW is a European network that promotes a citizen watch on nuclear safety and transparency. The network was launched in 2013 and gathers 47 organisations coming from 21 countries. See the website: <http://www.nuclear-transparency-watch.eu/>

<sup>10</sup> Op Cit.

involved in one R&D Work package (WP). It informed regularly the CS larger group on the progress of the work.

## 1.2. Structure of ICS activities in EURAD

One objective of EURAD is to foster interactions between WMOs, TSOs, REs and CS. Such interactions aim at improving mutual understanding of how and to what extent R&D activities on RWM make sense and contribute to improving decisions. The ICS activities in EURAD also contribute to developing ideas, propositions and methodologies on how to interact with Civil Society on scientific and technical results, how to deal with uncertainties, and how to interact with Civil Society in order to promote mutual benefit of available knowledge.

CS representatives have no mandate and represent themselves. They have specific concern on RWM safety, express views on what matters to them but are not research partners as the other EURAD beneficiaries. The ways they interact with the different activities of EURAD (through the implementation of the double wing model presented above) are summarised by the Figure 2 below:

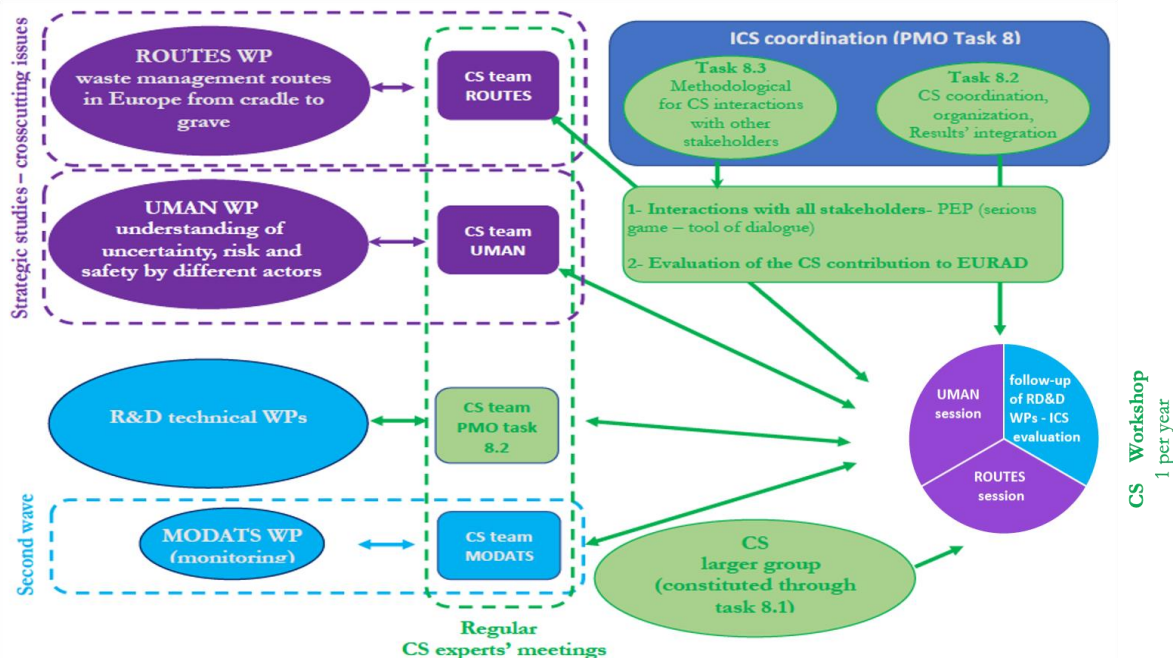


Figure 2 Structure of ICS activities in EURAD

ICS activities have been 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, when the second wave of EURAD WPs was launched, one CS expert team was directly included in one R&D project, MODATS, that is 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 has been 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. It was planned to have face-to-face workshops but due to Covid situation, the two first ICS workshops were organised online (May 5-6 2020 and March 25-26 2021). A panel of EURAD participants (WMOs, TSOs, REs) involved in UMAN-ROUTES- MODATS and other technical WPs attended the ICS workshops according to the topics discussed. A sixth ICS workshop

was implemented at the end of EURAD in order to discuss the ICS results in an integrated view and to provide recommendations for future research activities on RWM aiming at including civil society.

CS experts have also organised an ICS evaluation process with interviews of EURAD actors, organisation of dedicated meetings, establishment of criteria to enable fruitful interactions between researchers and civil society.

The results of all these activities have been integrated into various reports : milestones and deliverables in WPs UMAN, ROUTES, MODATS, CORI, and PMO. CS experts also took part in three EURAD training sessions (SITEX, UMAN and MODATS training sessions), three lunch and learn sessions and various dissemination events. The details of these reports and activities are described in the following part.

## 2. Synthesis of ICS activities in EURAD

Below are described the different ICS activities carried out in EURAD. For each type of activity, some elements of context are given before detailing the objectives and methodology chosen for implementing the activity and presenting a synthesis of the results.

### 2.1. ICS workshops

#### 2.1.1. Presentation of PMO WP

The WP1 of EURAD - “Project Management Office” (PMO) has a strategic role in ensuring the overall coordination of the deployment of EURAD. More specifically, the PMO ensures:

- Day-to-day management of the administrative, legal and financial aspects;
- Internal communication between EURAD Beneficiaries (Mandated Actors);
- Reporting to and interfaces with European Commission (EC);
- Overall scientific and technical coordination/ integration/ evaluation of impacts (RD&D, Strategic Studies and Knowledge Management (KM), interaction with civil society);
- Interfaces with third parties;
- Dissemination of EURAD progress and overall results (of RD&D WPs, Strategic Studies WPs and KM WPs) and outreach activities. was in charge of the coordination of all EURAD activities and administrative work.

In the frame of the PMO WP, the Task 8 is dedicated to ICS activities with the following 3 subtasks<sup>11</sup>:

- Subtask 8.1 dedicated to the constitution of the CS larger group.
- Subtask 8.2 dedicated to CS coordination, organisation and reporting.
- Subtask 8.3 dedicated to the ICS evaluation process.

The constitution of the CS groups is described in part 1 of the report. The evaluation process is described below (see chapter 2.6). One of the main aim of subtask 8.2 is to organise yearly ICS workshops to present the evolution of the work within the different ICS activities namely the 2 “strategic studies” WP ROUTES and UMAN as well as the outcomes from the team of CS experts involved in the follow-up of R&D technical WPs and in MODATS WP.

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<sup>11</sup> More information can be found in the deliverable D1.13:  
<https://www.ejp-eurad.eu/publications/eurad-d113-list-cs-group-members>

## 2.1.2. Objectives and methodology of ICS workshops

The ICS workshops which took place during EURAD programme 2019-2024 are listed hereafter.

ICS workshop no. 1:

- 5-6 May 2020: online
- 18 May 2020: Working group sessions, online

The first ICS Workshop was the opportunity for the Civil Society (CS) experts and panel of WMOs, TSOs and REs participants involved in EURAD to get to know the CS larger group members who have been appointed according to the Deliverable 1.13 “List of members of the Civil Society group”. The main aim of the CS larger group is to follow the ICS activities in EURAD and to give their opinions on the work done. Objectives of the meeting were to present EURAD and ICS activities and to discuss the specific ICS in ROUTES and UMAN and obtain feedback from the CS larger group on related deliverables.

ICS workshop no. 2:

- 25-26 March 2021: online

This meeting gathered the Civil Society (CS) experts and the members of the CS larger group involved in the EJP, plus some EURAD participants who have a specific interaction with the ICS activities (e.g. because they are involved in the same Work Packages - WPs). The aim was that the CS experts and the CS larger group members exchange on the work performed in EURAD, bringing their views, comments and suggestions.

ICS workshop no. 3:

- 16 March 2022: UMAN session, online
- 13 June 2022: Fontenay-aux-Roses (France) and online

The ICS Workshop n°3 was divided in two parts, one online session that took place Wednesday, 16 March 2022 and another hybrid session at the IRSN facilities on Monday, 13 June 2022.

These meetings gathered the Civil Society (CS) experts and the members of the CS larger group involved in the EJP, in addition to some EURAD participants who have a specific interest with the ICS activities (e.g. because they are involved in the same Work Packages - WPs). The aim of the ICS workshop n°3 was to inform the CS larger group members about the work done in EURAD, especially the work carried out by the CS experts. The goal was also to collect their views, comments and suggestions on the results of the work done and for future EURAD activities.

ICS workshop no. 4:

- 24-25 May 2023: Fontainebleau (France) and online

The ICS Workshop n°4 took place in Fontainebleau at the Ecole des Mines facilities on 24 and 25 May 2023 and enabled online attendance.

These meetings gathered the Civil Society (CS) experts and the members of the CS larger group involved in the EJP, in addition to some EURAD participants who have a specific interest with the ICS activities (mostly because they are 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.

ICS workshop no. 5:

- 18-19 Oct 2023: Brussels (Belgium) and online

The ICS Workshop n°5 took place in Brussels in BelV facilities on 18 and 19 October 2023 and enabled online attendance.

These meetings gathered the Civil Society (CS) experts and the members of the CS larger group involved in the EJP, in addition to some EURAD participants who have a specific interest with the ICS activities (mostly because they are involved in the same Work Packages - WPs). This ICS workshop was supposed to be the last one, before the agreement to have the additional ICS Workshop n°6, therefore it was conceived as a synthetic workshop, different from the four precedent ones. The objective of this final ICS workshop was double: firstly to step back and evaluate past ICS activities or results in EURAD and the contribution in terms of participation models; secondly 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. This workshop consisted of 3 half-day sessions, covering the following pillars for RWM: Shared Culture for Safety and Security, Intergenerational Stewardship Culture, Fruitful Interactions. In fact, this workshop was the first shared occasion to elaborate and discuss on these three pillars, in order to constitute the integrated vision that can be found in the part 3 of this present deliverable.

ICS workshop no. 6:

- 10-11 April 2024: Ljubljana (Slovenia) and online

The ICS Workshop n°6 took place in Ljubljana at the hostel Celica on 10 and 11 April 2024 and enabled online attendance.

These meetings gathered the Civil Society (CS) experts and the members of the CS larger group involved in the EJP, in addition to some EURAD participants who have a specific interest with the ICS activities (mostly because they are involved in the same Work Packages - WPs). The ICS workshop n°6 was not planned at the beginning of the EURAD programme, but followed the pathways opened by precedent ICS workshops, therefore aimed 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. Similarly to the ICS workshop n°5, this event was organised in a topical way using cross-cutting topics addressed in the different WPs.

### 2.1.3. ICS workshops summary results

In this part, the main outcomes and results of all 6 ICS workshops from EURAD year 1 to EURAD year 6 are synthetically presented, giving an overview of the outcomes from different methodologies implemented for these workshops and some insights of transversal topics addressed through these cornerstone events.

It has to be underlined that it was not planned that the ICS workshops would produce general outcomes regarding ICS activities, but would rather contribute to share about the work done in the different WPs in EURAD and to collaborate regarding next steps of those activities. Yet some transversal elements were built and assembled along the way, that can be found in the part 3 of this present deliverable: Integrated vision for ICS activities.

#### Interaction with Civil Society (ICS) Workshop n°1

The participants of several sessions in the ICS Workshop n°1, received the information by the EURAD responsible members from work packages PMO, ROUTES and UMAN and then were involved in moderated discussions and parallel small group sessions. The feedback, comments, questions and suggestions were used for deliverables in EURAD. Also, this first workshop established the relations between EURAD participants and CS larger group and built on trust.

