

# RICOMET 2018

Social Sciences and Humanities in Ionising Radiation Research

## International conference: RICOMET 2018

**Social Sciences and Humanities in Ionising Radiation Research**

Antwerp, June 13-15, 2018, University Antwerp, Belgium





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**Venue**

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Stadscampus  
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## Programme

### Monday, 11th of June

11:30	Registration and Welcome coffee - <a href="#">groundfloor D building</a>
12:00	Pre-conference workshop – room D226 – D328
14:00	<a href="#">Break – groundfloor D building</a>
14:30	Pre-conference workshop - room D226 – D328
18:00 – 19:00	Reception - <a href="#">groundfloor D building</a>

### Tuesday, 12th of June

9:00	Pre-conference workshop - room D226 – D328
11:00	<a href="#">Break – groundfloor D building</a>
11:15	Pre-conference workshop - room D226 – D328
13:00	<a href="#">Lunch - groundfloor D building</a>
14:00 – 16:00	ENGAGE meeting - room D226 – D328

### Wednesday, 13th of June

8:30	ENGAGE meeting – W. Elschotzaal
10:00	<a href="#">Break – A. Dürerzaal</a>
10:30	ENGAGE meeting – W. Elschotzaal
12:00	RICOMET registration - <a href="#">A. Dürerzaal</a> <a href="#">Welcome coffee</a>
12:30	Opening ceremony with key note speakers – <i>F. De Tassiszaal</i>
12:45	<b>Coping with nuclear and radiological terrorism</b> <i>Chairpersons: Iztok Prezelj, University of Ljubljana, Slovenia &amp; Patrick Meschenmoser, Mesh and Moser Situation Management, Austria</i>
	<ol style="list-style-type: none"> <li>1. Reflections on the Threat from Nuclear and Radiological Terrorism and Related Counter-Measures   Iztok Prezelj, University of Ljubljana, Slovenia</li> <li>2. Assessing the nuclear terrorism threat: an organizational approach   Brecht Volders, University of Antwerp, Belgium</li> <li>3. Weaponizing Social Media: How Terrorists Use Twitter &amp; Co. as Weapons and How Such Attacks Can be Counter   Patrick Meschenmoser, Mesh &amp; Moser Situation Management, Austria</li> <li>4. Crisis Communication during Brussels attacks   Peter Mertens, Federal Crisis Centre, Belgium</li> <li>5. SCK•CEN's security awareness program after Paris &amp; Brussels attacks   Benny Carlé, Maud Vanderthommen, SCK•CEN, Belgium</li> </ol>
14:15	<a href="#">Break - A. Dürerzaal</a>

14:30	<p><b>Involve, Engage, or Participate? Shaping “Engagement” with Stakeholders and Wider Publics in Radiation Protection</b></p> <p><i>Chairpersons: Catrinel Turcanu, SCK•CEN, Belgium &amp; Christiane Pözl-Viol, BfS, Germany</i></p> <ol style="list-style-type: none"> <li>1. <b>Keynote:</b> Enhancing transparency and public accountability through innovative radiation monitoring programs: The experience of Safecast seven years following the Fukushima Daiichi NPP disaster   Azby Brown, SAFECAT, Japan</li> <li>2. Reconceptualising stakeholder participation in Emergency Preparedness and Response   <u>Bieke Abelshausen</u>, Catrinel Turcanu, Tanja Perko, SCK•CEN, Belgium</li> <li>3. Rehabilitation of living conditions after Fukushima NPP accident: the practical experience and lessons learned from working with litate people   Yujiro Kuroda,, Fukushima Medical University School of Medicine, Japan</li> <li>4. From involvement, via engagement to active participation in the building of capabilities, trust and confidence in radiation protection issues   <u>Tatiana Duranova</u>, Jarmila Bohunova, VUJE, Slovakia &amp; Milan Marcinek, Academy of the Police Force, Slovakia</li> <li>5. Stakeholder engagement in radiation protection – what can we learn from practice?   <u>Christiane Pözl-Viol</u>, BfS, Germany &amp; Catrinel Turcanu, Bieke Abelshausen, Michiel Van Oudheusden, Tanja Perko, Gaston Meskens, SCK•CEN, Belgium &amp; Tatiana Duranova , VUJE, Slovakia &amp; Liudmila Liutsko, ISGlobal, Spain, &amp; Nadja Zeleznik, EIMV, Slovenia &amp; Diana Savu, NIPNE, Romania</li> <li>6. Risk of radon and crisis of communication   Cathérine Fallon, University of Liège, Belgium</li> <li>7. Radiation risk perception survey to support radon risk communication in Finland   <u>Johanna Vahtola</u>, Kaisa Raitio, STUK, Finland</li> <li>8. Collectively building an operational monitoring system for geological disposal: A case of ‘lab participation’   <u>Axelle Meyermans</u>, University of Antwerp, Belgium &amp; Céline Parotte, University of Antwerp and University of Liège, Belgium</li> <li>9. <b>Poster:</b> Saving and sharing knowledge on stakeholder engagement in radiation protection - challenge for knowledge base development   <u>Tatiana Duranova</u>, Jarmila Bohunova, VUJE, Slovakia &amp; Catrinel Turcanu, Bieke Abelshausen, SCK•CEN, Belgium &amp; Nadia Zeleznik, EIMV, Slovenia &amp; Christiane Pözl-Viol, BfS, Germany &amp; Caroline Schieber, CEPN, France</li> <li>10. <b>PANEL DISCUSSION:</b> “In and out of engagement in radiation protection: Connecting practices and experiences”  <b>Panel members:</b> Edward Lazo, OECD-NEA, France; Cathérine Fallon, University of Liège, Belgium; Yujiro Kuroda, Fukushima Medical University, Japan; Bieke Abelshausen, SCK•CEN, Belgium  <b>Moderator:</b> Michiel Van Oudheusden, SCK•CEN, Belgium</li> </ol>
16:30	Break - A. Dürerzaal



16:45	<p><b>How do radiation protection associations engage with society?</b>  <i>Chairpersons BVS-ABR: Isabelle Meirlaen, University Ghent, Belgium, Michel Ceuppens, Canberra, Belgium &amp; IRPA: Hiroko Yoshida-Ohuchi, Tohoku University, Japan</i></p> <ol style="list-style-type: none"> <li>1. Welcome by Michel Sonck, President Belgian Association for Radiation Protection (BVS-ABR).</li> <li>2. Introduction on structure and purpose of the workshop.</li> <li>3. Key note speeches of IRPA representatives: Roger Coates, IRPA President &amp; Hiroko Yoshida-Ohuchi, President Technical group on public understanding (IRPA).</li> <li>4. Presentation of different current national practices by the presidents or delegates of the national Radioprotection Associations from the Netherlands, Italy, UK and Belgium.</li> <li>5. Introduction of the panel participants to come to topics that would be useful to address in the guiding principles.</li> </ol>
18:00 – 19:00	Reception - A. Dürerzaal

## Thursday, 14th of June

8:00	<b>Refresher course on scientific methods: part 1</b> – T. Greshamzaal
9:00	Morning coffee - A. Dürerzaal
9:15	<p><b>Methodological issues, challenges and good practice in Social Science and Humanities research</b> – F. De Tassiszaal  <i>Chairpersons: Peter Thijssen, University of Antwerp, Belgium &amp; Cathérine Fallon, University of Liège, Belgium</i></p> <ol style="list-style-type: none"> <li>1. <b>Keynote</b> "Stirring up" TERRITORIES: Integrating social and ethical considerations into radioecology   Erik Fisher, Arizona State University, U.S.A &amp; Michiel Van Oudheusden, SCK•CEN, Belgium</li> <li>2. Making sense of uncertainty at the interface of natural and humanistic disciplines   Kata Saluri, Keiu Telve, <u>Dolores Mäekivi</u>, Alan H. Tkaczyk, University of Tartu, Estonia</li> <li>3. How to deal with grouchy smurfs in technological surveys? Modeling acquiescence in risk perception surveys   Peter Thijssen, University of Antwerp, Belgium</li> <li>4. Social Perception Analysis of Introducing the Nuclear Power Plant Programme (NPP) in Poland   <u>Katarzyna Iwinska</u>, Magdalena Kraszewska, Katarzyna Witkowska, Collegium CIVITAS, Poland &amp; Agnieszka Miśkiewicz, Institute of Nuclear Chemistry and Technology, Poland</li> <li>5. The Protest Survey Method And the Results of Five Anti-Nuclear Demonstrations   Pauline Ketelaers, University of Antwerp, Belgium</li> <li>6. <b>Poster:</b> The Questionnaire on Exploring People's Needs on Apps (mobile applications) for dose measurements &amp; health/well-being related to radiation exposure (WP1 SHAMISEN SINGS project)   Liudmila Liutsko, Adelaida Sarukhan, ISGlobal &amp; CIBERESP &amp; UPF, Spain &amp; Deborah Oughton, NMBU, Norway &amp; Paola</li> </ol>

