



TRANSDISCIPLINARY RESEARCH ON THE MANAGEMENT
OF HIGH-LEVEL RADIOACTIVE WASTE IN GERMANY

TRANSENS Summer School on

Transdisciplinary research for nuclear waste
disposal: science meets society

A not so serious report by Clemens Walther

August 19th - 28th, 2022
at the Physikzentrum Bad Honnef



Leibniz
Universität
Hannover

Preamble

Why not shoot the radioactive waste into the sun?

Even if you agree with the site selection process as a whole, would you accept a repository close to your home?

Why did in Sweden municipalities even volunteer to get the repository, while the mayor of the “rejected” municipality had tears in his eyes when he learned about the decision that the repository will be built elsewhere?

Is “transdisciplinarity” more than a fashionable buzzword to be used in project applications? Or, on the contrary: What is the added value of transdisciplinary research, especially when it comes to questions like the ones above?

Questions like these were addressed by the first lectures of the TRANSENS Summer School “Science meets Society”. 53 participants and lecturers from 18 countries met from August 19th to 28th in the Physik Zentrum Bad Honnef. The audience ranged from master students all the way to experienced scientists with background in physics, chemistry, geology, political and social sciences, and many more. In addition, interested citizens were present. It could not be more diverse.



19.8.

After a welcoming address by the organizers WOLFGANG SCHULZ (chemist) and CLEMENS WALTHER (physicist) both from Leibniz University Hannover, the project TRANSENS was presented by the project coordinator KLAUS JÜRGEN RÖHLIG (Mathematician, TU Clausthal). In two introductory talks, basics on radioactivity CLEMENS WALTHER revisited radiation protection, nuclear fission and reactor technology. KLAUS JÜRGEN RÖHLIG continued with an introduction to nuclear waste and disposal options. Particularly for the newcomers to the field, these four lectures provided the technical basis for the days to come.

20.8.

REBECCA TADDESSE (physicist and environmental engineer, OECD/NEA) introduced the structure and work of the OECD/NEA in a comprehensive lecture. Based on a short manuscript, participants discussed in small groups their opinions on stakeholder involvement, participation and building trust. When the discussion was continued in the plenum the question of general education on these topics, e.g. in schools, was addressed.

However, the technical side is only half of the story. This school focused on transdisciplinary research in nuclear waste disposal.

CHRISTIAN POHL (Departement of Environmental Systems Science, ETH Zürich) guided the participants through the multitude of existing definitions and practices, initiating lively discussions on relevance and parallels on one's own work. Most interesting and a new fact for many participants was how differently transdisciplinary research is implemented in countries such as Armenia, Brazil or Russia, depending on educational standards and political boundary conditions.

22.8.

Approaches to solve the problem of nuclear waste disposal in different countries were compared by THOMAS FLÜELER (environmental scientist, ETH Zürich



and Building Department Zurich) with a special focus on Switzerland. What might be a good socio-technical option in a

European country might not at all be suited for implementation in other places of the world, well in line with the reasoning of CHRISTIAN POHL the day before. This includes long term communication (atom semiotics) illustrated on the example of the very different implications we might experience with one and the same symbol: In India the swastika (Hakenkreuz) has a positive connotation symbolizing prosperity while in Germany this symbol is intrinsically connected with the terrible past of National Socialism. What might be the meaning of the present symbol for radioactivity, the winged wheel (Flügelrad), 1000 years from now?

Some very general and important insights are connected to communication. Most people do not

listen to understand but rather to reply. You want to contradict? That's what this means ...

In a second lecture, disposal of nuclear waste was compared to disposal of chemical hazardous waste. Surprisingly, already the definition of hazardous waste poses a problem. Not for the Swiss law: "Hazardous waste is what is defined to be hazardous waste". As obvious, some conventional hazardous waste since it does not decay. However, practices and perceived danger differ considerably.

"Nobody needs radiation protection!" psychologist OLIVER STRÄTER from the University of Kassel opened



his lecture and looked at CLEMENS WALTHER. He responded vigorously "What is psychology good for in the context of nuclear

waste disposal?" Of course this was only a game illustrating pitfalls in communication. Common patterns go way beyond private or even personal communication. In all kind of enterprises, deficits in communication culture cause distrust and are identified as one of the main reasons of accidents. Examples range from the 21 persons killed during the

love parade 2010 in Duisburg all the way to the Boeing 737 MAX airplane crashes. From these drastic failures, implications for safe handling of nuclear waste became obvious.