#### Interaction with Civil Society (ICS) Workshop n°2

During the workshop, there were some initial presentations made by two members of the Programme Management Office on the work achieved in EURAD for the last 1,5 years. Then, CS experts gave speeches on the work they carried out in different activities they are involved in: follow up of the technical WPs, ICS evaluation process, ROUTES and UMAN strategic studies. CS experts and CS larger group members gathered in small groups in order to discuss concrete case studies. During the session dedicated to the work done by the CS experts in ROUTES, they discussed participation and transparency in the frame of shared solutions for the waste based on the examples of the Nuclear Power Plant (NPP) in Krsko (Slovenia) and facility in Bohunice (Slovakia). During the UMAN session, they developed ideas on how ethical principles could help in the management of uncertainties along the disposal process (based on hypothetical case studies prepared by the CS experts involved in UMAN).

#### Interaction with Civil Society (ICS) Workshop n°3

The first part of the workshop in March was dedicated to UMAN while the second part of the workshop in June was dedicated to ROUTES, Knowledge Management, CORI-UMAN ICS activities and MODATS. The first part of the workshop was mainly a preparation for the UMAN seminar n°3 held on 14 and 15 June 2022. This first part of the workshop dealt with uncertainties related to human activities during the implementation of geological disposal.

The second part of the workshop focused on the first outcomes of the ROUTES deliverable D9.17 regarding national transparency in different countries (Czech Republic, Denmark, Germany, Greenland, France, the Netherlands, Slovakia, Sweden, the United Kingdom) in the decision-making for geological disposal facilities siting throughout Europe. This second part of the workshop held on June 13 continued with a presentation of the Knowledge Management activities and projects in relation to Civil Society. Finally, there was a time for some presentations on the outcomes of Civil Society participation in some technical work packages such as CORI and MODATS.

#### Interaction with Civil Society (ICS) Workshop n°4

The first day of the workshop started with a session on technical WPs (MODATS, CORI-UMAN-ICS, ACED, MAGIC) in the morning and ended with a session on the UMAN WP in the afternoon. In detail, the participants focused on the outcomes from the last MODATS Task 2.5 workshop and the perspectives for the next one, on the ongoing position paper and work done in CORI-UMAN-ICS, and finally were presented two technical works on ACED and MAGIC WPs by Laurent de Windt and Nicolas Seigneur from Ecole des Mines. In the afternoon, the UMAN session was dedicated to a presentation of the D10.17 on pluralistic methods for uncertainty assessment describing the lessons learned in the UMAN process and on an outlook on near field uncertainties.

The second day started with a session on the ROUTES WP in the morning and ended with transversal “World Café” in the afternoon on dissemination. In detail, the participants dealt, in the morning, with the overview and the outcomes from the deliverable D9.17 devoted to transparency in the establishment of national radioactive waste facilities, and with the deliverable D9.18 on how to ensure transparency and



public participation in radioactive waste management technical issues, and how to ensure long-term governance. In the afternoon, the session was dedicated to possible ways of dissemination of EURAD results.

In general, the interactions between all participants were very vivid and proactive. Important suggestions and feedback have been received and they have been included in the future ICS activities and in particular in the ICS WS n°5.

#### Interaction with Civil Society (ICS) Workshop n°5

The first half day was structured around the first pillar of shared culture for safety and security, relying on how this was conceptualized in both UMAN and ROUTES WPs, what are the elements at stake in that notion, and how it can be addressed from a regulator's point of view, as the Belgian authority presented elements on that topic. It was highlighted that the definitions of safety culture and shared culture for safety and the links with defence-in-depth were very strong, and that having independent expertise (and the notion of independence itself) appears to be a crucial importance of trust. During this session an animated discussion arose about the importance of the safety envelope as described by GEOSAF programme<sup>12</sup>.

The second half-day focused on the notion of intergenerational stewardship culture, and many topics related to intergenerational stewardship and long-term perspective were freely tackled here through a “creative process” stirred up with a synthetic presentation, articulating all key elements related to intergenerational stewardship. The creative process was followed by most participants and thus many drawings, open-style texts and infographic elements were produced at this moment.

The third half-day focused on the topic of fruitful interactions that helped to draw reflexive conclusions on the form of ICS activities. The session enabled discussion on topics such as how can the methodology of interactive serious game named Pathway Evaluation Process (PEP)<sup>13</sup> be renewed and linked to new topics as a continuous creation of an adequate framework, and how can the core concept of confidence structure the discussion in a technical WP, considering how the ICS activities contributed to in MODATS WP notably.

This fifth ICS workshop was the most transversal one, and its main outcome is the very deep resonance all actors found behind the definition of RWM activities as a decision making process in an uncertain environment, for which the three discussed pillars can be a source of robustness. Thus this workshop drew conclusions and opened new perspectives at the same time.

#### Interaction with Civil Society (ICS) Workshop n°6

After sharing outcomes and feedback for the different WPs in which CS experts were involved (PMO, UMAN, ROUTES, MODATS), a first topical session took place on the concept of intergenerational stewardship culture based on the portfolio of drawings produced by the participants of the ICS WS n°5 to deepen the dialogue on the topic. Finally, the first day ended with the evaluation of a visualization tool for civil society interactions, which conceptualization emerged in EURAD in the frame of the ICS WS n°5 in order, for all kinds of actors, to better grasp the complexity of a DGR safety objectives and core concepts in a shared and dynamic way, by using the outcoming results concerning Geosaf envelop.

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<sup>12</sup> During the period 2008-20117 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>

<sup>13</sup> The PEP is a tool of dialogue (designed as a serious game) developed under the frame of the SITEX-II project and SITEX.network that enable multi-actors' discussions in the field of radioactive waste management. EURAD Lunch and Learn Session on PEP methodology: <https://www.ejp-eurad.eu/news/recording-ii-pluralistic-tool-dialogue-rwm-pathway-evaluation-process-pep>

The second day addressed this cornerstone concept coming from ROUTES and UMAN works: shared culture for safety and security. The objective was to deepen and update the subjects on which civil society, TSOs, REs and WMOs could meet to enhance a better shared culture for safety and security. Then, the development and improvement of the current model of involvement of the civil society in EURAD was addressed. The discussed new model, based on the results of the “double wing model” already in place, called “triple wing model” is proposing a third “wing” enabling a better reach (local communities as well as other actors) and therefore a better collaboration and continuity of actions. Finally, based on the existing criteria previously presented in other ICS WS, in the last session the participants were offered to propose ideas for a charter for fruitful interactions to improve future interactions in the frame of RWM research programmes.

## 2.2. ICS activities in ROUTES

### 2.2.1. Presentation of ROUTES WP

The strategic study ROUTES describes and compares the different approaches to characterisation, treatment and conditioning and to long-term waste management routes between MS (member states). The interested organisations are from different countries, with programmes at different stages of development, with different amounts and types of radioactive wastes to manage. In this WP, were identified the safety-relevant issues and their R&D needs associated with the waste management routes (cradle to grave), including the management routes of legacy and historical waste, the development of waste acceptance criteria (WAC) prior to the availability of disposal facilities, and options for disposal of small waste inventories.

The WP considers past and present EU projects on the topics of interest and other initiatives carried out at international level such as IAEA, NEA in order not to duplicate the work. The aim of this WP is to identify relevant R&D topics or new strategic studies which could be collaboratively launched in EURAD 2.

The purpose of this WP is to provide an opportunity to the organisations of the Member-States to share their experience and to identify common R&D interest on such topics. In addition to providing an overview of good practices for different steps in radioactive waste management and guidance for research activities, the work package has provided an opportunity to consider sharing of technology and facilities<sup>14</sup>.

Among the 8 tasks of the ROUTES WP, Task 7 was solely dedicated to interaction with civil society involving 7 CS experts. In this chapter, the outcomes of these ICS activities are described.

### 2.2.2. Objectives and methodology of ICS activities in ROUTES

The objectives of Task 7 were the following:

- facilitate the translation of scientific/technical results of the ROUTES WP to allow effective interaction with the CS larger group which was drawn from Nuclear Transparency Watch (NTW) wider membership and interested associations<sup>15</sup>.
- create the conditions for the CS larger group to express its expectations or views linked to the topics addressed in the ROUTES WP.
- improve mutual understanding on the RD&D needed to develop safe acceptable solutions in processing and disposal of radioactive waste.

Task 7 has been divided in 3 consecutive subtasks with the following aims:

<sup>14</sup> See: <https://www.ejp-eurad.eu/implementation/waste-management-routes-europe-cradle-grave-routes>

<sup>15</sup> The process of identification of the CS larger group is presented in the D1.13: <https://www.ejp-eurad.eu/publications/eurad-d113-list-cs-group-members>

- to prepare the scoping of ROUTES tasks 2 to 6 objectives and actions in order to identify issues that are deemed of more specific interest in the perspective of developing interactions between CS and EURAD partners along the course of the WP<sup>16</sup>.
- to develop, for each year, one deliverable, devoted to a particular topic, based on the work in other ROUTES tasks involving discussions with panels of WMOs, TSOs and REs participants involved in ROUTES, together with civil society experts and interactions with the larger CS group in the dedicated yearly workshops.
- to summarise the conducted work in Task 7, covering the interaction framework developed and used in the WP, and including recommendations for future CS interaction within potential next joint programme for RWM (this deliverable).

Civil society (CS) experts involved in ROUTES Task 7 organised themselves at the beginning of EURAD in 2019 in order to fill those subtasks aims by exchanging on the results with the ROUTES tasks members and with the CS members of EURAD within EURAD PMO WP1, Task 8<sup>17</sup>.

The collaboration with the ROUTES WP leader was shared by the two Task 7 co-leaders and they also presented the results during the programme through various WP or tasks leaders' meetings. Meanwhile the CS experts of Task 7 have met regularly at least every two months sharing the work and the information collected by each pair of CS experts allocated to the follow-up of a ROUTES' task.

The CS experts of Task 7 also decided to form small teams, consisting of two CS experts each, to closely follow the activities in the individual ROUTES tasks based on their experience, interest, education and also their locality in order to reduce travel costs. For each of the ROUTES tasks, a CS expert was assigned as main contact person and another as stand-in to follow development in the respective task.

Finally, the CS experts involved in Task 7 have also attended the EURAD PMO WP1, Task 8 meetings and workshops as well as EURAD annual events to share results and adopt views points from other EURAD members within their work.

### 2.2.3. Summary of ICS results in ROUTES

The first subtask (7.1) was meant to scope the objectives of ROUTES tasks 2 to 6. This work led to a publication in 2021 with the Deliverable D9.15 "Scoping of ROUTES, initial ICS input and ICS action plan"<sup>18</sup>.

The second subtask (7.2) dedicated to different topics led to the production of the 3 following deliverables:

- D9.16 "CS discussion and input focused on the first topic identified in the ICS action plan"<sup>19</sup> providing an analysis of ethical and legal issues, good transparency and public concerns for shared solutions together with case studies (published in 2022).

The core part of this deliverable is devoted to the shared solutions of radioactive waste (RW) management and discusses some key ethical and legal principles for managing radioactive waste, which are relevant to different solutions and public concerns related to the shared solutions in general where the ideas and comments were collected from participants of ROUTES and also from CS larger group.

These are then illustrated with three cases of different shared solutions which exist and are interested by the Task 7 members. Based on lessons learned the more general recommendations are derived

<sup>16</sup> See: Zeleznik N., Swahn J., Haverkamp J., Hooge N.H., Rey H. (2021): Scoping of ROUTES, initial ICS input and ICS action plan, D9.15: <https://www.ejp-eurad.eu/publications/eurad-d915-scoping-routes-initial-cs-input-and-ics-action-plan-task-71>

<sup>17</sup> Ibid.

<sup>18</sup> Ibid.

<sup>19</sup> <https://www.ejp-eurad.eu/publications/eurad-d916-implementation-routes-ics-action-plan-first-phase>

which are of value also for other shared situations. For EURAD year 3 the focus of the investigation of Task 7 was foreseen to be on the work of Task 5 on “RWM Solutions for small amounts of waste” (and partially also new Task 8) as described in point 3 of the action plan in section 1.1. The Task 7 team focused on the public participation in case of national RWM developments based on the existing international legal frameworks (like Aarhus and ESPOO conventions) as an opportunity to review existing action plans and to address the ongoing development in other ROUTES tasks.