	<p>Fattibene, Sara Della Monaca, IS, Italy &amp; Vadim Chumak &amp; NRCRM NAMS, Ukraine &amp; Aya Goto, Yulia Lyamzina, FMU, Japan &amp; Philippe Pirard, Santé Publique France &amp; Natallia Novikava, ISEI of BSU, Belarus &amp; An Van Nieuwenhuyse, KULEuven, Belgium &amp; Yevgenia Tomkiv, NMBU, Norway &amp; Sylvie Charron, IRSN, France &amp; Mélanie Maître, Pascal Croûail, Thierry Schneider, CEPN, France &amp; Elisabeth Cardis, ISGlobal &amp; CIBERESP &amp; UPF, Spain</p> <p>7. <b>POSTER:</b> What about the c(l)ueless? Partisan cues and opinion on nuclear energy   Edwin Latré, Peter Thijssen, University of Antwerp, Belgium &amp; Tanja Perko, SCK•CEN, Belgium</p>
10:45	Break - A. Dürerzaal
11:00	<p><b>The ethics of methods and the methods of ethics</b> – F. De Tassiszaal</p> <p><i>Chairpersons: Gaston Meskens, SCK•CEN, Belgium &amp; Friedo Zölzer, University of South Bohemia, České Budějovice</i></p>
	<ol style="list-style-type: none"> <li>1. Introduction to ICRP Publication 138 "Ethical Foundations of the System of Radiological Protection"   Friedo Zölzer, University of South Bohemia, České Budějovice</li> <li>2. From exclusion to inclusion: an ethical approach to sustainable development of the Chernobyl Exclusion Zone   Deborah Oughton, NMBU, Norway</li> <li>3. Ethics for Radiation Protection in Medicine: Analysis of Clinical Scenarios in Radiotherapy   Christina Skourou, St. Luke's Radiation Oncology Centre, Ireland</li> <li>4. <b>Panel discussion</b></li> </ol>
12:30	Lunch - A. Dürerzaal
13:30	<p><b>Uncertainties and decision-making in short and long term exposure situations</b></p> <p><i>Chairpersons: Wolfgang Raskob, KIT, Germany &amp; Sylvie Charron, IRSN, France</i></p>
	<ol style="list-style-type: none"> <li>1. CONFIDENCE: Dealing with uncertainties in multi-criteria decision analysis tools   <u>Wolfgang Raskob</u>, Tim Müller KIT, Germany</li> <li>2. Characterisation of uncertainties in past nuclear emergencies: a case study approach   <u>Yevgeniya Tomkiv</u>, Deborah Oughton, NMBU, Norway &amp; Tanja Perko, Catrinel Turcanu, Bieke Abelshausen, SCK•CEN, Belgium &amp; Silvia Germán, Sergio López-Asensio, CIEMAT, Spain &amp; Melanie Maitre, CEPN, France &amp; Christian Oltra, Roser Sala, CIEMAT, Spain &amp; Thierry Schneider, CEPN, France &amp; Nadja Zeleznik, EIMV, Slovenia</li> <li>3. Managing uncertainties through citizen science: The case of Fukushima   <u>Michiel Van Oudheusden</u>, Joke Kenens, Catrinel Turcanu, SCK•CEN, Belgium</li> <li>4. Decision-making processes in post-accidental situations: manifestation of uncertainty   Jérôme Guillevic, IRSN, France &amp; Pascal Croûail, Mélanie Maître, Thierry Schneider, CEPN, France, et al.</li> <li>5. Living in a long term exposure environment: document review for identification of causes of societal uncertainties   <u>Jelena Mrdakovic Popic</u>, NMBU, Norway &amp; Tanja Perko, Bieke Abelshausen, SCK•CEN, Belgium</li> <li>6. <b>Poster</b> Societal uncertainties during radiological emergencies: a case study of a release of radioactive iodine   Tanja Perko, SCK•CEN, Belgium &amp; Pieternele</li> </ol>

	Lehaen, KULeuven, Belgium & Bieke Abelshausen, Catrinel Turcanu, SCK•CEN, Belgium
15:00	Break - A. Dürerzaal
15:30	<b>Comparing stakeholder engagement in waste disposal, decommissioning and environmental remediation</b> – <i>F. De Tassiszaal</i> <i>Chairpersons: Meritxell Martell, MERIENCE, Spain &amp; Horst Monken-Fernandes, IAEA</i>
	<ol style="list-style-type: none"> <li>1. <b>Keynote</b> IAEA project: Similarities and differences in stakeholder engagement approaches in waste disposal, decommissioning and environmental remediation   Horst Monken-Fernandes, IAEA</li> <li>2. Observations on concerns of stakeholders faced with decommissioning, environmental remediation and radioactive waste disposal   David Brazier, Environment Agency, U.K.</li> <li>3. Spanish case study of a long-lasting NORM exposure situation: analysis of social uncertainties   <u>Roser Sala</u>, S. López-Asensio, C. Oltra, S. German, D. Pérez, CIEMAT, Spain</li> <li>4. How to involve local players in decision on location of a Deep Geological Repository (DGR) in the Czech Republic?   Nikol Novotna, SÚRAO, Czech Republic</li> <li>5. Interactive session with the audience; Structured decision-making: A paradigm shift towards effective stakeholder engagement   Kelly and Paul Black, Neptune Neptune and Company, Inc, USA</li> <li>6. <b>Poster:</b> The Possibility Long-term Storage/Disposal of 14C Waste from RBMK-Type Reactors in Disused Mines   Borys Zlobenko, Institute of Environmental Geochemistry, Ukraine</li> </ol>
17:15 – 18:45	CONFIDENCE project meeting, WP 5, task 3 (case studies) – <i>F. De Tassiszaal</i>
19:00	Walking dinner with finger food in the Plantin and Moretus Museum

## Friday, 15th of June

8:00	<b>Refresher course on scientific methods: part 2</b> – <i>D226 – D328</i>
9:00	Morning coffee - groundfloor D building
9:15	<b>Stakeholder involvement in the development of radiation protection research agendas and roadmaps</b> <i>D226 – D328</i> <i>Chairpersons: Nathalie Impens, SCK•CEN, Belgium &amp; Caroline Schieber, CEPN, France</i> <ol style="list-style-type: none"> <li>1. Opening of the session; Caroline Schieber &amp; Nathalie Impens</li> <li>2. Stakeholder involvement for the orientation of the research agenda of a TSO : experience of IRSN   Sylvie Charron, IRSN France</li> <li>3. Stakeholder involvement in the elaboration of the research agenda of European Radiation Protection Research Platform: experience of EURADOS   Filip Vanhavere, SCK•CEN, Belgium</li> </ol>

	<p>4. Experience of a stakeholder involved in a process  Nadja Zeleznik, Nuclear Transparency Watch &amp; EIMV, Slovenia</p> <p>5. The stakeholder involvement process for the elaboration of CONCERT joint Roadmap   Nathalie Impens, SCK•CEN, Belgium</p>
10:45	Break – groundfloor D building
11:00	<p><b>Communication in the spotlight</b> - D226 – D328</p> <p><i>Chairpersons: Tanja Perko SCK•CEN, Belgium &amp; Meritxell Martell, MERIENCE, Spain</i></p> <ol style="list-style-type: none"> <li>1. <b>Poster:</b> Spanish case study of a radiological event: how risk communication can makes the difference   <u>S. López-Asensio</u>, S. German, R. Sala, C. Oltra, M. Montero, C. Trueba, CIEMAT, Spain</li> <li>2. When used in communication to general public, does plume maps lead to desired protective actions?   <u>Kaisa Raitio</u>, STUK, Finland &amp; Nina Kukkurainen, Finnish Meteorological Institute, Finland &amp; Johanna Vahtola, STUK, Finland</li> <li>3. Uncertainties related to radiological maps produced and used for nuclear emergencies   <u>Ludger Benighaus</u>, DIALOGIK, Germany &amp; Johan Camps, Tanja Perko, Catrinel Turcanu, SCK•CEN, Belgium &amp; Christina Benighaus, DIALOGIK, Germany</li> <li>4. Individual dose reconstruction after sever radiological accidents and its use for crisis communication   Kathrin Folger, Florian Gering, <u>Matthias Zähringer</u>, BfS, Germany</li> <li>5. Communicating Uncertainties regarding Radiological Risks via News Media: the Effectiveness of Numerical and Narrative Messages   <u>Hanna V. Wolf</u>, University of Antwerp, Belgium &amp; Tanja Perko, SCK•CEN, Belgium</li> <li>6. New technologies for public service: Would their use help engage people in radiation protection and preventive health behaviour? (SHAMISEN SINGS project)   Liudmila Liutsko, Adelaida Sarukhan, Elisabeth Cardis, ISGlobal &amp; CIBERESP &amp; UPF, Spain</li> </ol>
12:30 – 13:00	Farewell drink – groundfloor D Building

## **Session 1: Coping with nuclear and radiological terrorism Related Counter-measures**

Terrorism has become an increasingly relevant threat in contemporary Europe and the whole world. The threat of radiological or nuclear terrorism has also increased due to some actors who tried to obtain, produce or use radiological or nuclear weapons. Additionally, threats to nuclear/radiological infrastructures have been detected since 9-11. This threat has been characterized as a low probability-high consequence threat. In addition, preparedness for nuclear or radiological terrorism may have an impact on socio-political and ethical aspects of our society.

This panel will deal with various kinds of uncertainties related to the threat and risk of nuclear and radiological terrorism. The panel specifically aims to discuss the risks of this type of terrorism, societal vulnerabilities, preparedness (at the state and international level), crisis communication, emergency management, resilience, etc.

## Reflections on the Threat from Nuclear and Radiological Terrorism and Related Counter-Measures

Iztok Prezelj,

Assoc. Prof. and Vice-Dean for Scientific research, Faculty of Social Sciences, University of Ljubljana, Slovenia

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### Abstract

Since 9-11, terrorism has become one of the most serious national and international security threats in Europe and globally. The threat is clearly reflected by many security documents of European countries and also international organizations, such as EU, NATO, OSCE and UN. In the increasing number of terrorist attacks, we have not witnessed any successful nuclear or radiological attacks. However, there were attempts to obtain or build appropriate weapons and use them for terrorist purposes. Probability for successful execution of nuclear terrorist attack are low, but its consequences would be very high. It would also probably mean the end of the world as we know it.

The purpose of this presentation is to discuss the threat from nuclear and radiological terrorism conceptually and based on some known information published in international media. The threat will be diagnosed from perspective of motivations and capabilities. The author will discuss the process of radicalization towards the use of nuclear or radiological weapons for terrorist purposes. Also nuclear facilities as critical infrastructures will be discussed. Cases such as Al Qaeda and Aum Shinrikyo will be mentioned, etc. The author will also discuss why the nuclear option has not been attempted more often in comparison with conventional terrorism. The nuclear option is also discussed along with other options of non-conventional terrorism.

Finally, key challenges of counter-terrorism in the field of nuclear will be presented. The author will scan the institutional "landscape" and present key role of several security and other institutions. The author will also discuss the need for coordination among these institutions. The author argues that complex threat of nuclear or radiological terrorism requires a multiorganizational and interorganizational approach.

## Assessing the nuclear terrorism threat: an organizational approach

Brecht Volders  
University of Antwerp, Belgium

brecht.volders@uantwerpen.be

### Abstract

Nuclear terrorism is often a topic of popular, academic and political concern. Yet, assessing this risk is a challenging task. Nuclear terrorism can manifest itself in different ways, and the phenomenon is often shrouded in secrecy and uncertainty. Traditional nuclear terrorism assessments tend to focus primarily on terrorist motivations to employ nuclear terrorism, the availability of nuclear know-how and technology, and the opportunity for clandestine organisations to acquire fissile or radiological material. Scholars and experts, however, often neglect to elaborate on the challenges for terrorist organisations in organizing and implementing such a project. This presentation will therefore primarily focus on this aspect, and will be based on the ongoing doctoral research I am currently conducting.

Considering my doctoral research focuses on the threat of an terrorist organization constructing and detonating a crude nuclear device, this presentation will primarily use this example to demonstrate my arguments. In doing so, and adopting the aforementioned organizational approach, I will highlight the importance of an organizational approach by introducing the idea of an effectiveness-efficiency trade-off for terrorist organizations pursuing a nuclear capacity.

## **Weaponizing Social Media: How Terrorists Use Twitter & Co. as Weapons and How Such Attacks Can be Countered**

Patrick Meschenmoser  
Mesh & Moser Situation Management, Austria

meschenmoser@meshandmoser.com

### **Abstract**

With the rise of social media the way we communicate has changed dramatically over the past decade. Twitter & Co. know no boundaries, every post is global and can reach people everywhere. On social media, messages and news are not mediated and vetted by journalists anymore, they reach their recipients unfiltered and unvetted and can be spread in no time. With this, social media turned into the perfect tool for spreading fake news, either unintentionally or intentionally.