Every cognitive reaction is at the same time an emotional act. Hard wired in the most ancient region of our brain, the limbic system, confirmation of what we believe triggers positive feelings. Contradiction provokes the opposite. Not considering this fact prevents good communication even before it really can start. One hint: avoid the word "but" (and probably also "butt"). Why not continue with "and" instead?

In small groups, participants practiced communication on self-selected issues. Action and reaction, influence of how to start a discussion and further effects were observed closely following the G-R-O-W model (Goals-Reality-Options-Will).

Natural radioactivity is omnipresent in soil, air, water, food and even in human tissue. Ca. 8000 decays per second take place in our body. However, since humankind entered the "nuclear age",



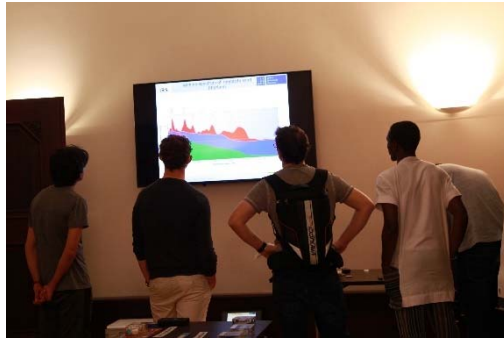
artificial radionuclides were released into the environment. In an after-dinner event, participants measured environmental samples with Geiger counters. The samples originated from the Bikini atoll (the former US nuclear weapon's test site), from Prypyat and Chernobyl and from the uranium mining legacy sites in Saxony. In addition, lignite and hard coal as well as scales from the oil and gas industry and from a water fountain of Jáchymov (radon bath) were available. Surprisingly, the samples of the second group, containing natural radioactivity, were much more radioactive than the ones of the first group. Many more radioactive objects were also part of the exhibition: watches with radium bearing dial, welding electrodes and incandescent mantles of gas lanterns containing thorium. Uranium bearing art work ranged from Italian tiles in bright orange via porcelain figures and plates painted with black pitchblende (uraniumdioxide) all the way to uranium



glassware fluorescing bright green when illuminated by UV light. The participants learned, that uranium was used at large scale in the color industry long before Henry Becquerel discovered uranium's radioactivity.

Who would have guessed that Brazil nuts contain radium and that potash is radioactive due to its high

potassium content (K-40)? Finally the question was raised how to find out which nuclides are present in



an unspecified sample. By use of a Geiger counter, this question cannot be answered. But of course we were prepared: By measuring

spectra of pitchblende from the black forest and monazite sand from an Indian beach with a NaI scintillation detector the participants got the answer: In pitchblende, uranium and its progenies was detected. Monazite, in contrast, contains thorium-232 and the members of its decay chain.

23.8.

The next day started with a "visit" of our northern neighbors: Finland will start operation of their disposal facility in Olkiluoto (Eurajoki) in 2024. Sweden decided on the site Forsmark (Östhammar) to host the repository the construction of which was recently approved by the Swedish government. Who could tell better than the mayors of the respective municipalities could? VESA LAKANIEMI (Eurajoki, FL) and JACOB SPANGENBERG (Östhammar, S) stressed the role of trust in all persons and confidence in the institutions involved. One major reason for this high

level of trust might originate from the fact that at both sites nuclear power plants and repositories for low and intermediate level waste are being operated safely for decades.

In Sweden as well as Finland, the local governments of the municipalities act in a much more sovereign way than this is the case in most Central European countries, Japan or the US. Voluntariness is a prerequisite for basically all decisions, strongly based on the votes of the local councils. In contrast to e.g. Switzerland, there is no direct democracy involved.

However, there are also important differences between the two Scandinavian countries. While there is strong participation in Sweden and active discussion on issues like copper corrosion, little or no interest in active participation by citizens is observed in Finland.

This fact is criticized by the social scientist



MARKKU LEHTONEN (Univ. Barcelona) in his lecture. A lack of critical dispute might lead to missed opportunities and compromise safety in the end.

The voice of critical groups is needed to guarantee a prudent process. He finished his talk with the strong statement that a lack of this interest in participation The lively discussion continued in a world café with the three speakers each hosting one table. Central topics were the influence of the political system on the success, particularly the role of the veto-right.