- D9.17 “CS discussion and input focused on the second topic identified in the ICS action plan”<sup>20</sup> providing an analysis of the Transparency in the establishment of national radioactive waste facilities with criteria for good transparency together with national case studies and recommendations (published in 2023).

The core part of the deliverable is devoted to the implementation of a broader understanding of transparency in RWM, in particular with establishment of RW disposals. It includes a description of what broader transparency means for CS, results of a short survey among the ROUTES participants and the larger CS group on transparency issues in RWM providing different views on transparency in the countries from different types of actors. Several national cases are also addressing the current situations regarding RWM transparency in different European countries, with advanced and early-stage programmes for large and small RW inventories (See appendix 2). Finally, based on lessons learned and findings from presented cases, more general recommendations are derived from national examples which are relevant also for other RWM situations.

The deliverable noticed problems in some countries regarding access to information from WMOs although there is a legal obligation for all WMOs to provide access to information as if they were a public authority, no matter what their status as state or private entity. The main arguments for this are that all environmental information produced and held by WMOs is an important ingredient for government decision procedures concerning RW, that full access to this information supports better quality decision making, and that WMOs implement government policies under oversight of a state authority and deliver a public service. In fact that this is currently not happening in all Aarhus signatory countries and all EU Member States. The lack of information is undermining the quality of decision making around nuclear waste in those countries and infringes the rights of citizens to be involved in decision making in this important field. Certainly, in an area, where intra- and intergenerational justice is an important issue, full transparency should be guaranteed.

- D9.18 “CS discussion and input focused on the third topic identified in the ICS action plan” providing an analysis of the short and long-term public participation in RWM technical topics (published in 2024).

This report focused on different aspects of Public Participation (PP) in RWM activities, and in particular to technical issues developed by responsible institutions. Therefore, in the report discussion on transparency and public participation in relation to RWM implementation is provided with an overview of legal frameworks, the position of regulators and an analysis of societal requirements. Results of a survey, conducted among the participants of ROUTES and the CS larger group, are providing views of different actors on public engagement in national context and in particular in technical topics. National case studies are focusing on PP in recent RWM activities, including also participation in technical issues. The results are meant to gain more understanding of back-laying dynamics in the role of civil society in radioactive waste decision procedures and research and highlighting some of the better practices. They

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<sup>20</sup> <https://www.ejp-eurad.eu/publications/eurad-deliverable-d917-routes-implementation-routes-ics-action-plan-second-phase>

relate to the creation of a pluralistic information environment, CS participation in technical topics, power distribution in relationships, the position of WMOs in transparency. Finally, the report also provides a summary for short and long term engagement processes which can be applied to RWM.

## 2.3. CS activities in Uncertainty Management Multi-Actor Network (UMAN)

### 2.3.1. Presentation of UMAN WP

The Strategic Study UMAN discusses the classification schemes and approaches applied to the uncertainties management and identifies possible actions to be considered in the treatment of uncertainties. The relevance for safety of the uncertainties associated with site and geosphere, human aspects, spent fuel, waste inventory, spent fuel and near-field, as perceived by each type of stakeholders, and approaches used by these stakeholders to manage these uncertainties were explored via questionnaires, workshops and seminars, with the aim to reach either a common understanding on how uncertainties relate to risk and safety and how to deal with them along the RWM programme implementation, or, when agreement was not achieved, a mutual understanding of each individual view.

Interactions between all tasks and actors including civil society are central in UMAN. These interactions took place notably through workshops (task 4) and seminars (task 5) where the significance of identified uncertainties (task 3), possible strategies and options to manage them (tasks 2 and 4) were discussed.

Civil society experts participated in all tasks, workshops and seminars. In this chapter, the outcomes of these activities are described, with a focus on the outcomes of the task 5 seminars.

### 2.3.2. Objectives and methodology of ICS activities in UMAN

UMAN is a work package with a strong outreach to civil society experts. The following assumptions guided the work carried out in UMAN and especially in task 5:

- The involvement of stakeholders is essential at all stages of a radioactive waste management (RWM) programme.
- Decisions related to radioactive waste management and geological disposal (GD) have to be made in the presence of uncertainties.
- Even in the post-closure phase, some uncertainties will inevitably remain, but it should be demonstrated that these uncertainties are managed in a way that they do not undermine safety arguments.
- Dealing with uncertainties associated with disposal facilities is particularly challenging due to the long timescales.

Based on these assumptions, task 5 developed the following objectives:

1. Develop a common understanding or at least 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.

Terms of reference for the UMAN seminars were established to ensure fruitful interaction in mutual respect. They identified the goal as fostering a common understanding of different viewpoints, but not

reaching a consensus. The task 5 lead is with civil society experts, but to help reach this goal, the seminars were organised by a pluralistic team of actors from the different colleges plus civil society. Moreover, CS experts took part in the UMAN workshops from other UMAN tasks and subtasks.

#### Organisation of seminars

All of the following five UMAN seminars were organised in the frame of UMAN task 5 (Interactions between all categories of actors including civil society).

UMAN Task 5 Seminar 1: What does uncertainty management mean for different types of actors and how it is related to risk, safety and the safety case?

Date: 26-27 October 2020, online

Getting to know and being able to discuss the different views of actors on uncertainties was a helpful first step for establishing the interaction of the three EURAD Colleges with the civil society experts in the frame of UMAN. Seminar 1 addressed the meaning of uncertainty management for different actors and of its relationships with risk, safety and the safety case. In advance of this seminar, two questionnaire surveys were conducted – one for the three EURAD Colleges and one for the CS experts in EURAD. The first day of the seminar presented results from both surveys which were debated from several viewpoints. In the second day, four pluralistically composed working groups reflected on the meaning of uncertainty management, on types of uncertainties, on evolution of uncertainties and on interaction with civil society.

UMAN Task 5 Seminar 2: Management of uncertainties related to site and geosphere characteristics

Date: 04-05-11 October 2021, online

Following seminar 1 which provided a global perspective on uncertainties and their management, seminar 2 examined the aspect of uncertainties addressed in UMAN, namely "site and geosphere related uncertainties". The aim was to identify and discuss the views of different types of actors on the following topics based on concrete cases: preferences regarding possible uncertainty management options, possible evolutions of uncertainties throughout different phases of a disposal programme and how the interactions with civil society could contribute to manage these uncertainties. The first days gave introductory information and presented the possible evolution and safety significance of uncertainties related to three site & geosphere related topics as well as possible options to represent these uncertainties in a safety assessment and, where needed, to reduce, avoid or mitigate them. The discussions in the working groups on the second day were based on concrete scenarios linked to site and geosphere uncertainties presented during the first day: site's natural resources, fault detection and reactivation and climate evolution (with a focus on future glaciations).

UMAN Task 5 Seminar 3: Uncertainties related to human aspects

Date: 14-15 June 2022, at IRSN facilities in Fontenay-aux-Roses (France) and online

Seminar 3 focused on the uncertainties related to human aspects. Human uncertainties are defined on a very large basis, i.e., the uncertainties related to human activities during the different phases of a geological disposal programme. The topic was considered too large to enable fruitful discussions, it was therefore necessary to select key topics to be further analysed. The aim of seminar 3 was to discuss the views of different types of actors on the following topics based on concrete cases: public acceptance, schedule to be considered for implementing the different phases of the disposal programme, new knowledge and adequacy of safety related activities for the implementation of safety provisions (with a

focus on the construction phase). The same method was used as in seminar 2: introductory presentations and pluralistically composed working groups discussing concrete cases.

UMAN Task 5 Seminar 4: How to manage uncertainties in a pluralistic way and in a long-term perspective?

Date: 14-15 Dec 2022, at IRSN facilities in Fontenay-aux-Roses (France) and online

Seminar 4 focused on methods to enable fruitful interactions between institutional/technical experts and civil society in the long term. Seminar 4 gave the opportunity to discuss the lessons learnt during the 3 previous seminars and task 4 workshops on how to manage uncertainties in a pluralistic way and in a long-term perspective. One of the objectives was to identify the potential needs for strategic research on methods to achieve this goal. The seminar started with presentations of views of UMAN research actors from task 4 and of CS experts. In the working group sessions the Pathway Evaluation Process (PEP) game was used, a tool enabling pluralistic discussions with participants expressing their views on the same footing.

UMAN Task 5 Seminar 5: Pluralistic assessment of near-field uncertainties.

Date: 6-7 Dec 2023, at BeIV facilities in Brussels (Belgium) and online

This fifth UMAN task 5 seminar was not initially planned but was integrated in the extension of the UMAN project decided during the second wave of UMA. It was decided to add an additional seminar to test the identified methodologies for exploring uncertainties in a pluralistic way. The near-field uncertainties were identified as a key topic and an interesting one to test these methodologies. The main objective of Seminar 5 was to discuss the UMAN results related to the near-field uncertainties, and to test the identified methodologies to explore uncertainties in a pluralistic way and especially the PEP game.

### 2.3.3. Summary of ICS results in UMAN

The results of the seminars are presented in various deliverables (one deliverable per seminar):

Results of the seminar 1 discussions were the central input for Deliverable D10.13 “Understanding of uncertainty management by the various stakeholders.” This deliverable came to a conclusion that the general views of WMOs, TSOs, REs, CS representatives and regulators about uncertainty types are rather similar. There are differences, though, with respect to priorities and focus. Main differences were identified in uncertainties connected to security issues, including intentional and unintentional human intrusion in a deep geological repository which is a very important topic for CS. Management of uncertainties should according to CS’ views include reversibility, recoverability, and approaches of rolling stewardship models. Effective implementation of the Aarhus Convention is seen as a key element guaranteeing access to information and participation in the process.

Results of the seminar 2 discussions were the central input for Deliverable D10.14 “Pluralistic analysis of site and geosphere uncertainty.” Such unexpected scenarios like the ones discussed in the seminar are difficult to predict. To deal with the unexpected (known unknowns and unknown unknowns, e.g., Yucca Mountain), it is necessary to find pragmatic solutions and allow the conditions to implement them if/when the situation occurs. Having pluralistic discussions could contribute to being prepared. The discussions produced outcomes on options for managing uncertainties related to the scenarios and gave inputs on governance and interaction between stakeholders to manage such situations. A key strength was identified as building up and keeping a regular dialogue with civil society. Also, transparency is a way to ensure trust and requires telling explicitly what is not known (rather than claiming everything is under control). It is required to discuss complex issues, safety assessment and scenario development («stylized approach») in a regular dialog. Regular dialog embraces two levels of

discussions: exchange between experts (that must include «CS experts») at «expertise knowledge» level (periodic assessments) and larger discussion with stakeholders (local and national).

Results of the seminar 3 discussions were the central input for Deliverable D10.15 “Pluralistic analysis of uncertainty related to human aspects”. Especially “public acceptance” is a quite controversial topic. Is it an uncertainty or a goal? Acceptance and acceptability are close notions but are not equivalent. The project must be acceptable before being accepted, both are necessary. The meanings of early involvement of the public, building of trust, continuous dialogue etc. were debated. Uncertainties that can arise from shifting a schedule were also examined by weighing pros and cons of shifting decisions. Besides other topics, security was a focus of the seminar, as in 2022 the Russian War against Ukraine started. Security is one of the topics of high importance for civil society, and many CS actors argue for including uncertainties related to intentional and unintentional intrusion in a (closed) DGR in the safety case.