In parallel, we witnessed a surge of international terrorism that made intense use of social and online media for recruiting and propaganda purposes. This presentation will focus on the question how these media can not only be instrumentalized to spread ideologies but literally be weaponized and used for terror attacks. Based on case studies it will be shown how this has already happened in the past and which damage was done by using social media as weapons. The purpose of this presentation is to discuss how social media could be used to amplify uncertainty and fear during a nuclear or radiological attack or by just pretending that an attack was carried out or is immanent.

At the end, the presentation will reflect on how this kind of disinformation attacks can be countered and how we need to prepare to effectively respond to this new kind of threat.



## Crisis Communication during Brussels attacks

Peter Mertens on behalf of D5  
Federal Crisis Centre, Belgium

Peter.Mertens@ibz.fgov.be

### Abstract

On March 22nd 2016, Brussels has been confronted with 2 terrorist attacks. 32 deadly victims were to deplore, together with many people who got heavy injured.

The National Crisis Center immediately started its emergency procedures, including the information to the population. Therefore, the communication unit could fall back on a time-tested method to organize its tasks and to distribute roles within the team: the Work Process Crisis Communication. By a good assessment of factual information, rumors, perceptions, sentiments, behavior, ... the crisis communication can meet better the public information needs.

Given the impact of the emergency situation, support to the communication unit was given by Team D5. This is a pool of communication collaborators throughout the country, that has been created by the Crisis Center to support local authorities when they are confronted with an emergency. During the Brussels attacks, the Team D5 gave support to the Crisis Center. In 2017, the team received therefore the '112-award' for Remarkable Crisis Communication.

## SCK•CEN's security awareness program after Paris & Brussels attacks

Benny Carlé, Maud Vanderthommen  
Belgian Nuclear Research Centre, Mol, Belgium

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### Abstract

As a consequence of the investigations after the Paris terrorist attacks on 13 November 2015 in Paris, the threat level in Belgium was raised by the authorities. In December, the government decided to strengthen the armed response capacities in critical infrastructures by deploying military armed forces on site.

On March 22nd 2016, Brussels has been confronted with 2 terrorist attacks. Immediately, important security measures were taken at SCK•CEN, which had a serious impact on the daily operations.

These events had a serious impact on the SCK•CEN personnel's sense of feeling secure in the research center. Together with a series of "hard" physical protecting measures, a program started to address the worries, and establish co-operation between the staff, the guards and the security professionals.

The baseline of this program was "two way communication". Security awareness sessions were organized in small groups, with a focus on what everyone can do, in 'normal' daily life and in case of security events. Several communication methods, such as a security hotline, FAQ list and regular status updates, supported the program.

In this talk, we focus on this internal awareness program.

## **Session 2: Involve, Engage, or Participate? Shaping “Engagement” with Stakeholder and Wider Publics in Radiation Protection**

Increasingly, radiation protection actors (scientists, science policy makers, oversight bodies, citizens) underline the importance of stakeholder engagement and ongoing dialogue between scientific experts, civil society organizations, and publics in the face of sociotechnical challenges (e.g. increasing use of ionizing radiation in medical applications; ongoing issues related to nuclear accidents). Yet, engagement takes on multiple forms, is enacted differently in formal and informal venues, and is continuously reshaped depending on situation and context. With these observations in mind, this session invites contributions from researchers and practitioners that reflect on the manifold meanings of “engagement,” “participation,” “stakeholder” and related notions, the needs and rationales for engagement/participation in radiation protection, the types of involvement at play, and the practical experiences and the lessons learned from participatory practice. The session particularly welcomes presentations that focus on engagement in medical exposures to ionizing radiation, nuclear emergency preparedness, response and recovery, and exposures to indoor radon. It will be concluded with an invitation to dialogue, taking the form of a panel.

## Enhancing transparency and public accountability through innovative radiation monitoring programs: The experience of Safecast seven years following the Fukushima Daiichi NPP disaster

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### Abstract

#### Background

Many citizen groups arose in Japan following the Fukushima Daiichi NPP accident in 2011, which aim to serve the information needs of citizens, but their experience and effectiveness have varied widely. Environmentally-focused NPOs often have an oppositional relationship with government and official bodies, with few areas of real cooperation. In Japan institutional structures have no clear guidelines for including citizen groups in monitoring and decision-making, which has hindered cooperation on radiation monitoring even when parties on both sides have been willing. Nevertheless groups such as Safecast have found informal work-arounds that enhance transparency to the benefit of the public and other stakeholders.

#### Methods and Results

Safecast implemented a robust and credible open-source based, crowdsourced data radiation gathering project based on GPS-enabled radiation detectors and accessible online maps. The group has welcomed unofficial, informal contact with government officials and TEPCO staff to frankly discuss transparency issues. On this basis, over the past year the group has gained regular access for radiation monitoring activities within the Fukushima exclusionary zone, and gained permission to install an independent realtime sensor within this zone in the town of Okuma, approximately 2km from Fukushima Daiichi. In addition, Safecast was able to gain the cooperation of TEPCO to openly survey the Fukushima Daiichi site using the Safecast GPS-enabled bGeigie system, with the clear understanding that the data would be published independently and openly. This paper will describe the engagement process and results of these and other precedent-setting engagement activities.

#### Conclusions

In order to gain inclusion by government and TEPCO in Japan it was necessary for Safecast to find approaches outside of normal institutional structures. By establishing important precedents and demonstrating the benefits for the public and all parties of increased transparency, Safecast hopes to help change such informal work-arounds into official policy which recognizes the importance of including competent third-party citizen groups in the monitoring and communication of radiation risks.

## Reconceptualising stakeholder participation in Emergency Preparedness and Response

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### Abstract

Stakeholder participation has been placed on the agenda of the radiation protection community since several decades and has been expressed as the “new normal”, particularly in the area of emergency preparedness, response and recovery. Lessons learned from various environmental management fields, as well as from major events such as the Chernobyl and Fukushima accidents, have resulted in a shift towards ‘engagement’ of stakeholders, including the general public. This shift brings forth conceptual, methodological and discourse challenges for strategic research agendas as well as for the radiation protection community, researchers and practitioners. Previous research in stakeholder participation and knowledge sharing has shown that participation is framed within a specific ‘zeitgeist’ and should therefore be continuously reconceptualised. This requires a (re-) examination of previously accepted conceptualisations of stakeholders and stakeholder engagement and conduct exploratory research. Within the frame of the ENGAGE project (ENhancinG stAkeholder participation in the GovernancE of radiological risks for improved radiation protection and informed decision-making) various research is combined and synthesized. First, a realist review is conducted on stakeholders, stakeholder participation and knowledge sharing in the field of environmental management. This entails the synthesis of quantitative studies, including surveys and systematic reviews, and qualitative research, including semi-structured interviews and focus group discussions. Subsequently, a systematic review is conducted on international guidelines and recommendations, and academic literature in the field of nuclear emergency preparedness and response. Concerning international guidelines and recommendations a non-exhaustive literature search is conducted. An exhaustive approach is used for academic literature published in the period 2007-2017 from the database Web of Science, key words include stakehold\* AND nuclear\* OR radiologic\* AND emergency OR accident. A synthesis analysis is conducted to explore the interpretation given to the term stakeholder and stakeholder engagement. This study provides insights into the conceptualisations of stakeholder engagement from various disciplines. The results are presented in a narrative manner highlighting challenges and opportunities, with particular focus on conflicting views and recommendations on how to address these.

## Rehabilitation of living conditions after Fukushima NPP accident: the practical experience and lessons learned from working with litate people

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### Abstract

litate village is located 30 to 50km northwest from the crippled nuclear power plant, which had a pre-disaster population around 6,000. Entire village was designated as "evacuation zone" due to the accident, and on March 31st, 2017, 19 of the 20 hamlets constituting litate village were re-opened to habitation. In this presentation, following issues will be discussed; 1)Long term effect on the villager's lives in terms of psychological and social well-being, 2)Effort in the new living environment: initiated by both litate village local council and villagers, 3)Lessons learned from community-based activities. Considering the "risk communication" -how low-dose radiation-related information was provided to community members- after the Fukushima nuclear accident, it can be said that due to the collapse of their trust in experts and government became the biggest obstacle to take measures to counter the nuclear disaster. Given that situation, the role of a trusted person in the community is considered as crucial, and acted as "Liaison" between the villagers and specialists. Community health workers including public health nurses who have local knowledge and understanding of the situation of the village are the most appropriate stakeholders to take on this role. In addition, expert networks would be necessary to be created in order to support them and respond, case-by-case and day-to-day needs and concerns.

## From involvement, via engagement to active participation in the building of capabilities, trust and confidence in radiation protection issues

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### Abstract

The complexity of the emergency preparedness and post-accident management was recognized and analysed deeply as well as relations among different stakeholders, their roles and tasks within the post-accident preparedness process in Slovakia. Each stakeholder has defined its specific role and work and form a part of the complex system; each stakeholder has defined where and how to be involved in the whole system.

The main goal of the activities undertaken under the different projects in the area of stakeholder engagement in Slovakia was to improve and strengthen the emergency and post-accident preparedness and recovery management at all levels: national, regional and local

The main interest and motivation for this activity is to share experience about different initiatives on emergency and rehabilitation preparedness and management throughout Europe and to develop and apply methods and models of stakeholder engagement and participation to allow and support dialogue. The model for stakeholder engagement and participation included the following: testing, customisation and use of models and tools; case studies using scenarios developed; building network and trust between partners within the Slovak Republic and within Europe through EC projects; facilitated workshops, exercises, seminars, training courses; establishing the Slovak panel and EURANOS Handbooks Users Group; and participation in the network involved in development of the EURANOS Handbooks for assisting in the management of contaminated inhabited areas, food production systems and drinking water.

This presentation summarises current work which aims to close gaps that have been identified in the area of emergency planning and emergency preparedness by European Commission and International Atomic Energy Agency after the evaluation of Fukushima disaster. The high timeliness of the implementation of the CONFIDENCE and ENGAGE projects in Slovakia follows from the Strategy of internal security of the European Union and from the Concept of the organisation and development of Civil Protection up to the 2020 and Concept of organisation, operation and development of the Integrated Rescue System in the Slovak Republic. This Concept reflects necessity of educational process improvement at all levels, including education at Academy of the Police Force in Bratislava, practical use and harmonisation of the decision support tools and systems within the structure of emergency planning and emergency preparedness at all levels of crisis management in the Slovak Republic.