In the afternoon, participants took the role of scientists conducting transdisciplinary research. PIUS KRÜTLI (environmental scientist, Department of Environmental Systems Science, ETH Zürich)



revisited shortly how the main characteristics and definitions of transdisciplinary research evolved over the past two decades. In order to solve a societal problem,

one needs to develop a conceptual model that transcends disciplinary perspectives. Non scientific sources are integrated. In many cases, learning cycles have to start from the beginning and lead to a joint framing. PIUS KRÜTLI pointed out definitions of multidisciplinary and interdisciplinary work. In multidisciplinary research, a problem is addressed by several disciplines in parallel, but not necessarily in a joint effort. The interdisciplinary approach includes strong collaboration and entanglement of the partners. Transdisciplinary research includes

collaborative work with non scientific groups in



addition. Guided by the “ten reflective steps for rendering research societally relevant” participants addressed self selected (virtual)

problems. They worked on the steps (1) Formulate a research question and classify research as basic, applied, or transdisciplinary (2) Distinguish between research question and societal problem; make links between both (3) Specify the societal problem identified in step 2 and relate it to the policy cycle (4) Identify knowledge needed by (primary) target group(s) check whether the knowledge needed is what research may provide.

24.8.

Many institutions interact in the decision and implementation processes for nuclear waste disposal in Germany. KLAUS JÜRGEN RÖHLIG gave a short overview of the process and its actors, and introduced the four Speakers of the day.

How to organize a good interaction between science and policymakers? JOCHEN AHLWEDE (physicist) from the Federal Office for the Safety of Nuclear Waste Management (BASE) put this question at the start of

his presentation. What is the right "dose" of science? During the Covid pandemic we all learned, there can be both, too little or too much. Instead of the classical so called linear approach of scientists advising politicians that decide afterwards, modern approaches favor a co-productive setting.

While BASE is the regulator, the German implementer is the federal company for radioactive waste disposal, BGE, represented by STEFFEN KANITZ (economist). Germany needs to take care of spent nuclear fuel and high level waste filling 1800 Castor® containers. During the process, speed and need for best possible safety and transparency are ever competing. STEFFEN KANITZ illustrates how the German approach will

consider all aspects in the self-learning procedure of the site selection act. He laid special focus on the participatory formats



planned during the selection process. He points out a paradox: while the perceived need for participation increases, the actual possibilities for influence decrease during the course of the selection process. Participation, science, self questioning, learning, transparency, ... what is most important?

A very different role play two of the advisory committees to the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV): the nuclear waste management commission (ESK) and the German commission on radiological protection (SSK).

ESK chair, BARBARA REICHERT (geologist, University of Bonn), presented the members of the main



commission and described the sub groups on waste conditioning, transport and interim storage; final disposal; and on decommissioning.

All members work by honorary appointment. BMUV issues advisory appointments that are worked on until a recommendation, statement or discussion paper is adopted. In addition, the ESK can also discuss topics they consider relevant even without specific appointments.

The SSK works on a similar basis, but addresses a broader range of radiation protection issues reaching far beyond nuclear waste disposal. The SSK, its seven permanent subcommittees and many working groups were presented by SSK vice chair URSULA NESTLE (oncologist, Klinikum Mariahilf Mönchengladbach and University of Freiburg).

Statements and recommendations are elaborated in a similar manner as the ESK does. They mainly aim at the BMUV but are publically available. They are published in German language to be easily accessible for the general population. Some are translated to English language, and selected working results are published in international peer reviewed journals.

Common for both commissions: they treat all matters based on good scientific practice and strictly confidential until they are published. Also important: all members are free to share their opinion in the public. However, unless they get an explicit mandate to do so they may not speak in the name of SSK as a whole.

25.8.

Half of the summer school was over – a good time to recap. The request of the organizers to produce some final statement was hanging over everybody's head like Damocles' sword. Groups should design some format of their choice, but no PowerPoint presentation. A video, a play, no limits. The morning was used for preparation in groups.