Results of the seminar 4 discussions were the central input for Deliverable D10.16 “How to manage uncertainties in a pluralistic way and in a long-term perspective?”. To summarise the UMAN results regarding the roles and functions of different actors at different GD phases, a broad range of actors’ categories were identified, covering those from international regulations. The types and number of the identified actors varies among the respondents, reflecting the different approaches employed in the national RWM programmes, the different national frameworks (political and administrative systems) and the current implementation phase. Regarding the pluralistic management of uncertainties, it was underlined that uncertainty management strategy should meet regulatory requirements/laws: participative and transparent process, application of defence in depth approach, demonstration of robustness of a disposal system, definition of specific criteria for site selection, implementation of reversibility including waste retrievability, recovery and others. To be able to meet all these requirements, a strong regulatory body is needed. It was mentioned that a common generic uncertainty management strategy is needed that must be based on a stepwise, iterative, and flexible approach that is safety-oriented and that implies a regular, continuous communication and dialog with stakeholders all along the programme phases. The seminar provided the opportunity to validate the different identified pluralistic methodologies for managing uncertainties at different stages of GDF’s implementation.

Results of the seminar 5 discussions were the central input for Deliverable D10.20 “Application of the methods for a pluralistic assessment of uncertainties and their management to near-field uncertainties”. Regarding the first objective of the seminar 5 (exploring near-field uncertainties in a pluralistic way), each actor presented its views for discussion. Following the same conceptual framework and template allowed better identification of the differences and similarities of concern. The pluralism of the discussions helped identify transversal key issues regarding the near-field uncertainties, such as the safety significance, the methods to reduce models’ uncertainty, or the importance of trust. The second objective was also reached: the creation of a specific PEP game for the near-field uncertainties allowing to plurally discuss its complex linked issues. The discussions that occurred during and after the PEP game session were highly interesting and led to more global than specific discussions on how to tackle uncertainty linked to waste, models, monitoring, or engineered barriers. Both the new PEP game and the discussions stemming from its use in this seminar can be considered as important results. However, some discussions about how to improve this tool for better pluralistic dialog suggested that this topic might be too technical for everyone to easily apprehend it.

Based on the various seminars’ results and the review of UMAN results, CS members involved in UMAN structured their views on uncertainty management. The main deliverable on civil society’s work in UMAN is Deliverable D10.17 “Synthesis report of WP UMAN outcomes from a civil society point of view”. The starting point for this deliverable was the beginning of the UMAN work when a questionnaire was developed for the members of the large civil society group in EURAD to collect their views on uncertainties. About 680 uncertainties were identified over all phases (from the concept to the post-closure phase), they were clustered as follows:



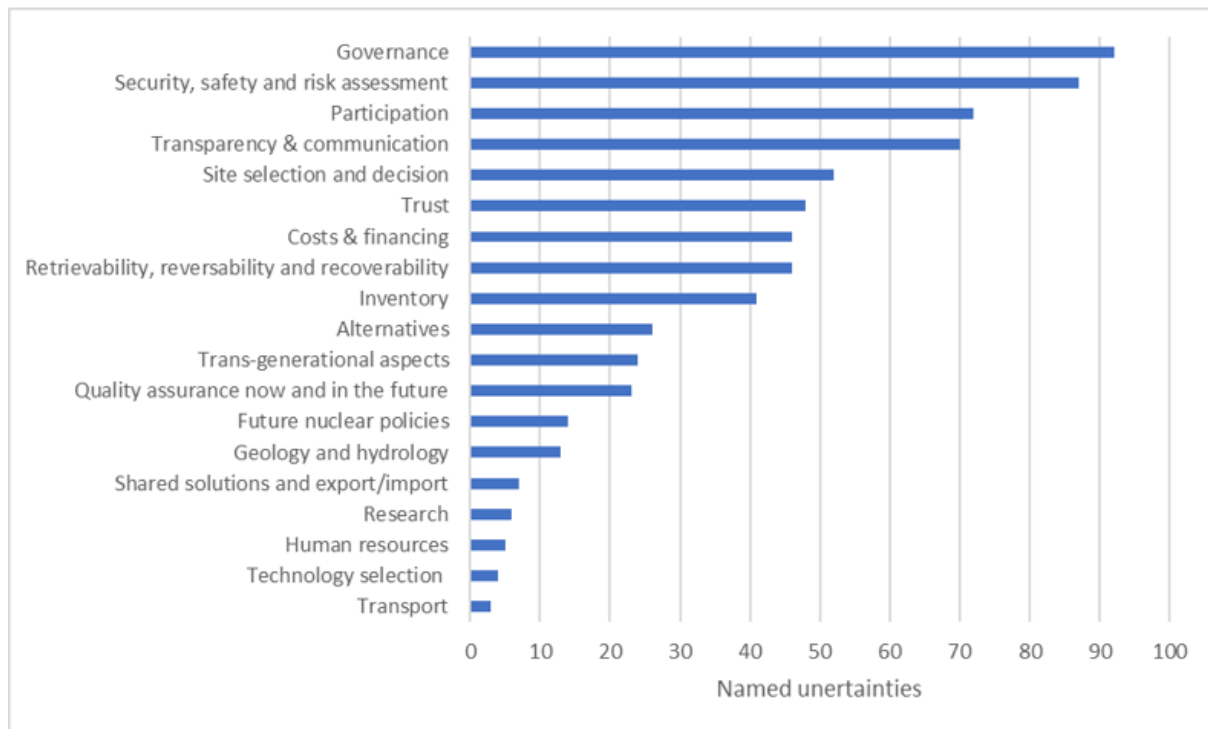


Figure 3 — Clusters of named uncertainties in the UMAN CS questionnaire, total over all six RWM phases (n=15)

As CS experts could not work on all these identified uncertainties, after UMAN Seminar 1 they selected the four topics that gathered the most of the answers to investigate in more detail in the frame of the UMAN WP Task 5. The four topics are interrelated.

- 1. Transparency and public participation (T&PP) with a focus on dealing with uncertainties
- 2. Development of a shared culture for safety and security
- 3. Guiding ethical principles
- 4. Governance with a special focus on intergenerational governance (LTS/RS)

Aspects of these four uncertainty topics were considered on in all UMAN seminars. Here, the resulting four key messages are introduced:

Key messages on transparency and public participation in uncertainty management

The UMAN questionnaire showed that for CS experts it is uncertain if there will be effective and good quality T&PP in RWM including DGR development. It is key that T&PP regimes be established from the concept phase to the post-closure phase. The need for regular appointments between the RWM actors and CS has clearly been established. Uncertainty management needs to be made a part of these T&PP regimes. Participation of CS in research projects like EURAD contributes to involve the interested public in an early stage as is required in the Aarhus Convention. As a method the double wing model has proved successful. Methods such as the serious game PEP have proven to be valuable for fruitful dialogue among all stakeholders. In EURAD, a list of preconditions for fruitful dialogues has been created that should be spread among all RWM actors. But to keep trust it is – amongst others – important to recognise that pluralistic interactions are no substitute for participation, especially participation in decision-making.

Key messages on a shared culture for safety and security

For CS experts it is of importance to bring to the debate uncertainties related to political systems and culture. Political uncertainties are not identical with societal uncertainties. Working with uncertainties is a good entry point for establishing a shared culture for safety and security. Independence of regulators and other RWM actors is a request that is confronted with vague definitions of independence; especially when questioning to what degree scientists can act independently of any type of influence from outside forces. An alternative could be to enable and provide “pluralistic expertise”, without giving up on the demand for independence, at least for the second expert opinions. The Russian war on Ukraine shows (again) that security issues need to be put into focus, also for RWM facilities. In the shared culture for safety and security this needs also to be reflected by preparing for intended and unintended human intrusion in a DGR.

#### Key messages on ethical principles

From a CS perspective, ethical principles must guide the process as well as the content of the RWM decision-making. Application of ethical principles related to the process of the RWM decision-making, is not specific to any one step of the GD. Consent cannot be obtained from all the affected parties in every situation, nor is it possible to get a full consensus. But it must be assumed that people who normally would be unwilling to accept a particular risk would be inclined to submit to a decision-making process which is embedded in a fair and democratic structure, respecting the integrity of individual rights. The main principle to be applied in regard to the content of RWM decision-making is the precautionary principle, a legal as well as an ethical principle that is considered one of the pillars of European environmental law. The precautionary principle is supplemented by the responsibility principle, that relates both to the process and the content of the decision-making and constitutes the broadest of all the ethical principles to guide the interactions between the stakeholders in RWM.

#### Key messages on rolling stewardship

During the UMAN seminars, rolling stewardship has been identified as a subject of interest in the UMAN agenda in regard to, in particular, the following questions: What levels of uncertainty could be acceptable in the long-term and very long-term from a CS perspective and how should they be managed? And more specifically: When comparing current on-going RWM to GD, what would be the most important differences regarding the types of uncertainty and risks entailed by each of these options? And last, but not least: How could rolling stewardship involving CS be implemented? In regard to the precautionary principle, rolling stewardship could be the best manifestation of this principle. In conclusion, there is little doubt that rolling stewardship addresses one of the core uncertainties in UMAN, namely the extremely long time-perspective of RWM and final disposal of RW, which is likely to make most risk estimates very complex and difficult.

## 2.4. ICS activities in MODATS

### 2.4.1. Presentation of MODATS WP

MODATS (Monitoring Equipment and Data Treatment for Safe Repository Operation and Staged Closure) is a R&D work package (WP), which is focused on evaluating, developing, and describing monitoring methods and technologies. The MODATS work package aims to evaluate, develop and describe monitoring methods and technologies, and to provide the means to measure, treat, analyse and manage monitoring data in a consistent manner.

Activities in MODATS WP focus on monitoring during the operational phase of repository programmes to build further confidence in the long-term safety case. The ambition of the MODATS WP is to address detailed questions regarding monitoring data that have been identified, but not resolved in previous

international collaborative activities. For further details regarding the initial objectives and context of MODATS WP, see its SotA document.<sup>21</sup>

Within the MODATS work package, primarily focused on sensor and monitoring data management, sub-task 2.5 aimed to facilitate discussions between the three colleges of EURAD (WMOs, REs, TSOs) and members from EURAD civil society groups (CS experts and CS larger group) to tackle the intricate challenges associated with monitoring within surveillance systems.

The ICS practices developed in MODATS are rooted in innovative methodologies aimed at facilitating interactions on equal ground. More specifically, ICS methodologies are openly employed during interactions involving contextualised case studies or dialogue tools such as the Pathway Evaluation Process (PEP) tool.

#### 2.4.2. Objectives and methodology of ICS activities in MODATS

The primary objectives of the ICS activities in MODATS is to cultivate mutual understanding and shared perspectives among participants, including research partners and civil society members, regarding key challenges and topics related to monitoring systems. Additionally, the dedicated task was to gather opinions, questions, and expectations from participants to enhance socio-technical dialogues. In essence, the central inquiry of this work is: **how to establish a suitable multi-party dialogue on issues linked to GDF monitoring?**

This overarching question guided the following objectives of sub-task 2.5:

- Contribute to the development of mutual understanding and shared perspectives on key challenges and topics related to monitoring systems and data management.
- Collect civil society's expectations on monitoring.
- Introduce a socio-technical interpretation of monitoring systems.
- Contribute to research by identifying points of vigilance.

The initial step involved considering five main topics for discussion, encompassing structural problematization questions:

- Data provided by sensors.
- Information systems to collect, view, analyse, and understand transferred data.
- Traceability of knowledge.
- Digital twins as examples.
- Connection with the governance process, reliability, trust, and unexpected data.

Additionally, the various conceptual and operational relationships between monitoring and safety cases were a cross-cutting topic addressed throughout the programme. Following this, sub-task 2.5 of MODATS organised two workshops (held in Nancy, France in April 2023 and in Paris, France in October 2023) to facilitate productive interactions between MODATS experts and members of the EURAD civil society groups (CSLG and CS experts). These workshops played a pivotal role in generating numerous methodological options. The insights gleaned from the discussions fed into assumptions about methodology and the dissemination of conclusions drawn from the oral exchanges. These workshops were held under the form of "3+1 multi-party dialogues", for the governance structure of the interactions with civil society (ICS) within EURAD follows this "3+1" dialogue approach, wherein civil society is considered as a legitimate participant but not with the same role as the 3 others: Waste Management Organizations (WMOs), Technical Safety Organizations (TSOs), and Research Entities (REs).