## Stakeholder engagement in radiation protection – what can we learn from practice?

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### Abstract

Stakeholder engagement and informed decision-making are recognised as central elements for the governance of radiological risks. Various guidelines and requirements focussing on stakeholder engagement were developed in the past at the international level. However, the practical implementation of stakeholder engagement in radiation protection is confronted with multiple challenges. This contribution addresses opportunities, challenges and best practice in three radiological exposure situations.

For radiological emergency preparedness and response, stakeholder engagement has been increasingly in focus, particularly in the aftermath of the Chernobyl and Fukushima accidents. While EU legal requirements are focusing mostly on public information and transparency, in practice the landscape of stakeholder engagement is very diverse and rich, including non-institutional approaches such as involvement of local communities in emergency preparedness or citizens' initiatives to measure radioactivity in the environment. With respect to radon exposure situations, stakeholder engagement has been done in several countries only to a limited extent. Most countries focused solely on informing the publics about risks from living in radon prone areas. This proved to have only short term effect, and resulted in low risk awareness related to radon among the exposed populations and non-compliance with protective actions. However, countries that applied stakeholder engagement practices in past years, report great success in their radon action plans. Legal international and national documents (e.g. the revised BSS) require now higher involvement of stakeholders in addressing the radon issue. For medical exposures, according to the BSS, medical practitioners have the responsibility to communicate about the risks of radiation-induced effects of diagnostic and therapeutic procedures to patients and other involved individuals, and to obtain consent before exposing them to radiation. Informed consent is an important ethical and practical part of engaging with patients, but its application in practice is often sub-optimal, for instance, because not enough time is left for a patient's decision, and there is lack of clear, individualized information.

The presentation will give a closer look at how legal requirements, guidelines and recommendations for stakeholder engagement in radiation protection are implemented in practice in these three exposure situations. Of interest are institutional as well as non-institutional approaches. The preliminary results are drawn from academic literature based on research in the social sciences and humanities (SSH), an analysis of practical experience reported in case studies and lessons learned from radiation protection and other relevant non-nuclear fields.

### Acknowledgement



The presentation reports on results achieved within the project ENGAGE “ENhancinG stAkeholder participation in the GovernancE of radiological risks for improved radiation protection and informed decision-making”. ENGAGE is funded under the H2020 CONCERT, Nov. 2017-Nov. 2019.

## Risk of radon and crisis of communication

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### Abstract

Radon exposure is a well-known risk in radiation protection policy. In Belgium data gathering and public information on radon is a federal responsibility, but only the south of the country (Wallonia region) is concerned with this risk. While interventions for mitigation and protection are more distributed between federal, regional and local authorities, as a public health issue.

Radon level of exposure is very site specific : in case of detection of high levels of exposure, public information and intervention is more related to crisis management than to risk management. This presentation will be based on a case study of a "radon crisis" in a public school in Wallonia and the questions related to stakeholders engagement at two different moments : in crisis management and in risk management. It will differentiate "stakeholders engagement" as public issues involving different professionals and different publics. The analysis mobilizes the recent theories in public policy evaluation and analysis with a constructivist perspective.

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## Radiation risk perception survey to support radon risk communication in Finland

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### Abstract

A Finnish Radiation risk perception survey was made by Finnish Radiation and Nuclear Safety Authority STUK. Survey responses (1124 respondents in total) represent the Finnish adult society by age, gender based on quotas by region. Data collection was done in 18.12.2017-9.1.2018.

STUK's strategic goal is that people understand the risks of radiation compared to each other and to other health risks. Our aim is to provide people with easy-to-understand radiation safety information to enable them to understand what is hazardous and what is not and consequently act correctly without unnecessary fear. Indoor radon is a significant health hazard to Finnish population, and therefore in the center of STUKs communication to general public. The goal of communication is to increase understanding of radon risk and to strengthen correct behavior. During the last two years STUK has carried out innovative communication campaigns about radon safety and the efforts will continue.

Objectives of the survey were to gather information about attitudes towards radiation and to investigate misconceptions and knowledge about radiation. The results are used to strengthen our understanding of the current risk perceptions and where the biggest gaps in understanding are. The survey will be used also as a measurement of the success of our communication efforts.

Survey results answer to following questions:

- How people understand risks related to radon compared to other ionizing and non-ionizing radiation?
- How are the radiation risks perceived in comparison to other health risks?
- What is general risk perception regarding nuclear waste disposal in a country where implementation of high-level nuclear waste disposal is agreed on?
- What are the democratic factors that effect on risk perceptions and utilization of information sources?

## Collectively building an operational monitoring system for geological disposal: A case of 'lab participation'

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### Abstract

Since the 'participatory turn', the non-expert public is increasingly engaging (and being engaged) in sociotechnical challenges related to nuclear waste management in various contexts and forms. Anchored in the Modern2020 project entitled "development and demonstration of monitoring strategies and technologies for geological disposal", this paper critically examines the engagement of local citizen stakeholders in the RD&D of monitoring strategies and technologies. We argue that this is a case of 'lab participation' (Bogner, 2012) since the public involvement in this project is not initiated by a concerned public sphere, but has instead been requested and organized by experts working on monitoring RD&D. Professionally carried out under controlled conditions and remaining rather unlinked to public controversies, this form of public participation raises some questions about the nature and implications of this 'laboratory-like' form of participation. Drawing on the preliminary results of the Modern2020 project, this paper considers this public participation process in its substantive and procedural characteristics. As such, it addresses specific questions such as: 'To what extent have the perceptions and opinions of the lay participants influenced the further technical development of monitoring strategies?', 'How can we assess the role of the social scientist responsible for initiating, organizing and running the citizens' participation process while social-scientifically observing the participation experiment at the same time?' and 'How to consider the instances of contestation and protest within this controlled participatory environment?'.

## **Saving and sharing knowledge on stakeholder engagement in radiation protection - challenge for knowledge base development**

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### **Abstract**

Over two decades of experience in the use of different forms of stakeholder engagement in emergency preparedness, response and recovery led to the development of a proposal for building a knowledge base reporting on stakeholder workshops and public participation under the NERIS Platform and other projects. Other organisations, for instance NEA/OECD, have also made efforts to document exemplary cases of stakeholder engagement practices around the world. Experiences from practices that have previously been undocumented because they were not 'officially' part of radiation protection have also their important place.

Building on these experiences, the ENGAGE project aims at supporting the development of a joint knowledge base for stakeholder engagement in Radiation Protection. This will cover three exposure situations: medical exposures to ionizing radiation, post-accident exposures and exposure to indoor radon. Specific focus will be given to the conceptualisation of stakeholders and stakeholder engagement, the rationales for and expectations from participatory processes, the level of engagement, the instruments used and other. Designing and building the knowledge base can contribute to learning from past experience, highlighting challenges and opportunities for stakeholder engagement and identifying good and bad practices, thus helping to shape and improve future processes. The knowledge base will allow comparing and contrasting stakeholder engagement processes in the three aforementioned exposure situations.

This presentation summarises the work undertaken under the NERIS-TP project and its further development within the ENGAGE Project. The approach developed for documenting the experience in stakeholder engagement in helping to plan for emergency response and recovery is reviewed and discussed to integrate other fields of stakeholder engagement processes studied within ENGAGE (medical exposures to ionizing radiation and exposure to indoor radon).

The presentation will open the floor for discussions and co-operation in the area of building a joint knowledge base for stakeholder engagement in Radiation Protection.

### Session 3: How do radiation protection associations engage with society?

Radiation Protection societies or associations have been founded with a primary goal to act as professional associations, allowing members to meet and exchange experiences. This allows the members of the associations to continuously improve their know-how and expertise in the field of protecting the humans and the environment of the negative impact of radiation.

Radiation Protection associations are also a stakeholder in radiation protection issues and as such they need to communicate and engage with general public, authorities, industry and other stakeholders. IRPA has recognized the need to collect good practices, explore ideas and publish '*IRPA guiding principles for communicating and engagement with the public.*'

The Belgian Radiation Protection Association (BVS-ABR) will hold a workshop on this topic. This workshop is the first on this topic, and the experiences could be taken as a model for workshops at different radiation protection events worldwide. The results will be collected and presented in the first draft guidance document at IRPA EC 2019 and the *IRPA guiding principles for communicating and engagement with the public* will be presented to IRPA15 2020 in Korea for approval and subsequent launch.

At this workshop members of European and Japanese Radiation protection societies and representatives of IRPA will discuss with BVS-ABR members pertinent issues, among others:

- What is the role related to public information, communication and transparency of different associations towards the general public?
- How to ensure recognition of associations as the stakeholder in radiation protection issues?
- What are challenges that associations are faced with and what are good practices in communication and stakeholder engagement?
- How to share RP knowledge and how to put it in the best possible perspective for the general public?
- Should the role of associations be limited to communication in a case of emergency event, to educate or/and to provide advice in public debates related to radiation risks and benefits that are currently very active in many countries?
- Concrete examples of communications of radiation protection associations with public will be presented and discussed (e.g. radiological emergencies, medical treatments, NORM, nuclear risks...), opportunities and misconceptions will be defined.

## **Session 4: Methodological issues, challenges and good practice in Social Science and Humanities research**

This session calls for presentations and critical discussion on the use of quantitative, qualitative and mixed methods in risk research, with a focus on the governance of radiological risks. We particularly welcome contributions on innovative methods and experiences, challenges and good practice in Social Science and Humanities research related to ionizing radiation.

Contributions addressing quantitative research in social sciences studies are invited to reflect, among other, on techniques to improve the quality of surveys related to technological risks. Possible topics may include quantitative or qualitative ways to limit response bias, the merits of using survey embedded experiments, the challenges of conducting protest surveys, the ways to make reliable cross-national comparisons, good practices regarding equivalent question wordings and detection of non-attitudes, the problems of differential item functioning, the do's and don'ts of using so-called vignettes in a survey.

Contributions addressing qualitative social science research are invited to discuss the use of interpretative methods to generate hypothesis or to gain in-depth knowledge for a better comprehension of social phenomena. Such methods give due emphasis to the meanings, experiences, and views of all the participants. The variety of qualitative research methods (QRM) is usually underestimated, as are the quality criteria mobilized to ensure internal / external validity to address the research question.

## **"Stirring up" TERRITORIES: Integrating social and ethical considerations into radioecology**

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### **Abstract**

In this presentation, we present initial results from a coordinated series of studies designed to collaboratively integrate social and ethical considerations into radioecology and radiation protection research. This collaborative approach is now an integral part of the EU TERRITORIES research project, which aims to develop more integrated and graded risk management for long-lasting radiological exposure situations (<https://territories.eu/>). It builds on the sociotechnical integration research (STIR) framework (Fisher & Schuurbiers 2013), which has previously been applied only to new and emerging technologies. Integration is achieved by having an embedded social scientist interact with laboratory practitioners by closely following and documenting their research, attending laboratory meetings, holding regular interviews and collaboratively articulating decisions as they occur. The collaboration is based on a decision protocol that maps the evolution of research and helps feedback observation and analysis into the laboratory context itself. More than other social science approaches currently deployed in radioecology, STIR seeks to develop radioecologists' adaptive capacities and reflexivity, ultimately with the aim of building more socially responsive research agendas, processes, and institutions.