In the afternoon, everybody went on this year's excursion to Koblenz. After surviving "Travelling with Deutsche Bahn" we all had a nice tour of Koblenz' "Old Town" and the Ehrenbreitstein Castle. The working dinner in the restaurant Weindorf was accompanied by an experimental seminar lead by CLEMENS WALTHER on local food origin and ingestion pathways particularly relevant in this region. Just after midnight, we arrived back at the Physikzentrum.

Tomorrow would start at 9:00 as usual...



26.8.

And it did - with an expert, nobody wanted to miss. ORTWIN RENN (risk scientist, institute for advanced sustainability research, Potsdam) gave a lecture on "Risk Governance: Coping with the risks of nuclear

waste management." He addressed problems in communicating the three scientific challenges complexity, uncertainty and ambiguity. Risk assessment applied to nuclear waste disposal poses some special challenges. The complexity of the problem might not be much higher than with other long-term waste forms. However, it poses an extremely high stigmatization potential and high politization.

Nuclear waste is framed as symbol for technocratic visions. In other countries nuclear waste is a symbol of long-term engineering accomplishment. Appraisal of risk assessment includes hazard identification, exposure assessment, risk estimation. RENN devided risk management in four categories: (1) dealing with routine linear risks (2) complex risk (3) highly uncertain risk (4) highly ambiguous risk multilayered management.



To each of them strategies were presented. An important finding came last: a special focus lies on resilience, i. e. how resistant a system or process is against stress.

FERDIANA HOTI (social scientist, SCK CEN, Antwerp) continued with an example: Might Germany keep the remaining three nuclear power plants running? This question, however, remained unanswered.



HOTI explained the normative rational: legitimacy means those affected should have the say. However, who is willing to participate? Motivation and willingness for participation differ considerably in Belgium and Germany as she found out based on an online inquiry. Self-confidence and self-reflection influence the call for and the willingness to take part in participation. In addition, feelings and emotions come into play.

After a group work addressing six questions defined by RENN and HOTI the results were summarized in a panel:

Should uncertainties be part of scientific communication?
Are they (too) often excluded?
Reasons for and against communicating uncertainties were weighed against each other.



How to decide between a number of possible sites?
ORTWIN RENN suggested to proceed according to a model they developed for a case in Switzerland: to pick randomly equal numbers of citizens of each town and let them decide among themselves.

Compensation should be made a public process. The word compensation already suggests that something went wrong. In the USA it's called benefit program.

Why do many people sit in the back of the Lecture hall, though you see and hear much better in the front rows?

HARALD SCHAUB (psychologist, Bamberg University) addressed this typical problem of complexity of human behavior in his lecture on human factors. The human brain was built by evolution for a much simpler world than we have today. It still acts

surprisingly well, however, we are limited to the number of tasks we can perform in parallel.

Parallel tasks exceeding the so-called magical number of 7 ± 2 need to be handled by complexity reduction. Problems may be approached, avoided or ignored but in any case, this involves an emotional action or decision.

How is this taken into account at critical workplaces? Do we always consider our maximum timespan of only 20 minutes to focus on one single topic? Not always. Interesting also the use of common sense: use it to ask questions but don't try to obtain solutions with it.

And a final advice: Imagine what your grandma would think if she was to be operating the machine you are about to design!

The day concluded with a role play set up by OLIVER STRÄTER and PIUS KRÜTLI: Consider a rural community of 20000 inhabitants. 80% land use for ecological agriculture and 20% for industry use, the city trying to further develop. Most inhabitants commute to work. The community is offered either a windpark in scenario A or a deep geological repository for nuclear waste in scenario B.

How might discussion and decision processes happen? The participants are asked to address this situation in small groups using the so-called power vs. interest grid to identify stakeholders (and

disciplines) and potential conflicts and applying the G-R-O-W model.

27.8.

The next morning started with a surprising facet for many: the role of the church in the process. At least, this was the teaser of MONIKA C. M. MÜLLER (biologist, Protestant Academy Loccum). She leads workshops on how to deal with "Atommüll" (nuclear waste) for many years now. Stakeholders, regulators, operators and citizens including pupils are brought together with the overarching aim to protect creation and human beings and care for peacekeeping. Furthermore, the church addresses societal challenges.

No doubt, nuclear waste disposal fits in here. The church acts with high ethical values, without personal interests and above political lines, MÜLLER points out. In a first step the topic of any Loccum meeting is defined and only in a second step persons are invited according to expertise and stakes fitting this topic. Science and society were involved from the very beginning in 1994. A true and early transdisciplinary process, as MONIKA MÜLLER points out. The best argument should win, there is no specified result, no mission.