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<sup>21</sup> Bertrand J., Haines, T., White, M. (2023): Initial state-of-the-art on monitoring in radioactive waste repositories in support of the long-term safety case. Final version as of 24.08.2023 of deliverable D17.1 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

The multi-party dialogue process undertaken in MODATS sub-task 2.5 was implemented in two phases.

1. A preparatory phase aimed at defining terms, topics, and questions consistent for the multi-party dialogue on monitoring. This definition of topics started by a review on previous work done in the project Modern2020<sup>22</sup>, funded by the European Commission related to public participation. Finally, the preparatory phase identified in a collective manner five main topics to be discussed.
2. An implementation phase was then undertaken in two steps:
  - a. a first workshop dedicated to three topics on monitoring with a methodology of dialogue based on practical cases,
  - b. a second workshop dedicated to digitalisation of monitoring and trust issues that used the PEP methodology.

The governance topic was a cross-cutting issue that has been discussed during the two workshops. The organisation of the workshops enabled testing several methodological possibilities (discussion on practical cases, transversal dialogues on shared concepts, PEP, etc) and gave interesting results on how to address monitoring issues in a multi-stakeholder framework.

### 2.4.3. Summary of ICS results in MODATS

The results of the ICS activities in MODATS are detailed in deliverable D17.5: “Enhanced system understanding, multi-party dialogue.”<sup>23</sup>

The organisation of the two multi-stakeholders' workshops workshops 1) enabled to discussed key topics related to monitoring and data management, 2) contributed to confirm the validity of experimental methodological processes: discussions based on practical cases and elaboration of a specific version of a PEP tool and 3) helped to lay the foundations for a socio-technical interpretation of monitoring.

Indeed, the two workshops and their preparatory work confirmed the validity of experimental methodological processes: discussions based on practical cases and elaboration of a specific version of a PEP tool. The specific PEP on monitoring and digitalisation that was created for the second workshop brought many results and is a promising tool that could be used in future research involving multi-stakeholders. Members of the public can bring a different way of thinking that would be useful to consider in a comprehensive approach: including members of the public in face-to-face discussions can help build trust, 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.

The workshops organised in the frame of MODATS sub-task 2.5 highlighted 6 major outcomes regarding monitoring: the definition of the major monitoring concepts, the links between data, models and digital twins, the knowledge management challenges, the long-term issues, the core concepts of confidence and trust, the role of civil society in monitoring strategies. These outcomes which emerged in multi-party dialogues, helped to lay the foundations for a socio-technical interpretation of monitoring that could be used for the organisation of other socio-technical exchanges related to GDF monitoring, and opened the axis of future activities.

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<sup>22</sup> <http://www.modern2020.eu/>

<sup>23</sup> Debayle C., Dewoghelaere J., Fontaine G., Geisler-Roblin A. (2024): Enhanced system understanding, multi-party dialogue. Final version as of May 24 of deliverable D17.5 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

## 2.5. ICS-CORI-UMAN process

### 2.5.1. Conditions of the process' emergence

Starting from June 2021, thanks to the initiative of members of Civil Society, a dialogue took place between the R&D WP CORI, focusing on organic matter and cement reactions in a geological disposal, the 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). Those inter-WPs interactions were not initially planned in the EURAD programme, but were foreseen by the European Commission as possible additional activities in the context of the programme, notably through the “Added Value” section of Description of Work document.

### 2.5.2. Objectives and methodology of ICS CORI UMAN process

This process led to several meetings between the three entities, almost once every two months, until summer 2023. 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.

Working meetings were organised between CORI and UMAN in January 2022, between CORI and CS experts in March 2021 and June 2021, between UMAN and CS experts in April 2021 and December 2021, and all three parties together in October 2021, November 2021, January 2022, February 2022, June 2022, October 2022, November 2022, March 2023 and June 2023. The process was presented to the EURAD Bureau in December 2021.

One important milestone for the process was the organisation of a specific plenary session of 2h30 during the second EURAD annual event.

### 2.5.3. Summary of ICS CORI UMAN process results

The main concrete outcome of this process was the organisation of a specific plenary session of 2h30 during the second EURAD annual event that took place in Paris from the 28th to the 30th of March 2022, a plenary session dedicated to this ongoing dialogue between CORI, UMAN, and ICS.

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 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, facilitated 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 facilitated 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 possibility of the redaction of a position paper has been largely discussed and constituted the main objective in the second part of the process, after summer 2022. However, as no budget was planned in any of the three teams involved, the draft version of position paper was not published during the time of EURAD programme.

That position paper would have contained four main parts, all validated by the three teams:

- Objectives of the ICS-UMAN-CORI dialogue, notably those of putting R&D in a broader perspective of uncertainty management and enabling participation to a shared safety culture
- Approach used in the implementation, from its beginnings, the EURAD 2022 annual event session, the interest for crossed safety culture questions and the crucial importance of UMAN diagram on iterative uncertainties management strategy.
- Exchanges on Organic Matter-Radionuclides-Repository interactions, with the multi-actors perspective, the R&D perspective, and the CS perspective.
- Outcomes of the dialogue and lessons learnt, such as considerations around the different notions and meanings of safety, links between safety and uncertainty, methodologies of long lasting process such as interWPs dialogue, benefits for three kinds of actors, possible next steps on continuation on safety assessment and application of UMAN analysis of the diagram to some other countries and finally recommendations for future interactions of this type : R&D - Strategic Study - ICS notably for EURAD-2.

In conclusion, the transversal experimental process of interaction between a technical WP, a strategic study WP and CS experts raised several manifestations of interests and stirred up fruitful interactions, but did not go through the redaction of a structuring document, due to lack of dedicated resources.

## 2.6. Evaluation of ICS activities

### 2.6.1. Rationale behind the evaluation process

Interactions with Civil Society involve an active participation and collaboration between technical partners and civil society organisations representatives. These interactions are innovative, for they were done within a R&D program, i.e. in the making of science and not after. As those interactions constitute 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 led the evaluation activities to focus on the concept of “fruitful interactions”. The development of fruitful interactions in the context of a scientific research programme and civil society requires appropriate and innovative methods and processes. The overall perspective of achieving fruitful interactions is the main landscape in which this dialogue will take place, while the ultimate purpose of such interactions lies in the structuring value of enhancing shared safety.

This is why were organised in the subtask 8.3 of PMO WP the following activities of evaluation: 1) grounding the EURAD ICS Evaluation Methodology thanks to a synthetic review of the participatory process implemented in order to develop and validate this methodology, 2) implementing this Evaluation Process according to the proposed methodology, in order to draw out well-grounded conclusions of ICS evaluations.

### 2.6.2. Objectives and methodology of ICS Evaluation process

This evaluation activity aimed 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, R&D 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 that aims at drawing general conclusions stemming from empirical field surveys. Indeed, this “methodologically dynamic” framework that provides ways to navigate through the situations rather than being a complete methodology was considered very

suitable 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 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 evaluation activities have been structured in two waves:

1) The elaboration of an adapted methodology for evaluation of Interactions with Civil Society in the context of EURAD, which led to the objective of fruitful interactions grounded on nine evaluation criteria. The main document gathering all the elements for this part is the PMO deliverable D1.14 “Mid-term evaluation of the ICS activities and experimental model of interaction between EURAD participants and Civil Society” (2022).

2) The implementation of the evaluation methodology to several kinds of interactions with civil society in EURAD: several WPs, several forms of activities and processes.

Firstly, 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.

Then, starting from this list of five major items, a series of semi-directive interviews were 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 civil society larger group members, 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 concepts. Among all these identified subjects, the methodological team selected nine topics 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.

In consequence to this elaborated methodology, the evaluation is 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 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: Legitimacy, Methodology, Postural changes, Personal unity, Expertise function, Meaning of the repository, Territory, Shared complexity, and Addressing the long term.

This methodology, it has been applied to 7 ICS events in 3 different WPs and to 1 contribution process:

- ICS workshop n°4 – Fontainebleau, May 2023 (France).
- ICS Workshop n°5 – Brussels, October 2023 (Belgium).
- UMAN Seminar n°3 – Fontenay-aux-Roses, June 2022 (France).
- UMAN Seminar n°4 – Brussels, December 2023 (Belgium).
- ICS-CORI-UMAN session, EURAD annual event – Fontenay-aux-Roses, March 2022 (France).
- MODATS Workshop – Nancy, April 2023 (France).
- MODATS Workshop – Paris, October 2023 (France).
- ROUTES process of contribution to deliverables D9.16, D9.17 and D9.18

### 2.6.3. Summary of ICS evaluation process results

All the detailed elements of construction and of results of both the methodology grounding and evaluation implementation can be found in the two following PMO deliverables:

- D1.14 Mid-term evaluation of the ICS activities and experimental model of interaction between EURAD participants and Civil Society
- D1.16 Evaluation of experimental model of interaction between EURAD participants and Civil Society

As a conclusion of this evaluation process, it can be said that 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 and the ICS activities with this grid - within strategic studies and within R&D WPs - has shown very positive results regarding the fruitfulness of interactions. This grid also makes it possible to have a basis on which to compare these events or processes, and comparing them. It 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 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 deliverable: 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.

## 2.7. Dissemination of ICS activities

### 2.7.1. Lunch and learn sessions

EURAD webinars were organised to connect people, both in- and outside of EURAD, to communicate the main results from the European Joint Programme EURAD and to present hot topics in the field of radioactive waste management. The webinars were live streamed and recorded. CS experts participated to two “Lunch-and-learn sessions” in order to present results related to their results and methodologies:

- *EURAD Lunch & Learn session on a pluralistic tool of dialogue on RWM: the Pathway Evaluation Process (PEP)*. The webinar was held on 28.09.2022. It provided the opportunity to



present the PEP methodology that structured several ICS activities in EURAD (notably in UMAN and MODATS).<sup>24</sup>

- *EURAD Lunch & Learn session on the role of Knowledge Management in Civil Society.* The webinar was held on 30.11.2022. It provided the opportunity to present some ICS results and to identify links with knowledge management structure elaborated in EURAD.<sup>25</sup>

### 2.7.2. Training sessions

EURAD elaborated elements for establishing a School of Radioactive Waste Management which aims to compose a diverse portfolio of tailored basic and specialised training courses. CS experts participated to three training sessions organised in the frame of this school:

- The EURAD Training Course on Safety Case Development and Review. The course was held from November 28, 2022 to December 2, 2022 in Prague (Czech Republic) in collaboration with SITEX network. The aim of the training was to provide theoretical knowledge about safety case objectives, strategy of its development, context and components, documentation and, about the different aspects involved in the safety case process. The training also provided elements on the different steps from safety case development, over review to implementation and safety requests settlement based on real life examples of safety case practice from advanced programmes. On December 1, a lesson was given on The Pathway Evaluation Process (PEP) game.<sup>26</sup>
- The UMAN training course. The course was held from February 14, 2023 to February 16, 2023 in Brussels (Belgium). The main aim of the training was to address the training need “Treatment of uncertainty” as one of the five most urgent and highest priority topics. The training also addressed other urgent and high priority topics such as “Safety strategy”, “Confirm waste form compositions, properties and behaviour under storage and disposal conditions, including impact on the disposal environment (waste form)” or “Spent Nuclear Fuel”. On February 16, a lesson was given on “views of Civil Society on Uncertainty Management”.<sup>27</sup>
- The MODATS training course. The course was held from January 22, 2024 to January 26, 2024, online. The main aim of the training was to provide elements on monitoring in Geological Disposal facilities of radioactive waste based on MODATS work. On January 25, a lesson was given on stakeholder participation in monitoring.

### 2.7.3. Articles and presentations outside EURAD

CS experts have participated to the following events, in which they contributed to share outcomes from EURAD ICS activities:

- International Conference on Environmental Remediation and Radioactive Waste Management (03-06/10/2023) in Stuttgart (Germany), organised by ICEM: presentation of the paper “*Transparency in establishment of national radioactive waste facilities - criteria, cases, recommendations*”<sup>28</sup>.