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## Making sense of uncertainty at the interface of natural and humanistic disciplines

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### Abstract

This work presents the objectives and challenges of empirical research within the TERRITORIES project team at University of Tartu (UT). This work is based on a nine-month-long collaboration within the interdisciplinary UT team, which includes eight scientists from four disciplines: Radioecology, Applied Measurement Science, Environmental Physics and Analytical Chemistry. The UT team has the important objective to investigate uncertainties in radiological assessments. The present research was developed to understand the social and ethical aspects linked to uncertainty in radiological assessments, with a special focus on radioecological modelling. The present research development was led by the aim to enhance scientists' reflexive perspective toward every step of their decision making and to help raise the social awareness of their work.

We concentrate on a six-month-long qualitative research activity held during the nine-month interaction. The work is conducted by reflecting on the research model, discussing the choice of methods (interviews, observations) and, analyzing content. Portions of the work are based on the Socio-Technical Integration Research (STIR) protocol developed by Dr. Erik Fisher from Arizona State University. We form the recommendations for the development of the laboratory ethnography study and reflect on how our application of this method has helped the scientists in their work.

The results from the collected material are divided between three main topics: (1) the time management of the researchers and ethnographic team, (2) the different understandings of uncertainty and the development of shared language, and (3) the elucidation of the central topic within fragmented research tasks and intertwined research schedules.

The present experience of laboratory ethnography shows the potential to connect natural and humanistic disciplines, and to benefit from the collaboration. We see importance to share the methodological knowledge gained from the field, which could be useful for subsequent research processes.

### Acknowledgement

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## How to deal with grouchy smurfs in technological surveys? Modeling acquiescence in risk perception surveys

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### Abstract

In general surveys on technological issues some people tend to agree or to disagree with every survey item irrespective of the actual content of the item. Furthermore, the tendency towards acquiescent response behavior often is context dependent and thereby hampering reliable results of cross-national comparisons. Usually researchers cope with these measurement issues by balancing the question wording of the items. However, some of the standard items measuring risk perception cannot be balanced. Luckily, structural equation modeling enables us to take response biases into account even for scales without balanced items. We will demonstrate the use of this technique based on data from the SCK risk barometer regarding risk perception in both Flanders and Wallonia. The regional differences in terms of risk perception would be gravely overestimated if one would not take acquiescent response behavior into account.

## Social Perception Analysis of Introducing the Nuclear Power Plant Programme (NPP) in Poland

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### Abstract

The aim of the study was an assessment of social aspects of introducing Nuclear Power Plant Programme in Poland (NPP) with special consideration of public participation process. Poland is one of the few European countries without nuclear power, however, in 2009 the government has started to develop NPP. For the country, which is one of the largest hard coal producer and the second largest coal consumer in Europe, nuclear power is a real huge transition.

Studies of peoples' perceptions of technological risk, decision-making process and sustainable energy transition are crucial with respect to the nuclear power plants impacts' assessment.

Our methodological approach combines information from both qualitative and quantitative data in order to obtain results which are a spectrum of knowledge from existing data (public opinion polls) and the qualitative sociological research. Internet monitoring of the nuclear discourse was being conducted as well as the analysis of public perception and expert assessment of nuclear energy. To gain the understanding of different groups' subjectivity we conducted the interviews within Q-methodology [1,2] which is a quantitative-qualitative approach measuring the subjectivity (opinions, beliefs, attitudes of the respondents). In this study, we identify four main Poles' perspectives on implementing NPP and three different perspectives/narratives of the decision makers.

We present main results of the Q-methodology analysis conducted within chosen polish citizens and decision makers from the Polish government in 2016 and 2017.

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### Acknowledgement

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## The Protest Survey Method and the Result of Five Anti-Nuclear Demonstrations

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### Abstract

In the last decades protest has become an increasingly accepted means to address political issues. Some scholars speak of today's 'social movement society', since both the sheer number of protest actions and the number of (different) people that take to the streets, increases. For researchers, studying protest demonstrations can provide important information about 'who' protests, 'why' and 'how'. However, in order to guarantee comparable, representative and valid data, we need standardized sampling procedures and standardized ways of dealing with non-response. In this presentation, I will explain the 'protest survey method' that can be used to gather data during protest events and I will show some results of five street demonstrations against nuclear energy that we surveyed in Belgium, the Netherlands, Sweden and Switzerland.

## The Questionnaire on Exploring People's Needs on Apps (mobile applications) for dose measurements & health/well-being related to radiation exposure

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### Abstract

#### Intro

In order to develop recommendations regarding mobile Apps (applications) for dose measurements and health indicators related to accidental or environmental radioactive exposure, we need to explore the needs and expectations of the general public and other relevant stakeholders. The objective of the presentation is to discuss the questionnaire and its main features.

#### Methods

WP1 of the SHAMISEN-SINGS project includes the development of a questionnaire to gather the public opinion on "Needs on Apps (mobile applications) for dose measurements & health/well-being related to radiation exposure". This questionnaire was elaborated by partners and experts in the project from Spain, Italy, Norway, France, Ukraine, Belarus and Japan. The original version of the questionnaire (in English) is to be translated into other languages and is available at <http://radiation.isglobal.org/index.php/es/stake-survey>. The average time for completing is 5-10 minutes.

#### The questionnaire scope and structure

The questionnaire is divided into four main blocks. The first one concerns general data of the survey participants: age group, sex, professional status, and area of work or study, country and province/region of residence, level of education, and information about family nucleus (living with children or not, along, etc.).

The second block is dedicated to self-assessment of knowledge and concerns about ionising radiation and sources. The participant should also answer the question whether he/she lives near a NPP (nuclear power plant) or not.

The third block refers to the participant's potential interest in using mobile Apps for measuring dose, assessing health and obtaining information/advice. Here the acceptability to share data obtained from such Apps with other stakeholders (local authorities, doctors, etc.) is evaluated.

The fourth block is optional and targets only those persons who have already had a radiological or nuclear emergency experience. Questions on past experiences such as access to information during the emergency and application of radiation protection measures in daily post-accident behavior are assessed.

#### Acknowledgements

SHAMISEN SINGS is funded by CONCERT (Agreement N° 005/2017), an EU Joint programme for the Integration of Radiation Protection Research.

#### Key words

SHAMISEN SINGS; Questionnaire; nuclear accidents; public opinion; mobile applications; dosimetry measurements; health and well-being

## What about the clueless? Partisan cues and opinion on nuclear energy

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### Abstract

In order to explain opinion formation on nuclear energy, this empirical research integrates political factors into the psychometric risk model. This allows us to see the influence of the often-used psychometric variables such as risk or benefit perception and trust on opinion about nuclear energy, vis-à-vis factors like vote intention. More specifically, this research analyzes i) whether people use partisan cues when forming an opinion about nuclear energy, ii) how they use them, and iii) the influence of traditional risk research factors on opinion about nuclear energy.

For this research we use the SCK•CEN barometer of 2015. This is a largescale public opinion survey on perceptions and attitudes towards nuclear technologies in the Belgian population (CAPI). The sample we obtained (N=1028) is representative of the population on gender, age, province, education and habitat. The interviews were conducted in Dutch or French.

Our results show that the psychometric factors like benefit perception, risk perception and trust explain more of the variance in the individual opinions regarding nuclear energy than the political factors. However, some people also use partisan cues when forming their opinion about nuclear energy. We found that partisan cue taking occurs more often among the voters of the parties occupying the clearer and opposing stances in the nuclear debate, i.e. the issue owning parties and the policy defending parties. Cue taking voters of these parties adopted a somewhat more extreme opinion in the direction advocated by their preferred party. Hence, parties seem to have a polarizing impact on public opinion on nuclear energy. Moreover, partisan cue taking is not a low information heuristic as it occurs more often among the voters of the more vocal parties, and among respondents more strongly involved on the issue of nuclear energy and more issue specific knowledge. These results therefore contradict studies that claim that partisan cues serve as low-information heuristics.

## Session 5: The ethics of methods and the methods of ethics

Reflections on ethics in relation to radiological protection to date have largely focused on virtue ethics. They logically and reasonably follow from the question of what it would imply for a scientist, manager, policy advisor, medical doctor or regulator concerned with radiological protection to be 'responsible' or 'good'. In that sense, in its publication 'Ethical foundations of the system of radiological protection', the International Commission on Radiological Protection (ICRP) has identified the core ethical values underpinning the system of radiological protection as being 'beneficence and non-maleficence', 'prudence', 'justice' and 'dignity'. This set of core values is completed with three 'procedural values', being 'accountability', 'transparency' and 'inclusiveness' (stakeholder participation).

However, to what extent and in which way do formal regulatory 'systems' and specific 'cultures' (political, scientific, educational) enable, stimulate or eventually hinder the adoption of ethical values such as those mentioned above? In a series of invited presentations, the workshop will discuss this question in general, and the consequences thereof for the radiological protection system in particular. The idea is that ethical thinking in relation to radiological risk governance requires broader reflection than traditional virtue ethics alone, and that it should be completed with ethical reflection with regard to the potentialities and 'hindrances' that characterise the systems and cultures in which mandatories concerned with radiological protection are formed and meant to operate.



## Ethics for Radiation Protection in Medicine: Analysis of Clinical Scenarios in Diagnostic Imaging

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### Abstract

#### Background

The current ethical foundation for the protection of the radiotherapy patient shares the same four principles of medical ethics (autonomy, beneficence, non-maleficence, and justice (Beauchamp and Childress 2001)) as all other patients. However, the International Commission on Radiological Protection (ICRP) has published an extended set of values underpinning the principles of radiation protection of individuals and society (ICRP 2018). The two systems must be used concertedly to ensure the protection of radiotherapy patients and their rights. As a result, a related pragmatic five-values set has been identified (dignity/autonomy; non-maleficence/beneficence; justice; prudence; and honesty). The applicability of this value set to the healthcare professional in radiotherapy is examined.

#### Methods

Ten scenarios illustrating ethical circumstances in radiotherapy have been developed. The pragmatic value set has been used as the framework for ethical evaluation and reflection of each of these scenarios.

#### Results

The application of a practical ethical decision-making framework to common situations is demonstrated for both the ethical examination and the reflection process. The assessment of each individual scenario with respect to each value of the pragmatic set is presented in tabular form.