As early as 1995, the feasibility of an "Energiewende" was discussed. Important steps of the last decade were accompanied such as the StandAG (Site

Selection Act), the site selection process and the "Fachkonferenz Teilgebiete".

Do we need Loccum being just one more player amongst all the many others? A clear „yes!“ from former participants points out the uniqueness of bringing all together in a provocation free space.

Participation of citizens (and experts) in a completely different institution was introduced by WERNER RÜHM (physicist, Helmholtz Center Munich, Chair of SSK and chair of ICRP): the National citizens' oversight committee (Nationales Begleitgremium, NBG). Required by the Site Selection Act in 2017, it



comprises 18 persons: scientists, former politicians, students and interested citizens. Absolute

transparency is the uppermost rule. The process of looking for a site and setting up the repository shall be critically observed by the NBG and such contribute to the self scrutinizing learning process. Trust shall be built up by monitoring the quality of public participation. The NBG formed a structure of four sub groups on participation, geology, radiation protection

and reflection on the selection procedure. The NBG has the unique right to read all documents, including internal ones, of BGE and BASE, really a powerful tool of supervising the process. This demands full transparency of BASE and BGE at any time helping to gain confidence in these two authorities.

In the following, DANIEL LÜBBERT (member of the Planungsteam Forum Endlagersuche, PFE) points out that the PFE takes over the role of the critical society in the site selection

process. PFE has 16 members plus so called alumni. BASE, BGE and NBG send ca. 1/3 of the members, the civil society



the remaining 2/3. According to its self-conception, BASE will not supervise BGE continuously on a technical scientific basis. Amongst other tasks, PFE raises the claim to fill this gap and hence provide important quality assurance of the process. PFE identified a number of note conflicts of BASE, DANIEL LÜBBERT points out, based on the many roles and tasks BASE fulfills.

Three persons jointly presented this morning's last talk from the TRANSENS project: ROMAN SEIDL



(psychologist)

CORD

DRÖGEMÜLLER

(social

scientist) and

HENRIKE

NEUMANN

(member of

AGBe). They

highlighted the

role of the continuous citizens' working group (Arbeitsgruppe Bevölkerung, AGBe) as maybe the most important transdisciplinary element in this research Project. ROMAN SEIDL described the quite elaborate recruiting process starting with a survey amongst 5000 participants followed by two more selection steps including 28 ZOOM interviews until the 17 members of the AGBe were named. Though not representative for the German population, the AGBe is well balanced according to gender, age and educational background of its members.

In September 2020, the AGBe held its constituent meeting in Hannover CORD DRÖGEMÜLLER pointed out. The AGBe members take their role as extended peer community providing critical input and gaining insights into scientific reasoning. In about four workshops per year topics of interest are discussed such as trust (from daily life to the special case of nuclear waste disposal) the safety case, the role of

recovery and retrieval and monitoring, to name but a few.

HENRIKE NEUMANN reflected her impressions from the AGBe member's perspective. She values the respectful way TRANSENS scientists and AGBe members treat each other. Discussions base on full transparency and trust. She values, always getting answers to questions in a way they understand.

The TRANSENS scientists confirmed this: we learn a lot from each other.



If one now may think, so what? Is this just a cheap copy of the NBG and PFE? No, not at all! Just as TRANSENS acts research-based and not as part of the site selection process, so does the AGBe. The true aim is better understanding the interaction processes between science and society. As an outcome, TRANSENS will point out possible pitfalls and on the other hand suggest improved ways of communication when „Science meets Society“, closing the circle to the title of this summer school.

28.8

So what remains? The impression of the participants in the Closing Session on Sunday morning:

You remember the German show family duel? PIUS KRÜTLI, CLEMENS WALTHER and ROMAN SEIDL were asked by group 1 to come to the front and to guess the participant's EduVote answers on difficult questions like "Are you sad to leave now?", "Where will the final repository in Germany be?" and "What topic did you learn most about?" The answers were "Yes", "Bavaria", and ... "wine (!)"

Physik Zentrum Bad Honnef or Hogwarts? The movie of group 2 started with everybody leaving the building and doing the broom trick. Then they each named in a short statement their impression of the school. In the end, they thanked Deutsche Bahn for "character forming exercise".☺ Everybody expressed their hope to have a follow up school next year.