<sup>24</sup> The link to the records of the webinar about the PEP is the following:

<https://www.bigmarker.com/sckcen/Lunch-Learn-A-pluralistic-tool-of-dialogue-on-RWM-the-Pathway-Evaluation-Process-PEP?bmid=9664ce6eba5b>

<sup>25</sup> The link to the records of the webinar about KM and ICS is the following:

<https://www.youtube.com/watch?v=vrupvumJITE&list=PLahXOQn-bremN911IEn0w8yAzQyuUR3ky&index=19>

<sup>26</sup> More details about this training course are available on EURAD website: <https://euradschool.eu/event/training-course-on-safety-case-development-and-review/#>

<sup>27</sup> More details about this training course are available on EURAD website: <https://euradschool.eu/event/eurad-training-course-on-uncertainty-management/>

<sup>28</sup> Zeleznik N., Swahn J., Daniška M., Haverkamp J., Hooge N.H., de Butler M, Wales C., (2023): Transparency in Establishment of National Radioactive Waste Facilities - Criteria, Cases, Recommendations, ICEM2023-109822, <https://www.researchgate.net/publication/375977843>

- International Conference on the Safety of Radioactive Waste Management, Decommissioning, Environmental Protection and Remediation: Ensuring Safety and Enabling Sustainability (6-10/11/2023) in Vienna (Austria), organised by IAEA: presentation of the poster “*Possibilities and Challenges of RWM with Regard to Civil Society Interactions*”<sup>29</sup>.
- WM24 Conference - Future European Collaboration on Radioactive Waste (March 2024) in Phoenix (United-States), organised by WM Symposia: presentation of “Results from the EURAD Routes Work Package - Towards Waste Management”.
- BASE Symposium, Including civil society in R&D projects on Radioactive Waste Management (November 2021) in Berlin (Germany)<sup>30</sup>, organised by BASE : presentation of Interactions with Civil Society (ICS) in EURAD.
- EASST conference, in combined format Open Panel P307: Transdisciplinary sensibilities in investigating nuclear research and innovation<sup>31</sup> (16-19 July 2024) in Amsterdam (Netherlands), organised by EASST and 4S : presentation of *Lessons learnt from EURAD interaction with civil society (ICS)*.

Nuclear Transparency Watch (NTW) has also organised an Aarhus Convention and Nuclear (ACN) Round Table on Radioactive Waste Management<sup>32</sup> with the DG ENER (European Commission) in between 13-15 January 2021 involving several actors representing every EURAD college.

During this seminar, in between a session on the “Implementation of the information and public participation provisions of the Radioactive Waste Directive (2011/70/Euratom)” and a session on the recent developments in civil society access to expertise and research<sup>33</sup>, many national cases were discussed involving representatives from a variety of actors.

### 3. Integrated vision for ICS activities

In this section are presented the lessons learned from the process, a proposal for an integrated vision of ICS activities and recommendations coming from ICS activities carried out in EURAD.

#### 3.1. Lessons learned from the process

The lessons learned from ICS carried out in EURAD were topics discussed during the two last ICS workshops. Two main generic results emerged from the discussions.

- First, the ICS have been successfully implemented in the different WPs. Safe spaces for discussions were created, enabling fruitful discussions between institutional experts and civil society members. Conditions for generating trust for all involved actors were gathered and allowed to implement ICS activities in one technical RD&D WP that was not initially planned (ICS in MODATS).
- One thing to be improved was the question of the number of CS participants involved (that should be enlarged for future ICS activities) and also the question of non-replacement of members from the CS larger group. It was planned that the 22 members would participate for the whole five years but some of them had to withdraw for personal reasons before the end of EURAD. Then, there was no procedure (approved by executive instances of EURAD and

<sup>29</sup> Zeleznik N., Hooge N.H., de Butler M, Miksova, Jitka; Harvey, Elisabeth., (2023): Possibilities and Challenges of RWM with Regard to Civil Society Interactions, IAEA-ICWERN2023,

<sup>30</sup> <https://sand.copernicus.org/articles/1/247/2021/sand-1-247-2021.pdf>

<sup>31</sup> <https://nomadit.co.uk/conference/easst-4s2024/paper/84996>

<sup>32</sup> <https://www.youtube.com/watch?v=qN6mQ8aFq0I&list=PL8iBc389W3s4fh1tozM-4RBtvGBZaBaPf&index=1>

<sup>33</sup> In those sessions some actors from EURAD were speakers such as Ms Louise Théodon, ANDRA, EURAD coordinator, Mr Valéry Detilleux, Bel V, Ms Anne Bergmans, University of Antwerp or Mr Gilles Hériard-Dubreuil, Mutadis.

different Colleges) for having replacement of the CS members. It is the reason why a recommendation was suggested to improve the double wing model (see section 3.3)

Lessons were also learned according to the different WPs where ICS were implemented:

### **Lessons learned from ICS activities in UMAN**

As key successes, the discussions underlined the adaptability of the seminars' process with an adaptation of the initial structure planned according to the results of the first seminar. For each seminar, the organisation of the sessions was based on feedback from previous seminars. The UMAN Task 5 process enabled also to create a safe space for pluralistic discussions with a pluralistic preparation of the framework (the preparation teams were composed by members of the 3 different Colleges and CS members) and UMAN seminars enabled pluralistic exchanges on complex topics. The seminars' participants constituted a community for 3+1 dialogue in a 5 years' dialogue. The UMAN processes tested successfully pluralistic methodologies: double wing models, and PEP (PEP on near-field tested in December 2023) and methodology of concrete cases enabling discussing technical issues (site and geosphere uncertainties) and issues with contrasted views point (human uncertainties, notably GD acceptability, security issue, plan B, post-closure) with a focus on transparency and public participation. ICS in UMAN contributed to the dialogue between WPs inside EURAD through the ICS CORI UMAN process. The UMAN process also identified fruitful concepts to develop pluralistic assessment of uncertainties: shared culture for safety and security, intergenerational stewardship culture, appropriate legal framework (Aarhus, T&PP), stepwise approach (reversibility, retrievability, recoverability, continuous knowledge management). It also enabled the participants to share concerns and understanding on key aspects important for CS: integration of socio-technical, contextual and governance issues in uncertainty management, importance of unknown unknowns (how to be prepared for the unexpected ?) and ignored knowns factors (knowledge one may not be aware of), independence of expertise (what does it mean? How can it be done in practice ?), importance of CS in the upholding of the safety standards and in the confidence of the system.

Points to be improved were also identified. Due to Covid situation, some seminars were virtual and notably the first one. As a process based on interactions between different types of public, it is clearly not ideal: it is important to have at least the first seminar «in person». Difficulties were encountered with the hybrid format, notably for implementing the PEP methodology but after several attempts, it was quite well managed (notably for the seminar 5 and the PEP game test on near-field uncertainties). The finalisation of the results arriving at the end of the projects, as it was originally planned, is a part of the methodology to be improved. It would have been more interesting to have results disseminated regularly, including the draft deliverables presenting the seminars results. The very long time for the review process has to be more anticipated because the delays in the deliverables reduce the impacts of the results.

Several challenges for the future have been identified: How to continue the work and implement recommendations carried out in UMAN regarding pluralistic methodologies for assessing uncertainties? In future research activities, there are no specific projects planned to continue to investigate the identified concepts in UMAN but methodologies should be able to be further refined in different research projects. SITEX.Network could also be a space to disseminate results (notably for PEP and shared culture for safety and security), as well as dedicated NTW working groups (as it was done for rolling stewardship in parallel of EURAD work). A second identified challenge is how to enlarge the community of interest and results dissemination? Interesting links were created during the 3+1 dialogue (3 colleges + CS) of UMAN seminars but the question is how to enlarge the public engaged in these discussions and how to improve dissemination of results? Some recommendations presented in section 3.3 of the report try to provide answers to the challenge. A third challenge is how to continue the cross-cutting process with technical projects? CORI-UMAN-ICS demonstrated the interest to engage dialogue with the public on technical projects through management of the uncertainty paradigm. How to continue this work?

### Lessons learned from ICS activities in ROUTES

As key successes, the flexibility of process in ROUTES should be underlined. CS members had the possibility to decide what topics to investigate in depth based on the interaction with other tasks. CS experts were deeply involved in activities of other Tasks (and it was assessed as a strength by other ROUTES actors for the quality of the results). They provided a huge amount of work with an involvement of Civil Society representatives on case studies from over 12 European countries: Belgium, Czech Republic, Denmark, France, Germany, Greenland, the Netherlands, Slovakia, Slovenia, Sweden, Switzerland, the United-Kingdom. Concepts to support legal requirements were identified: shared culture for Transparency and Public Participation for shared and national RWM activities, intergenerational stewardship culture in RWM activities, including technical topics. Recommendations for implementing a fruitful legal framework (Aarhus, Directive 2011/70/EURATOM) were also made. CS members had the possibility to share concerns and understanding on key aspects important for them: independence of expertise (What does it mean? How can it be done in practice ?), importance of CS in the upholding of the safety standards and in the confidence of the system. The national cases studied in the D9.17 of ROUTES were presented by NTW outside the frame of EURAD though the mean of a webinar series. This work dissemination presenting T&PP in RWM for 9 European countries in 2023 during a monthly webinar series (available on NTW YouTube channel) was entirely volunteer. Further dissemination was done in the frame of EURAD with the presentation of ROUTES results at international events (ICEM 2023, IAEA November 2023).

Room for improvement was also identified. Involvement of many actors/authors over a long period of time can be difficult to manage in order to meet the time schedule and workload foreseen. Lack of resources was encountered to be as exhaustive as desired and to be able to structure dissemination within civil society.

Several challenges for the future were identified. First, how to continue the work and implement recommendations carried out in ROUTES regarding Transparency and Public Participation? A future strategic study in EURAD-2 is foreseen (ASTRA) to continue the work but the results could be shared in other areas (IAEA, NEA, SHARE platform) as well as in SITEX and NTW networks. Second, how to enlarge the community of interest and results dissemination? Third, how to continue and enhance socio-technical interactions? Deliverables from ROUTES showed the interest from the different stakeholders to engage a dialogue with the public notably on socio-technical topics. Several approaches were established and should be enhanced. How to improve and maintain this in the future?

### Lessons learned from ICS activities in MODATS

The integration of ICS activities in a R&D WP could be seen as a key success. 3+1 dialogue and pluralistic interactions in RD&D project were not initially planned. MODATS managed to implement it and have interesting discussions on monitoring and digitalisation of data. The ICS activities in MODATS provided the opportunity to develop and test pluralistic methodologies on monitoring issues: concrete cases enabled to discuss technical issues related to monitoring data during the first workshop and a PEP tool on monitoring issues were developed and tested during the second workshop.

Regarding the points to be improved, MODATS Task 2.5 prepared the framework of workshops including views of different types of actors but the preparation of the workshops could have been more pluralistic and the audience of the workshops could have been enlarged. There is also a need for more tests on the PEP tool (diversity of public) to improve it. ICS activities in MODATS were elaborated as complementary to the technical results and ICS workshops should have been more integrated with the different results of MODATS (like in UMAN)

Challenges for the future were also identified: how to make visible the ICS results in MODATS? ICS results in MODATS arrived at the end of the EURAD programme. Time was short for finalising the deliverable presenting the results. Interesting discussions were initiated during the 3+1 MODATS workshops but questions remained such as: how to enlarge the public engaged in these discussions

and how to improve dissemination of results? Finally, how to ensure the continuation of the work done in MODATS?

### 3.2. Proposal of an integrated vision

After the strong experience gained on RWM topics by the participation into EURAD joint programme, Civil Society members are willing to introduce a discussion on a narrative of RWM that could be shared by all parties involved.