#### Conclusions

The presentation of scenarios is a powerful tool for guided discussion, exposure, and contemplation of common ethical dilemmas in radiotherapy. The four principles of medical ethics benefit from their integration with the values of the ICRP system on radiation protection. The values of justice, prudence and honesty have a prominent role in the decision making process of healthcare staff in radiotherapy; the same values however are often conflicted by autonomy and beneficence. The pragmatic value set offers a practical framework for recognition and contemplation of each value and any potential dissonance amongst them, use of which can aid the development of ethical awareness and sustained ethical practice in radiotherapy.

#### References

Beauchamp and Childress; Principles Biomedical Ethics, OUP, 5th edition 2001

ICRP Publication 138; Ethical Foundations of the System of Radiological Protection, Ann. ICRP 47(1) 2018.

## Health Apps – Empowerment of publics or shifting responsibility

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### **Abstract**

More than 250,000 mobile health apps are currently available to the public and their use has expanded enormously over the past 5 years, including in radiation protection (medical and environmental). These raise a number of practical ethical questions such as data protection and distribution, but also deeper ethical challenges linked to the relationship between publics and institutions, shared responsibilities, and perceptions of health.

## Ethics for Radiation Protection in Medicine: Analysis of Clinical Scenarios in Radiotherapy

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### Abstract

#### Background

The current ethical foundation for the protection of the radiotherapy patient shares the same four principles of medical ethics (autonomy, beneficence, non-maleficence, and justice (Beauchamp and Childress 2001)) as all other patients. However, the International Commission on Radiological Protection (ICRP) has published an extended set of values underpinning the principles of radiation protection of individuals and society (ICRP 2018). The two systems must be used concertedly to ensure the protection of radiotherapy patients and their rights. As a result, a related pragmatic five-values set has been identified (dignity/autonomy; non-maleficence/beneficence; justice; prudence; and honesty). The applicability of this value set to the healthcare professional in radiotherapy is examined.

#### Methods

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#### References

Beauchamp and Childress; Principles Biomedical Ethics, OUP, 5th edition 2001

ICRP Publication 138; Ethical Foundations of the System of Radiological Protection, Ann. ICRP 47(1) 2018

## **Session 6: Uncertainties and decision-making in short and long term exposure situations**

Decision making, whether at national, regional or individual level, is a challenging issue following a nuclear or radiological incident or accident, or in the context of remediation after NORM contaminations. Various sources of uncertainties affect decisions, ranging from epistemological uncertainties, for instance the effects of low radiation doses, through to uncertainties of modelling, analysis and interpretation of results, to social uncertainties, for instance how people make sense of and cope with such radiological exposure situations.

This session invites contributions addressing uncertainty handling and decision making under high uncertainty, with a focus on social uncertainties and the values and ethics influencing decision making processes.

A panel discussion will be organized to conclude the session, inviting scientists and practitioners to a dialogue on the above defined topic.

The session is hosted by two European projects CONFIDENCE and TERRITORIES, integrated in the H2020 project CONCERT and addressing scientific and social uncertainties in short and long term exposure situations by means of collaborative research between natural and social scientists. Results from both projects will be presented alongside other contributions.

## Dealing with uncertainties in multi-criteria decision analysis tools

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### Abstract

#### Methods

The Multi Criteria Decision Analysis (MCDA) is a decision support method that can support decision making: it provides a ranking on a set of alternatives on the basis of values of contributing criteria that are important to the given scenario and the intention of the decision makers. The criteria can either be numerical or nominal as well as either measured or computed. In respect to these criteria the highest ranked alternative is the best one to choose. To address uncertainties, statistical distributions of the input parameters can be introduced. Ensemble techniques are then applied to evaluate these probabilistic input values.

#### Results

The following example should explain the way uncertainties are treated with input for a decision support system such as JRodos. The example is related to an accidental release from a nuclear power plant:

- Collection with 30 weather realisations times 3 source terms = 90 scenarios, each with a particular probability
- Distribution of results will be generated as bar realisation (a number of bins will be dynamically defined and all results will be sorted into these bins)
- The MCDA generates a high number of evaluations (e.g. 2000) out of the bins defined
- Strategies with a given preference setting can be tested against these MCDA ensembles
- Ranking of strategies is provided e.g. on probabilistic evaluation of the ensembles result

In this respect, not only one result, but a distribution of results is provided indicating which strategy performs best.

#### Conclusions

The approach will be implemented into the MCDA tool of KIT and presented to various stakeholder panels in the frame of CONFIDENCE. This will allow to test and improve the tool for operational use.

## Characterisation of uncertainties in past nuclear emergencies: a case study approach

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### Abstract

Decision-making in the aftermath of radiological or nuclear emergencies is a challenging task and is further complicated by the various sources of uncertainty affecting the decision-making of various actors. It is, therefore, crucial to develop approaches to deal with uncertainty in ways that improve protection, health and well-being of the affected population, and minimise disruption of daily life. This study aims at identifying scientific and social uncertainties in the light of past incidents and accidents, and at analyzing their implications for decision-making, including ethical issues. This study is a part of the CONFIDENCE project (COping with uNcertainties For Improved modelling and DEcision making in Nuclear emergenCiEs), which focuses on identifying and reducing uncertainties in the release and post-release phases of an emergency.

A retrospective analysis of the past nuclear events has been performed in five European countries: Belgium, France, Norway, Slovenia and Spain. This analysis was based on publications, reports, press releases and other documents available. Additionally, a qualitative content analysis of the newspaper articles covering each of the events was done.

These analyses revealed a wide range of uncertainties faced by decision makers and public in the aftermath of the past nuclear or radiological events. Scientific uncertainties were related for instance to measurements, underestimations and faulty assumptions about the course of events. Societal uncertainties included contradictory information, absence of clear responsibilities, and lack of transparency and openness, among others.

The results of this study will be used as a base for semi-structured interviews with a variety of stakeholders including affected population and decision-makers in the analysed radiological emergency. The interviews will help to further identify the uncertainties that stakeholder's are faced with the aftermath of the radiological emergencies.

## Managing uncertainties through citizen science: The case of Fukushima

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### Abstract

Citizen science is a form of science developed and enacted by citizens, with citizens collecting or analyzing various kinds of data. Following the Fukushima Daiichi Nuclear Power Plant disaster (11 March 2011), citizen science has demonstrably contributed to filling information gaps and enabled citizens to gain more control over the situation, as residents in the affected areas monitor radioactivity in the environment and communicate about environmental risks (e.g. <http://en.minnanods.net/>, <http://blog.safecast.org/>). By developing new, innovative ways of assessing risks using existing and new technologies (e.g. self-assembled Geiger counters), these citizen scientists highlight discrepancies between expert and lay appreciations of risk, initiate contextual learning about disasters, and assist in post-disaster recovery. In this paper, we discuss various types of uncertainties (technical, conceptual, epistemological, social and ethical) citizen scientists in Japan face today. We analyze how such uncertainties are collaboratively managed and which opportunities and concerns they embed or give rise to. Findings are drawn from extensive ethnographic research (interviews, participant observation, participation in activities) conducted in and around Fukushima in February-April 2018. The study has been conducted in the framework of doctoral research at SCK•CEN and KU Leuven, in cooperation with Osaka University and the European project CONFIDENCE.

### Key words

Citizen science, Ethnography, Fukushima, Monitoring, Radiation, Uncertainty.

## Decision-making processes in post-accidental situations: manifestation of uncertainty

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### Abstract

In the framework of the European project TERRITORIES, a dedicated work package (WP3) aims to analyse the decision-making processes in long-lasting radiological exposure situations, taking into account all components of risk assessment, with two key points: management of uncertainties and stakeholder engagement. Among existing exposure situations is the aftermath of nuclear accidents. Criteria have to be defined as a basis for decision making and risk assessment, notably for the level of exposure of populations over time and for addressing the effectiveness and control of protective measures. The establishment of criteria is complex and involves many assumptions and analytical processes. There are also many associated uncertainties of scientific, economic, political and societal dimensions, leading to considerable difficulties in managing existing exposure situations in the past.

The first step of the TERRITORIES WP3 aimed to identify in which decision areas, and for which potential decision factors and criteria, uncertainties are the highest and the most questionable by the public could impact the life of affected people.

This paper proposes to present this first analysis which has been published in a dedicated deliverable last December 2017 (D.9.65), focusing on the main uncertainties of concern as well as the necessity to explore the difficulties that have arisen to date with their management.

Based on insights from past experiences of post-accident situations (post-Chernobyl and post-Fukushima), the presentation will propose an analysis of the different manifestations of uncertainties which come out in these contexts, as for example: radiological characterization and impact assessment, zoning of affected areas, feasibility and effectiveness of the remediation options, health consequences, socio-economic and financial aspects, quality of future life in the territory, social distrust. Then, the presentation will present the general approach adopted in WP3 to further address how uncertainty management comes into play in decision making processes for such situations and influence stakeholder's decisions and choices, with a view to developing improved mechanisms of governance to facilitate good decision making under uncertainty.



## Living in a long term exposure environment: document review for identification of causes of societal uncertainties

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### Abstract

Although scientific and technical aspects of environmental remediation have been extensively addressed, studies on uncertainties due to legal, technological, financial, and socio-ethical aspects, as well as risk communication and stakeholder engagement in Naturally Occurring Radioactive Materials (NORM) exposure situations, are however still lacking. Experiences at both national and international level have shown uncertainties at different stages in processes of the regulatory decision-making including remediation at long lasting exposures due to NORM. Radiological protection at NORM sites has recently evolved as legislative regulation and management are now required by EU Directive 2013/59. Many countries, thus, have significant interest in the management of NORM existing exposure and/or legacy sites. Thus far, systematic research has not been conducted to scientifically determine and analyse these uncertainties in a long term exposure situations due to NORM or an industry. Therefore, this research aims to address this lack by identifying uncertainties according to, on the one hand, the nature of the uncertainty and, on the other hand, the object of the uncertainty. The research is conducted via document analysis of international and European legislation, directives and standards, as well as regional and national legal and technical documents, guidelines, scientific papers and publications. Desk review of these documents showed that uncertainties related to living in a long term exposure environment can be categorised according to varying causes of uncertainties. These causes are imbedding in different frameworks including national policy and legal and regulatory framework, technical decisions, historical knowledge, waste management, financial decisions, socio-ethical decisions and risk perceptions, communication, and societal uncertainties. In general, it can be deduced that uncertainties concerning living in a long term exposure environment result mainly from socio-political and economic factors rather than technical factors. Additional qualitative and quantitative research is, however, needed to clarify and classify uncertainties and concerns related to living in a long term exposure environment , and to determine their interrelationship, for example possible causal relationships and influential properties.

### Acknowledgement

The research has been conducted in the context of the TERRITORIES project, which has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 662287.