Piano sounds opened the video of group 3&4. Picture yourself in the year 2525. Grandma Lena tells a story how there was a big blackout in the past after Russia invaded the West. Faulty energy politics lead to electricity blackout and shortage of gas. In a retrospective to the year 2022 a short discussion on use of nuclear power and how to deal with the waste

problem was abruptly ended by plugging in the electrical heater, overloading the electrical grid. Darkness. Back in 2525 grandma tries to explain that the solution of the waste problem was stored in the cloud. "In what?" the grand children asked?" "The internet". Sadly it became clear: this information was lost. The scene ended by ... plugging in the heater. Black!

Group 5 (named isotones) extracted keywords they remembered best from the school. Wordles were slowly forming with terms like exposure, dose or radiation, also Finland, France and development being very prominent. Impressions of the Physik Zentrum Bad Honnef, the Drachenfels and the excursion to Koblenz concluded the video.

Another video by group 6: "This is disciplinary arrogance" is the opener. "We did include *five* persons – this is enough." The reply: "But you need more. And transdisciplinarity needs to be included in each and every research project- where did you get your education?" Escalation at its best. Just the contrary of what the G-R-O-W model suggests for good communication. In a second attempt, a few days later, the same topic was discussed much more quiet and with the success of reaching a good compromise.

Group 7 did a PowerPoint presentation – oh better not. A video instead, that starts with the well-known martial opening of Beethoven's 5th symphony. Scenes of nuclear disasters and unpleasant

associations with radioactivity flicker over the screen. Then the music turns to the serene "Für Elise" as the background for display of the many peaceful nuclear activities. "Nuclear is the only large scale energy production taking full responsibility of its waste" was one of the final statements. Nevertheless, the terms trust, transparency, science, communication, safety, perception and education were the very fitting closing remarks of the last video.

"Goodbye (no more) stranger"¹ and "take the long way home"¹ were the "famous last words"¹ by CLEMENS WALTHER. "We thank you all!"²

¹ © Supertramp

² © Freddy Mercury, Queen

Appendix:
Program booklet

1 INTRODUCTION

Objectives of the Course:

The purpose of the school is to connect prospective and newly graduated young scientists with people of the public with a personal or professional interest in the finding of sustainable solutions for the final disposal of nuclear waste. It will include nine days of intensive lecturing, workshops and panel discussions.

For this purpose, world renowned experts in this inter- and transdisciplinary scientific field will offer about 40 lecture units and interactive exercises. Open scientific questions with high public relevance will be discussed addressing the needs of the next generation of young and innovative scientists.

Main topics:

- A) Disposal Options
- B) Participation
- C) Science – Society Interface

Program committee:

Prof. Dr. Klaus-Jürgen Röhlig	Institute of Disposal Research, Clausthal University of Technology
Prof. Dr. Clemens Walther	Institute of Radioecology and Radiation Protection, Leibniz University Hanover
Dr. Pius Krütli	TdLab ETH Zurich
Dr. Roman Seidl	Institute of Radioecology and Radiation Protection, Leibniz University Hanover
MSc. Dörte Themann	Research Center for Sustainability (FFN) Freie Universität Berlin
Prof. Dr. Oliver Sträter	A&O Work and Organizational Psychology Universität Kassel

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
Registration

Dr. Wolfgang Schulz
at the Physikzentrum, Reception Lounge

Door Code

 0511# For entering the Physikzentrum
during the whole School

WLAN Access Point

WLAN SSID **PBH**
Password:  011235813
Encryption WPA-2 personal

2 PROGRAM

Friday, 19th August 2022

16:00-21:00	Arrival and registration at Physikzentrum Bad Honnef	
18:00	Common dinner	

Saturday, 20th August 2022 – Scientific basics and transdisciplinary roots

9:00-10:30	Welcoming/Organizational	Walther, Schulz, Röhlig,
10:30-11:00	Coffee break	
11:00-12:30	Radiation Basics	Clemens Walther, LUH
12:30	Lunch break	
14:00-15:30	Technical Basics in Nuclear Power	Clemens Walther, LUH
15:30-16:00	Coffee break	
16:00-17:30	RWM management / Disposal Options	Klaus-Jürgen Röhlig, TUC
18:00	Dinner	