Following this new synthetic vision, RWM could be defined as: “a long-term complex decision-making process, in an uncertain environment, involving a plurality of stakeholders. “

It appears that the general objective of most actors on radioactive waste policies is a certain stability in an uncertain context. With the vision here proposed, RWM can rely on three pillars in order to remain stable through uncertainty:

- Safety Culture, as a shared, dynamic, reflexive and active realization of the best safety methods and standards. This culture is a set of characteristics and attitudes in organisations and individuals which establishes that, as an overriding priority, nuclear safety issues receive the attention warranted by their significance. This definition was given by INSAG4 in 1991<sup>34</sup>, and is the keystone of RWM, as SITEX Network emphasizes it. Shared safety culture can be understood as a practical means to improve safety, not only as formal rules. As it happened in the CORI-UMAN-ICS dialogue, safety culture can be driving a renewed perspective of research on radioactive waste.
- Intergenerational Stewardship Culture, as a conscious attitude from organisations and individuals regarding the continuous temporal responsibility brought up by RWM, and thus an attitude of vigilance in uncertainties enabling an appropriate governance. This opens the current decisions to a long-term perspective and concerns several actions designed as part of the management of radioactive waste: implementation, maintenance, monitoring, operation, planification, research, sealing, skills management, survey, etc. This culture sets out the emergence of possible reliable contributions from successive generations to an intergenerational stewardship of radioactive waste policies and facilities, adapted to several contexts including geopolitical and institutional changes, oriented to safety.
- Fruitful interactions between all the actors, as the central means of dynamism of the two first pillars. It requires a pluralistic and co-framing approach for communities of organizations and of individuals, as mutual trust conditions. It can be constituted at different levels and concerns a plurality of actors of RWM such as: regulators, operators, experts, researchers, civil society, end-users, etc, as individuals and institutions. As introduced in UMAN task 5 seminars, in ROUTES task 7 and MODATS task 2.5, and detailed in the deliverable D1.14 from EURAD PMO task 8.3, fruitful interactions aim at creating and maintaining relations between a plurality of actors, with the capacity to conduct a variety of inquiries (scientific, moral, social) and to address the complexity of radioactive waste management.

Thanks to these three pillars of stability of the meaning of RWM, it can be envisaged to consider RWM as a dynamic and robust system that should be able to cope with an uncertain environment, including all hypotheses regarding nuclear waste production.

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<sup>34</sup> [https://www-pub.iaea.org/mtcd/publications/pdf/pub882\\_web.pdf](https://www-pub.iaea.org/mtcd/publications/pdf/pub882_web.pdf)

### 3.3. Recommendations coming from ICS activities

As an introduction to the following recommendations, it has to be said that these elements are a synthesis of the outcomes from the ICS work in the different WPs (UMAN, ROUTES, MODATS), but were elaborated through the continuous interaction between the ICS activities in these WPs and the exchanges in all 6 ICS workshops.

#### Recommendations from the UMAN ICS activities

Based on the key messages developed in UMAN task 5, the following are the recommendations, elaborated by this task 5 team in the documents produced for the WP, regarding future work on uncertainty management and its involvement with CS. In addition to originating from the content of this Deliverable, they constitute common and general reflections based on our four years of activity in UMAN. The recommendations target different actors for their work not only in research projects but also beyond.

Recommendations on transparency and participation: Transparency and public participation (T&PP) are crucial in RWM. Without them, no final repository will be tolerable or even acceptable for the public. But good quality T&P regimes for such a long-term intergenerational activity like a DGR for high level waste do not exist yet. Existing procedures like environmental impact assessments need to be adapted to become effective, and new procedures need to be established. The following points need to be fulfilled to allow for good quality T&P:

- Develop a continuous T&PP regime over all phases of RWM, not only for the site selection.
- Prepare to engage in the long-term in RWM. RWM authorities should help establish reliable structures for long-term dialogues with all stakeholders including CS on local but also national level, e.g., by enabling long-term advisory boards with CS participants (both from CS experts and general public).
- Engage in fruitful interactions with CS on a regular basis in technical organisations, establish continuous interaction with CS and hold the dialogue alive in the long-term. This includes adapting communication concepts to reach the young generations, and to establish organisational knowledge transfer of these interactions.
- Interaction is important not only with the general public, but especially with the interested public; different ways of interaction will be needed for those two groups of civil society. Especially in research projects, a regular and good quality dialogue with CS experts leads to added value and fulfils legal obligations of the Aarhus Convention at the same time.
- Helpful tools for working together with the interested public in research projects are:
  - the PEP-game, which should be further developed at national and local level.
  - the double-wing model, should be expanded to a three-wing dialogue
- Dialogue on uncertainties and their management options can be used as entry points in debates with the public.

#### Recommendations on a shared culture for safety and security

In a shared culture for safety and security, civil society is a partner like other stakeholders. We recommend broadening up definitions of safety culture to actively include civil society in defining and working for a culture for safety. This encompasses also the inclusion of topics of nuclear security which are of high importance for civil society.

A culture for safety and security is based on independence of nuclear regulators and TSOs, and a legal structure that their independence cannot be challenged by political change.

Independent and multi-perspective expertise on RWM issues will help building trust. Good practice examples like the former Swedish MKG NGO-office would help to provide a second opinion that is trusted by CS. But such organisations would need continuous funding.

To develop a good quality shared culture for safety and security, social science research in RWM is needed.

Recommendations on application of ethical principles: Application of ethical principles related to the process of the RWM decision-making, can always be done at more than one step of the process. The most suitable ethical system to be applied in this process is deontological ethics, where decisions are only permissible when they are approved by those whose rights and interests are at risk. Thus, the decision-making process should be embedded in a fair and democratic structure, respecting the integrity of individual rights. The main principle to be applied in regard to the content of the decision-making is the precautionary principle, which should be used as much as possible.

Recommendations on rolling stewardship: The viability of rolling stewardship in its capacity as a long-term intergenerational RWM concept should be further explored and evaluated in the perspective of the parameters that have already been established in EURAD Strategic Studies.

## Recommendations from the “ROUTES” ICS activities

### 1 - Triple wing model

To improve the dissemination of EURAD's work results, it has been underlined by CS experts and CSLG members that a straightforward step would be to open some parts of the EURAD annual event to the public. Moreover, enabling participants to attend various events online within EURAD within the WP activities would greatly enhance interaction and engagement. This first-hand experience would undoubtedly benefit the broader community and foster more meaningful interactions.

How to enlarge civil society involvement in EURAD (number and type of representatives) and to construct a triple-wing model was discussed during one of the ICS workshops (n°4 and n°6). The exchanges focused on how to include CS participants in future RWM research activities, who have little knowledge about RWM, how to enlarge the number of CS participants involved in the dissemination process, and how to improve the ICS model in EURAD. A way to tend to reach this broader community would be to develop the double wing model into a *triple wing model*, where members of CS are accepted into EURAD, although they have not necessarily been engaged in RWM in their capacity as CS, have not acquired knowledge of aspects of RWM, or shown interest in regard to RWM. In fact, this could be a way to expand and diversify the pool of CS members involved in future activities.

The added value of a triple wing as shown in *Figure 4* would be to demonstrate the efficiency of the double wing model, when faced with other segments of CS, as well as expand the field of recruitment for the CS larger group, including notably local communities and CS members from European organisations like representatives of EESC<sup>35</sup> for instance.

The benefit of the triple wing model is that it embraces greater CS inclusivity and as a consequence is more representative of CS generally, although implementation will pose some challenges which will have to be overcome, not only by the CS experts, but also by EURAD's three Colleges, when they present and disseminate their findings, conclusions, and recommendations to the wider public. Some tools developed or/and tested during EURAD (like PEP<sup>36</sup> monitoring and PEP near-field tools) could be used to facilitate the discussions during specific events held to disseminate results and organise exchanges with the wider public.

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<sup>35</sup> Part of this expanded field of recruitment could, e.g., be the EESC (see Note 18) and members of local communities.

<sup>36</sup> The PEP is a tool of dialogue (designed as a serious game) developed under the frame of the SITEX-II project and SITEX.network that enable multi-actors' discussions in the field of radioactive waste management. EURAD Lunch and Learn Session on PEP methodology: <https://www.ejp-eurad.eu/news/recording-ii-pluralistic-tool-dialogue-rwm-pathway-evaluation-process-pep>

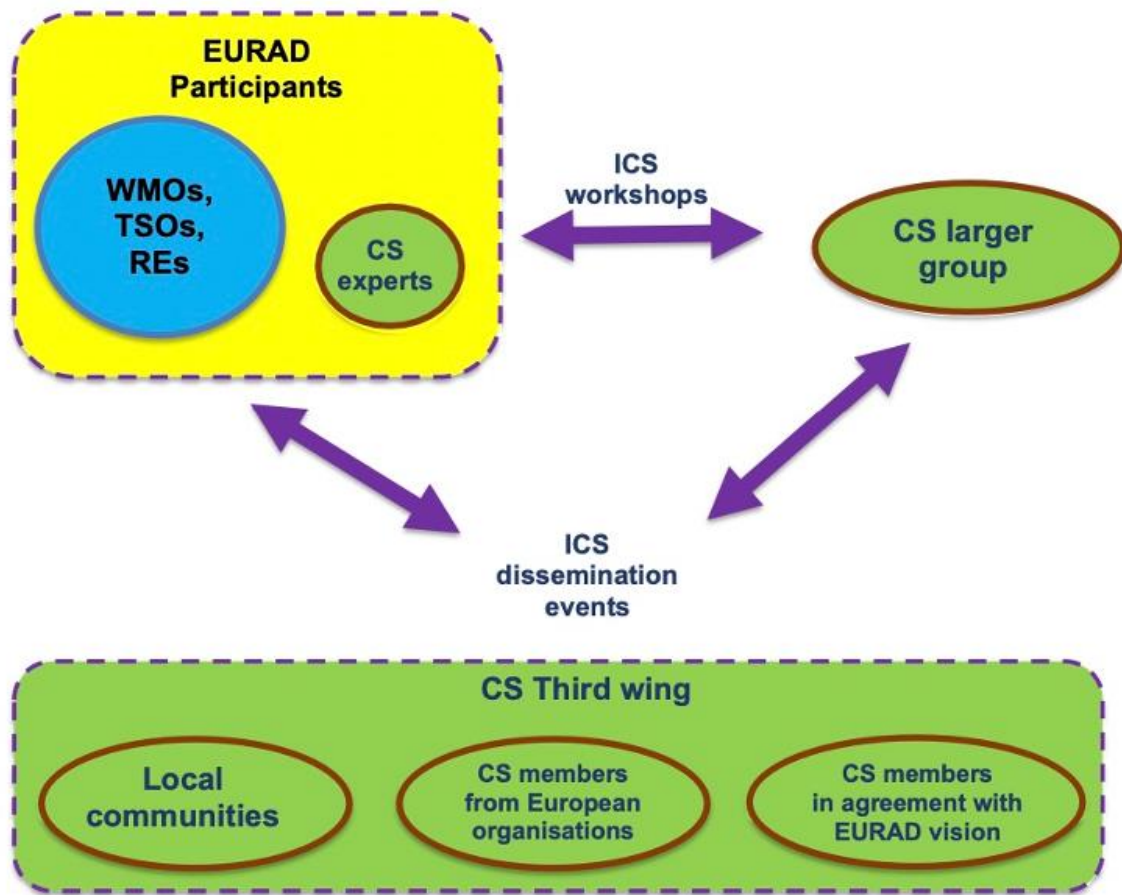


Figure 4 — Triple wing model of interaction with civil society proposed for future programmes

Transparency & Public Participation (T&PP):

The following recommendations on T&PP in the implementation of RWM based on ROUTES Task 7 and deliverables D9.16, D9.17, and D9.18 were summarised in the D9.19:

**1. T&PP at international and national level**

International organisations like the IAEA and the OECD-NEA give a lot of guidance to states but access to information and public participation within these organisations still differs strongly from the principles of the Aarhus Convention. Therefore, they should develop their own transparency and public participation policies based on the principles of the Aarhus Convention as under its art. 3(7), these principles should also be promoted in international settings, and therefore recommend that EU Member States and EU institutions (e.g. the European Commission, ENSREG) use their influence to introduce these principles of transparency and public participation also increasingly within the work of these organisations.