## Societal uncertainties during a radiological emergency: A case study of an accidental release of radioactive iodine

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### Abstract

On August 22nd 2008, radioactive iodine (<sup>131</sup>I) was accidentally released from Institut des Radioelements (IRE), a facility producing radioisotopes for medical use, located in Fleurus, Belgium. Due to the particularities of the source term, the release went unnoticed for several days. People living in neighbouring areas were informed no sooner than 6 days after the onset of the incident. It was only then that the Belgian authorities activated a nuclear emergency plan, taking protective actions for the population; including restrictions on the use of local farming produce within 5 km of the release point for a period of two weeks. 1320 people have been tested for possible contamination in thyroid. While technical aspects such as thyroid measurements, environmental monitoring or radiological assessments received a great deal of attention ((Carlé, Perko, Turcanu, & Schröder, 2010; Van der Meer et al., 2010) (FANC, 2008)), the concerns, uncertainties and behaviour of the affected population have thus far not been empirically investigated. Furthermore, a social scientific analysis of this incident provides a valuable basis to draw lessons to be learnt in terms of how to address societal issues in the event of such emergencies.

In order to identify societal uncertainties associated with a radiological emergency, this study reviews personal experiences from the radiological accident in Fleurus by examining how communication and public information were managed. The (mixed) methodological approach for this study includes media analysis, document analysis, and a qualitative study based on semi-structured interviews with the population living in the affected area, spokespersons at the time of the emergency, key experts and first responders.(Perko and Abelshausen, 2017)

Preliminary results reveal the complex causal relationships wherein an event or aspect of the radiological incident are both an element of societal uncertainty and the cause for subsequent societal uncertainties. A preliminary framework is developed, which identifies and classifies common denominators as either (or both) a cause of societal uncertainty or an uncertainty as such. Sources of societal uncertainties include, among others, contradictions in communication (e.g. although citizens were advised not to consume self-harvested fruits and vegetables, local farmers were allowed to sell their produce on the market), the delays in prescription of protective actions, or the inappropriate inclusion of stakeholders in communication. Examples of factors that were both intrinsic uncertainties and triggers for additional uncertainties are the thyroid measurements (intrinsic: purpose of monitoring and meaning of results; cause: concern about a potential rise in thyroid cancer), the lack of transparency in the communication about the incident, or the lack of trust in authorities. Other intrinsic uncertainties were for example the ambiguity concerning the causes and consequences of the incident (impact of human health and environment, financial aspects, consequences resulting from insufficient isotopes for medical and industrial applications), as well as its management, disagreements between political parties, lack of transparency in the communication about the incident, lack of trust in authorities. The analysis of societal uncertainties and the (preliminary) development of an analysis framework allowed for the identification

of lessons to be learned and possible improvements in addressing societal uncertainties during a radiological emergency.

#### Acknowledgement

The study has been conducted in the context of the CONFIDENCE project, which receives funding from the H2020 CONCERT (<http://www.concert-h2020.eu/>).

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## **Session 7: Comparing stakeholder engagement in waste disposal, decommissioning and environmental remediation**

Stakeholder engagement is now globally recognised as being an integral part of any decision-making related to nuclear activities. In addition to having stakeholders participating on national decisions whether a country should embark or not in a nuclear programme, stakeholder engagement and communication is also very important in the scope of activities related to the back-end of the nuclear cycle i.e. decommissioning, waste disposal and also in environmental remediation noting that in many circumstances these activities are intertwined. It is also important to recognize that stakeholder engagement and communication in environmental remediation may differ quite significantly when one is dealing with the remediation of a legacy site or a site affected by a nuclear or a radiological accident.

While there is a manifold of guidelines and reports on communication and stakeholder involvement in these three activities, they hold particularities that might entail the need of specific approaches while dealing with stakeholders in these projects. No comparative analysis is available so far of the extent to which the perception and concerns of the different stakeholders differ depending on whether they are involved in a project related to waste disposal, environmental remediation or decommissioning. The underlying questions is: Should the approaches to be used for communication and stakeholder engagement be the same – and if not to what extent they will differ - depending on the specific project one is dealing with?

*This session is oriented to reflect on whether the opinion and the concerns of stakeholders are different when they are faced with a decommissioning, an environmental remediation or a waste disposal project and if the methods used for communication and stakeholder engagement are/should be universal or they depend on the specific related activity.*

## Similarities and differences in stakeholder engagement approaches in waste disposal, decommissioning and environmental remediation

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### Abstract

Stakeholder communication and engagement in the decision making process related to environmental remediation, decommissioning and waste disposal is a crucial step in the implementation of related projects (noting that in many situations these activities may be intertwined). There is a general belief that the mechanisms for stakeholder engagement and communication may be the same and a common approach can be used regardless the situation in consideration. Experience on the other hand shows something different. For example, stakeholder communication and engagement in decision making in the scope of remediation after an accident can be very different from a situation where a legacy site is to be remediated. Along the same lines, remediation can be seen as a de facto situation while the construction of a waste repository is something to be implemented and therefore will have to deal with different boundary conditions. It is to be considered that both remediation and decommissioning will need to have available disposal routes - that might as well take the form of a repository to be constructed (as in the case of Fukushima). If a disposal route is not made available, both remediation and decommissioning can be derailed.

With the above in mind, the IAEA is developing a project aiming at exploring and discussing possible similarities and differences in the approaches to be used in stakeholder engagement and communication involving activities related to environmental remediation, decommissioning and waste disposal taking into consideration that these activities may be interlinked in some situations. The discussions will lead to the production of a report that will capture the inputs and provide recommendations for those responsible and involved in the implementation of such projects.

## Observations on concerns of stakeholders faced with decommissioning, environmental remediation and radioactive waste disposal

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### Abstract

'Voluntarism and partnership' have defined the search for a radioactive waste disposal site in England and Wales since 2008 – but only for higher activity wastes. The siting of lower activity waste disposal facilities remains technocratic, with local engagement constrained by planning law and regulatory processes.

Routine developments or planned changes at existing facilities, whether nuclear sites or repositories, are not anywhere near as newsworthy as the prospect of a new site and facility entering a region. The concerns of professional local authority stakeholders with responsibilities at existing nuclear communities are focused more on socio-economic prospects of nuclear development (or decommissioning) than safety. Familiarity and experience leads these stakeholders to take 'safety' as a given at most existing sites.

Consultations and communications for new facilities are typically based on idealised, highly-simplified concepts of facilities with cartoon/virtual reality depictions of operations and a trouble-free future envisaged. Proactive industry communications on developments at existing facilities have to pay attention to the messy detail and reality.

Talk will also present developments from the WPDD task group on society and decommissioning.

## Spanish case study of a long-lasting NORM exposure situation: analysis of social uncertainties

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### Abstract

In the framework of WP3 of TERRITORIES project, the objective of the present study was to understand the set of communicative, societal and ethical uncertainties and difficulties around the management and remediation of the phosphogypsum waste repository in Huelva, Spain. We aimed at analyzing how people make sense of and cope with such long-term radiological exposure situation and with the uncertainties appeared.

We carried out a documentary and media content analysis and semi-structured interviews with members of the local population as well as some stakeholders with some role in the decision-making process (experts, authorities, industry, neighbourhood associations, environmental NGOs). The data obtained were analyzed by means of content analysis using MAXQDA software with an inductive approach. Media content was also analyzed quantitatively using SPSS software.

From the documentary analysis, a first case description was developed which collected all important and existing information related to the case and served as a starting point for empirical and qualitative data. From the media analysis, the first identification of uncertainties and stakeholders was carried out. Finally, from the interviews, the main psychosocial dimensions were drawn.

A preliminary analysis of the media and interviews shows that the main uncertainties around the management and remediation of the phosphogypsum waste repository are linked to different risk perceptions of the exposure dose to population and workers; to the lack of consensus and opposition to the program; difficulties in the assignment of responsibility for remediation and the cost of remediation; and problems in the coordination between administrations.

A successful management and remediation of NORM sites should consider and integrate the societal, communicative and ethical uncertainties that appear in such situations. These findings will serve as the basis for the discussions in the next stakeholder workshop that will take place in Spain in the forthcoming months.

## How to involve local players in decision on location of a Deep Geological Repository (DGR) in the Czech Republic?

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### Abstract

Communication strategy: how to involve local players in decision on location of a Deep Geological Repository (DGR) in the Czech Republic? The concept for RAW and SNF management in the Czech Republic is based on the Government decision in 2002 and on the update of the concept, issued in 2014. According to the decision a deep geological repository (DGR) situated in suitable host rock is considered the only feasible option for the final solution for the management of spent fuel. Based on geological screening and other criteria, six sites were identified as potentially suitable for further investigations in the beginning of 2002. In the following year, however, the site investigations were interrupted and a moratorium for the project was enforced for five years because of public opposition in the affected municipalities. After the moratorium, in 2009, a new strategy was adopted, based on the voluntary participation of municipalities in geological surveys for DGR. In 2010, the Working Group for Dialogue (The Working Group) was established as an advisory group for the Ministry of Industry and Trade (MIT) and Ministry of Environment (MoE). Although the Working Group for Dialogue was a central platform for interaction and information exchange between state institutions, municipalities and other stakeholders, it did not manage to promote acceptance towards site selection process among stakeholders. At present, there are 9 candidate localities for site investigations. Six of the localities (Brezový Potok, Čertovka, Čihadlo, Hrádek, Horka and Magdalena) have been identified based on previous geoscientific research and the seventh site located close to an old uranium mine (Kraví Hora) was included in the candidate site list in 2011. In addition, both nuclear power plant sites in Czech Republic (Dukovany and Temelin) were included among the candidate sites in 2015. The opposition at the localities is largely based on the referenda that were conducted already 15 years ago. Reliance on the outdated poll results indicate that the local decision makers do not consider the present site selection process different from that in the early 2000s. Although it is difficult to assess how much of the local opposition is stemming from peoples' negative associations with nuclear waste, it is evident that the process is not regarded fair to build up trust in the repository project. The Government, the MIT and SÚRAO are the key drivers of the site selection process and they should strive for a mutual effort; it seems however, that the political commitment to the overall process is weakened by the local opposition, which has resulted in unexpected changes in the site selection schedule. Overall, the division of responsibility on the operational level between MIT and SÚRAO is not clear. This results in inconsistent and unpredictable communication, which lowers the credibility of the site selection process. NGOs have a strong influence on the site selection process on the local level by amplifying the resistance of local people against the state authorities. On the national level, NGOs are well organized and actively connected to the international anti-nuclear network. The present communications of SÚRAO consist of several actions, e.g. including local information dissemination activities, educational programmes with schools, press releases etc. However, the lack of trust for, and confidence in the Czech state is general societal challenge. Experience here was similar to what has been seen in some other countries: a lack of trust in levels of government; increased public distrust resulting from perceived attempts or from earlier attempts to impose a facility. Such factors counteract efforts to build the mutual trust and cooperation that are so important in a siting process. A new dialogue - SURAO is aiming for the start of a new fair, transparent and open siting process, in which the role of municipalities and all other stakeholders is



meaningful and strengthened and which would bring added value for the communities involved from the beginning of geological works. The main aim is to strengthen the role of the local players in the siting process and to increase the transparency of the siting process.