Sunday, 21st August 2022–Global approaches towards transdisciplinarity

9:00-10:30	HLW/SNF disposal: Current Status	Klaus-Jürgen Röhlig, TUC
10:30-11:00	Coffee break	
11:00-12:30	The work of the NEA and group discussion on stakeholder engagement	Rebecca Tadesse, NEA OECD
12:30	Lunch break	
14:00-15:30	What is TD?	Christian Pohl, ETH
15:30-16:00	Coffee break	
16:00-17:30	TD in other countries	Christian Pohl, ETH
18:00	Dinner	

Monday, 22nd August 2022 – Society interface

9:00-10:30	The swiss approach to final disposal	Thomas Flüeler, ETH
10:30-11:00	Coffee break	
11:00-12:30	Parallels to non-nuclear hazardous waste disposal	Thomas Flüeler, ETH
12:30	Lunch break	
14:00-15:30	Risk communication	Oliver Sträter, Uni Kassel
15:30-16:00	Coffee break	
16:00-17:30	Risk communication	Oliver Sträter, Uni Kassel
18:00	Dinner	

Tuesday, 23rd August 2022 – Participation / 10 steps: science – society interface

9:00-10:30	Participatory process, Deliberate spaces, Input lectures	Markku Lehtonen, UPF Vesa Lakaniemi, Eurajoki Jacob Spangenberg, Osthammer
10:30-11:00	Coffee break	
11:00-12:30	World Cafe	
12:30	Lunch break	
14:00-15:30	10 steps: Showcasing the Td-approach	Pius Krütli, ETH
15:30-16:00	Coffee break	
16:00-17:30	10 steps: Showcasing the Td-approach	Pius Krütli, ETH
18:00	Dinner	

Wednesday, 24th August 2022 – Stakeholder / Science Policy Interface

9:00-9:45	Science policy interface: The role of the BASE	Jochen Ahlswede, BASE
9:45-10:30	Making science-based decisions in a societal and political context	Steffen Kanitz, BGE
10:30-11:00	Coffee break	

11:00-11:45	Role of the Nuclear Waste Management Commission - ESK	Barbara Reichert, ESK
11:45-12:30	Role of the Commission on Radiological Protection - SSK	Ursula Nestle, SSK
12:30	Lunch break	
14:00-15:00	Speed dating	All 4 session speakers
18:00	Dinner	

Thursday, 25th August 2022 – Field trip

9:00-10:30	Group work on final presentation	Pius Krütli, ETH
10:30-11:00	Coffee break	
11:00-12:30	Group work on final presentation	Wolfgang Schulz, LUH
12:30	Lunch break	
14:00- ca. 23:30	Field trip to Koblenz	Clemens Walther, LUH Wolfgang Schulz, LUH

Friday, 26th August 2022 – Risks and human factor

9:00-10:30	Input and panel: "Risk Governance" and...	Ortwin Renn, IAAS
10:30-11:00	Coffee break	
11:00-12:30	..."Risk perception and communication of uncertainty"	Ferdiana Hoti, SCK CEN
12:30	Lunch break	
14:00-15:30	Human factors	Harald Schaub, Uni Bamberg
15:30-16:00	Coffee break	
16:00-17:30	Error Culture	Simon Maurer, Safety Expert
18:00	Dinner	

Saturday, 27th August 2022 – Civil society and the role of the "Loccum Conferences"

9:00-10:30	Civil society and the "Loccum Conferences"	Monika Müller, Akademie Loccum
10:30-11:00	Coffee break	
11:00-12:30	The role of NBG (National Citizens' Oversight Committee)	Werner Rühm, HZM/NBG
12:30	Lunch break	
14:00-15:30	The role of PFE "Planungsteam Forum Endlager"	Daniel Lübbert, PFE
15:30-16:00	Coffee break	
16:00-17:30	Citizens' Working Group (AGBe)	Roman Seidl, IRS, Cord Drögemüller, IRS; Henrike Neumann, AGBe
18:00	Dinner	

Sunday, 28th August 2022 – Closing / wrap up

9:00-10:30	Presentation by students	Pius Krütli, ETH
10:30-11:00	Coffee break	
11:00-12:30	Summarizing and outlook	Walther, Krütli
13:00	Common lunch and departure	