It is also recommended that implementation of these obligations, since Aarhus Convention principles have been introduced in Directive 2011/70/Euratom, including access to justice, is overseen by the European Commission in conjunction with the Aarhus Convention and the Aarhus implementing EU legislation. In fact, even if ratified by all EU member states, Aarhus Convention transposition to national legislation has been found in concrete cases to be still insufficient (“streamline” procedures which could lead into a reduction of the rights), a compliance of national legislation would be recommended.

Furthermore, since it usually takes years until the Aarhus Convention Compliance Committee (ACCC) issues its findings on issues of non-compliance, it is recommended to adopt measures to shorten the



time the ACCC to investigate issues of non-compliance and provide additional assistance for the public and NGOs in raising non-compliance objections.

It is also recommended that relevant public entities (experts, NGOs, active citizens) are actively sought and encouraged to participate from an early stage of drafting national strategies, policies and similar documents on all levels, that is on the level of the EU / Euratom by the European Institutions, on the national level as well as on a local level.

## 2. T&PP and authorities

It was recommended to have a clear regulation in place that fulfils the obligations under Aarhus for all institutions that are providing public services under the oversight of a public authority. This would mean that WMOs should align their transparency policies, including access to information and public participation, with their national nuclear regulators in agreement with the Aarhus Convention and EU transparency law and existing jurisprudence, early enough in the process before any kind of permit application (e.g., operation licences, 10-year periodic safety reviews, licences for individual safety related activities, also licences for closure). In other words, it's a recommendation for more attention to the implementation of other obligations under Aarhus, like art. 5(6) (operators are encouraged to inform the public regularly) and art. 6(5) (encouragement of prospective applicants to enter into discussion with and provide information to the public concerned before applying for a permit).

Finally, authorities should prioritise transparency and public participation from the public's perspective, not just operators and promoters notably to improve the decision-making quality and to sustain public trust. In other words, it is recommended, that these authorities see themselves in issues of transparency and public participation rather as representatives of the general public (citizens) and oversee that transparency and public participation obligations are implemented from the point of view of the rights and needs of interested citizens, rather than the restrictions preferably seen by operators and project promoters (see 2.4 in D9.18).

## 3. T&PP in the long-term

It is recommended to address the challenge of continuity in citizens engagement, especially where the issues become more technical, in particular with some forms of “rolling stewardship” (local information committees, NGO secretariats or similar civil society clearing houses, beyond the participation of democratic representative bodies (e.g. municipal councils)) enabling a sustained involvement of structural public participation. Addressing this implies providing these structures with sufficient financial resources for continuity of in-depth and self-governed participation enabling a trusted and based socio-technical dialogue in the long-term. Furthermore, it was recommended to develop and test forms of structural long-term stewardship during earlier stages to ensure public engagement during facility operation, closure, and post-closure.

National and international legislation could provide such structures with an independent governance and financial resources allowing them to participate actively in sharing information and raising awareness (technical training, bringing response to all questions of civil society) which needs time and competencies. Maintaining skills is also needed for dialoguing with society since it is not innate for technical experts and it can be a tough exercise, for which they may need support from CS experts inside their own structure and/or independent CS experts.

## Recommendations from the MODATS ICS activities

### 1. Dynamic framework for a socio-technical interpretation of monitoring

An analysis of the outcomes of this work carried out in MODATS sub-task 2.5 helped build the grounding steps for a socio-technical interpretation of monitoring. This interpretation offers a dynamic vision of monitoring related to governance issues, based on various pillars: safety, monitoring strategy, data management, transparency, confidence / trust, decision making and transparency.

- **Safety as main concern.** Safety is the main priority, an essential prerequisite guaranteeing a framework within which the project can proceed, and all considerations about monitoring or

surveillance of such a facility should be considered through this prism, at every stage of the project. It is therefore important to always approach the analysis of this type of socio-technical project including safety concerns.

- **Monitoring strategy.** All knowledge grounding the monitoring strategy is supposed to bring confidence and certainty to allow a good decision-making process. It should be considered how to share such information and knowledge with stakeholders and especially the public, considering this highly complex question about sensors and positioning optimisation.
- **Data management.** Data management is a crucial point to be examined to develop a common understanding of disposal throughout its life. The conceptual, material and socio-technical knowledge management issues linked to the development of data-based science and engineering are rising due to the need to handle, store and interpret vast amounts of data on very long timescales. These issues are also linked to transparency, openness of the data, and public trust.
- **Confidence and trust.** Confidence and trust play pivotal roles within the socio-technical system, particularly in the surveillance system of a GDF, for they are a prerequisite to enable public support of important decisions related to such systems. Understanding the dynamics of how monitoring contributes to building, strengthening, or weakening trust and confidence unveils the intricate complexities of the linked socio-technical issues.
- **Decision-making.** Decision-making processes are intricately linked to surveillance and monitoring within a GDF. The data and parameters selected for monitoring are deemed important because they offer information critical to the effective implementation of the project. Governance and decision-making concepts at each project stage provide insights into both the significance of monitoring for society.
- **Transparency.** Transparency is a fundamental aspect that interconnects confidence, trust, and decision-making within the context of monitoring systems for GDFs. By emphasising transparency, monitoring systems contribute to building and maintaining trust, fostering a sense of accountability, and promoting a shared understanding among all involved parties.

These pillars are broad themes that cut across most of the issues raised by the socio-technical topic of monitoring and enable stakeholders to grasp the complexity of the problems, the temporal dynamics and the differences in viewpoints between the various stakeholders. At the intersection of these different themes, specific questions may arise, linked to the divergence of viewpoints between the different stakeholders or the intertwining of social and technical issues. This first step to establish a global vision of the issues at stake is shown here to push further discussions and does not claim exhaustivity. One recommendation from the MODATS ICS activities is to continue developing this framework that tries to create a conceptual space in which monitoring can be thought of as a socio-technical issue and thus be tackled efficiently by all stakeholders.

## 2. Collaborative framework and activities for future development

One of the main outcomes of the MODATS ICS activities is that it is crucial to anticipate the differences and the continuity between the ICS within a research programme and within an operational one. As it is difficult to imagine how to precisely fill these different steps between research and operation, the MODATS ICS activities highlighted the necessity to develop a collaborative framework allowing researchers, experts and members of civil society to dialogue on monitoring. This collaborative framework should promote transparency, inclusivity, and a shared understanding of complex monitoring issues. These future activities, that could be implemented in knowledge sharing framework, could include:

- **Interactive Workshops** that bring together researchers, experts, and representatives from civil society to collaboratively explore and understand the tools used for representing data from

monitoring systems. These workshops can facilitate hands-on experiences, discussions, and knowledge-sharing sessions.

- **Training Programs** to enhance the technical literacy of researchers, experts, and civil society members in navigating and interpreting data visualisation tools. This initiative can empower participants to actively contribute to discussions on monitoring systems.
- **Open Access Platforms** or portals where diverse stakeholders can access and analyse data representation tools. This promotes democratised access to information, enabling broader participation in the discourse surrounding monitoring strategies.
- **Multi-Stakeholder Dialogues** that involve researchers, experts, and civil society in joint discussions about the design, functionality, and application of tools representing monitoring data. This ensures diverse perspectives are considered in refining and optimising these tools.
- **Collaborative Research Initiatives** where researchers and experts work hand-in-hand with civil society representatives to evaluate and improve the effectiveness of data representation tools. This can lead to the development of more user-friendly and comprehensible tools.
- **Public Awareness Campaigns** to inform civil society about the significance of monitoring systems and the tools used for data representation (user interfaces, colours, units, etc.). This can foster a more informed and engaged public that actively participates in discussions related to repository safety.

## 4. Conclusion

This report highlights the processes and main results of EURAD activities of interactions with civil society. In accordance with the perspective of the Aarhus Convention that grounds the civil society participation in the programme, the ICS activities carried out within the EURAD programme have demonstrated that managing uncertainties through a pluralistic and inclusive approach is essential for ensuring the safety and transparency in RWM.

The seminars and workshops have successfully brought together researchers, technical experts, and civil society representatives, fostering productive interactions and constructive dialogue. The development of collaborative frameworks, including interactive workshops, training programs and multi-stakeholder dialogues, has been identified as a promising path to improving mutual trust. These interactions have facilitated a shared understanding of key processes in RWM and have contributed to the enhancement of decision-making processes. The double-wing model, which includes both a larger civil society group and a group of civil society experts, has proven to be an effective framework for fostering meaningful engagement and dialogue.

In conclusion, it is recommended to continue developing this collaborative framework to promote a culture of shared safety and to ensure ongoing and informed participation of all stakeholders. Engaging with a broader community in a triple wing model is an outcoming proposal of this report. Continuing these efforts will help strengthen mutual trust between publics and technical experts and ensure that RWM strategies and systems meet the expectations and needs of society as a whole.

Thanks to the Aarhus Convention perspective, the EURAD programme has laid a strong foundation for integrating ICS activities into RWM. By continuing to build on this foundation and implementing the recommended strategies, future projects can further enhance the safety and transparency of RWM, leading RWM to be defined as: “a long-term complex decision-making process, in an uncertain environment, involving a plurality of stakeholders”.

## References

The deliverables can be downloaded from EURAD website: <https://www.ejp-eurad.eu/publications>

Debayle C., Dewoghelaere J., Fontaine G., Geisler-Roblin A. (2024): Enhanced system understanding, multi-party dialogue. Final version as of May 24 of deliverable D17.5 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

Dewoghelaere J. (2024): UMAN - How to manage uncertainties in a pluralistic way and in a long-term perspective? Final version as of 05.2024 of deliverable D10.16 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

Dewoghelaere J., Fontaine G., Hooge N. H., Mraz G., Wales C. (2024): Synthesis report of WP UMAN outcomes from a civil society point of view. Final version as of 05. 2024 of deliverable D10.17 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

Dewoghélaère 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.

Dumont J.-N. (2023): UMAN - Pluralistic analysis of uncertainty related to human aspects. Final version as of 26.02.2024 of deliverable D10.15 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

Fontaine G., Dewoghelaere J. (2024): UMAN - Application of the methods for a pluralistic assessment of uncertainties and their management to near-field uncertainties Final version as of 05.2024 of deliverable D10.20 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

Geisler-Roblin A., Fontaine G., Lavelle S., Dewoghélaère J. (2024): Evaluation of the ICS activities and experimental model of interaction between EURAD participants and Civil Society. Final version as of 25.07.2024 of deliverable D1.16 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

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.

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.

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.

Zeleznik N., Swahn J., Haverkamp J., Hooge N.H., Rey H. (2021): Scoping of ROUTES, initial ICS input and ICS action plan, Final version of deliverable D9.15 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593

Zeleznik N., Swahn J., Haverkamp J., Hooge N.H., Rey H., Daniska M. (2022): Implementation of ROUTES action plan first phase: Shared solutions, Final version of deliverable D9.16 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593

Zeleznik N., Swahn J., Daniška M., Haverkamp J., Hooge N.H., de Butler M, Wales C., (2023): Implementation of ROUTES action plan second phase: Transparency in establishment of national radioactive waste facilities, Final version of deliverable D9.17 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593

Zeleznik N., Swahn J., Daniška M., Haverkamp J., Hooge N.H., de Butler M, Wales C., (2024): Implementation of ROUTES action plan third phase: Short term and long-term public participation in RWM technical topics, Final version of deliverable D9.18 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593

Zeleznik N., Hooge N.H., Haverkamp J., de Butler M, Swahn J., Daniška M., Wales C., (2024): Synthesis of Task 7 activities. Final version of deliverable D9.19 of the HORIZON 2020 project EURAD. EC Grant agreement no: 847593.