### **Structured decision making: A paradigm shift towards effective stakeholder engagement for sustainable waste management, disposal and remediation decisions**

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#### **Abstract**

Stakeholder-engaged structured decision making (SDM) provides the potential for a useful paradigm shift in the way nuclear waste management, and remediation decisions are made. SDM is a deliberative-analytical process. The deliberative side centers on understanding stakeholder concerns and values, developing objectives and subsequently identifying options that might achieve those objectives. Objectives often include minimizing human health risk and minimizing cost, but in the full scope of a sustainability-based approach to decision making, it can include objectives related to economic, environmental and social issues.

This sets the stage for the analytical part of SDM, which requires modeling the options through the objectives. The structure of SDM makes it clear exactly what is needed from science modeling. SDM leads to directly finding the best option given the inputs (values and science models) and assumptions made. The same SDM approach to finding the best options can be used instead for prioritization and resource allocation.

Because all of the information is captured in a formal system with the help of computer tools (a software framework built specifically for implementing SDM), the decision models that are developed for an application can be fully quantitatively evaluated. This includes uncertainty and sensitivity analysis that can be used to guide the need for further data/information collection if necessary. SDM also supports adaptive management if conditions change based on new information, potentially leading to a change in decisions if warranted.

This approach has been applied to a wide range of US EPA and DOE projects, and appears to hold great potential for increasing the effectiveness and efficiency of decision making for nuclear waste and remediation decisions.

## The Possibility Long-term Storage/Disposal of $^{14}\text{C}$ Waste from RBMK-Type Reactors in Disused Mines

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### Abstract

The safe long term disposal of high level nuclear waste has proven to be problematic worldwide. This can be due to a range of reasons ranging from technical to socio-political in nature.

There are a lot of problems with storage/disposal of decommissioning waste of RBMK reactor and other Chernobyl waste. Much of this waste contains of transuranic elements and a large number of other long-lived radionuclides, making it unsuitable for near-surface disposal. For solved problem of the radioactive long-lived ILW (metal and graphite) storage/disposal from decommissioning of the Chernobyl Nuclear Power Station possibility of disposing in a disused mine of Ukraine. Development of a National Plan for Radioactive Waste Geological Disposal in Ukraine (Project U4.01/14 B) should be accelerated in accordance with the regulatory document "General Safety Provisions for Radioactive Waste Disposal in Geological Repositories". Radioactive waste management is critical issues for public perception of any nuclear development project. Support in forming of public positive attitude to site selection process in Ukraine, including consideration of international practice of creation of similar facilities. According to "Requirements for Siting of a Radioactive Waste Disposal Facility", radiation protection of future generations is considered to be adequate (taking into account uncertainties of estimates for times far into the future) if risks estimated for human health range from  $5^{-7}$  to  $5^{-5}$  per year. The risk of  $5^{-7}$  per year is regarded as the target value used in optimization of radiation protection. The Law of Ukraine "On Decision Making Procedure for Siting, Design, Construction of Nuclear Facilities and Radioactive Waste Management Objects of National Value" establishes legislative and organisational provisions for siting, of nuclear facilities and radioactive waste management objects and determines procedure for decision making for repositories designed for disposal of spent nuclear fuel or radioactive waste. Ensuring success of the government policy requires public acceptance. It requires continued open dialogue and information exchange between all the interested stakeholders at national and local levels to build trust and understanding. Public acceptance should improve with a successful completion of the new confinement, which was commissioned in 2017.

## **Session 8: Stakeholder involvement in the development of radiation protection research agendas and roadmaps**

In the past years, the radiation protection research platforms MELODI, EURADOS, NERIS, ALLIANCE and EURAMED, and also experts in Social Sciences and Humanities in the field of Radiation Protection (SSH) have developed Strategic Research Agendas (SRAs). These SRAs present lists of challenges and priority research areas for each of the platforms and within the field of SSH.

The SRAs are currently being translated in roadmaps, to plan the research over the next decades within the CONCERT project. While each platform is developing an individual roadmap of use for a more detailed research planning, a joint roadmap is being produced covering the different areas of radiation protection research, to serve as a guide to organize a long-term plan for research, eventually supported through a long term call-planning, subject to appropriate funding at the national and European scale. The first steps towards the development of individual and joint roadmaps have been published as publicly available CONCERT deliverables D2.5 and D3.4 (links: <http://www.concert-h2020.eu/en/Publications>).

One of the key issue for the future development of the roadmaps is the involvement of stakeholders at various stages of their elaboration, so that research correspond better to the expectations and needs of those actors of radiation protection.

## **Session 9: Communication in the spotlight**

Communication about radiological risks, especially for low radiation doses, faces specific challenges: complexity in assessing causal relationships, uncertainty and ambiguity in interpreting results. Scientific advice related to radiological risks for policy makers or potentially affected audiences has traditionally been framed as providing objective knowledge to support rational decision making. However, over the last decades the understanding of what science can and should deliver has dramatically changed. In this session, communication models for radiological risk communication addressing complexity, uncertainty, ambiguity for different exposure situations and different stakeholders will be presented and discussed. It will be highlighted how radiation protection advisers and communicators can frame their messages such that uncertainties and ambiguities are not ignored or misinterpreted by policy makers or other stakeholders, including lay people.

## Spanish case study of a radiological event: how risk communication can makes the difference

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### Abstract

In the framework of WP5 of CONFIDENCE project, the objective of the present study was to identify and analyze the societal uncertainties around a nuclear radiological event in Spain. The final aim was to understand public and stakeholders' response to uncertainty in past incidents and accidents.

Three data collection tools were implemented: a review of documents, media analysis (n= 275), and semi-structured interviews with the affected population (n=10) and relevant stakeholders (n=13). A description of the event was developed by means of documentary review and the main knowledge gaps were identified. The media analysis was used to identify the key stakeholders and a preliminary list of sociotechnical uncertainties around the case. Interviews were used to identify a more exhaustive set of societal and communicative uncertainties linked to issues such as risk perception, communication and involvement with the local population. The qualitatively data obtained were analyzed with content analysis using MAXQDA software. Media content was also analyzed quantitatively.

A preliminary analysis of the data shows that the communicative aspects around the emergency (such as the delay in communication, the lack of information about the event and the perceived lack of transparency) have been as important in the development of the emergency as the uncertainties linked to the characteristics of the event and the management of the incident or its consequences.

The findings suggest that eliciting stakeholders' preferences and priorities for uncertainty management is a key issue to improve emergency planning. Some implications for risk communication during emergencies are derived.

## When used in communication to general public, does plume maps lead to desired protective actions?

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### Abstract

A Finnish Radiation risk perception survey was made in collaboration with STUK and FMI. Survey responses (1124 respondents in total) represent the Finnish adult society by age, gender based on quotas by region. Data collection was done in 18.12.2017-9.1.2018

Objectives for the survey were to gather information about attitudes towards radiation, investigate misconceptions and gaps in knowledge about radiation and maps as a communication tool during a hypothetical radiological accident. Special attention was given for the question "How general public perceive the need of protective actions when plume maps are used as a communication tool"

In Finland, communication during radiological accidents requires a strong collaboration between the responsible authorities. Required maps are produced in collaboration with The Finnish meteorological institute and The Finnish Radiation Authority STUK. Survey results are used in decisions making about the maps and other communication material produced for Finnish general public in the future

Survey results also answer to following questions, to support preparedness for radiological accidents from communications' point of view

- Does peoples level of knowledge predict behavior during hypothetical radiological accident?
- What kind of actions might be taken and what kind of behavior would occur when different kinds of maps are used in communication to the general public
- What are likely factors that lead to spontaneous evacuation?
- Does parents behave differently during hypothetical radiological accident?

## Uncertainties related to radiological maps produced and used for nuclear emergencies

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### Abstract

The way we visualize information related to radiological releases in emergency situations is of extreme importance for decision-making, both for experts involved in emergency management, as well as for the potentially affected population. Experts produce a series of maps (e.g. ongoing or predicted releases, doses to the population, radioactive contamination, affected areas). They use different tools and standards (e.g. specialized systems such as RODOS, GIS, Google maps) and apply different visualizations (e.g. colors, contours, measurement units). Decision-makers at different levels (from federal level to mayor of a local community) and first responders need to interpret these maps and advise the population on protective behavior (e.g. don't consume vegetables from your garden). Mass media often refer to these maps and they publish them on-line (e.g. interactive maps); maps also appear in social media (e.g. blogs, tweets). Affected population needs to understand these maps in order to know what and when to take certain actions or not in case of an emergency (e.g. which roads to take during an evacuation, at what time).

This study focuses on uncertainties, miss-interpretations, miss-communications originating from radiological maps produced and used by experts, media and population in recent nuclear emergency exercises (international INEX-5 workshop, Belgian exercise at a NPP) and measurements of (limited traces of) radioactivity in the air from radiological releases (106, 103Ruthenium, 131Iodine) are analyzed and uncertainties identified.

Preliminary results show that radiological maps can be of great use in visualizing the affected environment and thus of great added value in emergency management. Unfortunately, radiological maps analyzed in the context of this research were often a source of uncertainty, miss-interpretation and caused communication issues. The following issues have been identified: maps lacking contextual information (e.g. on-going release or predicted release; missing legend); a huge diversity of measurement units used ( $\mu\text{Sv/h}$ ,  $\text{mR/h}$ ); diversity of colors has been used unrelated to the meaning of the color (e.g. blue for the extremely low release, below legal norms); zones for protective actions indicated using country borders; scientific uncertainties not presented (e.g. related to time of release, meteorological conditions), low doses presented in many different ways (e.g. white color, blue color, units), no indication of health impact.

Results of this research will help develop recommendations for radiological maps for nuclear and radiological emergency management and public information in case of an emergency.

### Acknowledgement

*The study has been conducted in the context of the CONFIDENCE project and at SCK•CEN.*

## Individual dose reconstruction after severe radiological accidents and its use for crisis communication

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### Abstract

The RODOS decision support system provides geographical diagnostic and prognostic dose assessments based on either atmospheric dispersion modelling or radiological measurements. These data can be utilized to convolute with individual movement profiles of the affected population or emergency workers. According to German emergency plans, individuals affected in urgent countermeasure zones will be attended in special emergency care centers. These centers provide measurements of individual contamination and radioiodine intake accompanied by an individual consultancy. The possibility to provide them with real data based dose assessments and also prognosis for future dwellings is a powerful tool for individually targeted risk communication. It is also needed to identified individuals at relative high risks and distinguish them from the so-called worried well.

A prototype system has been developed by BfS based on the RODOS system and already tested in exercises. Fig. 1 shows a screenshot of the prototype system. The potential benefit and prerequisites for its use are discussed.

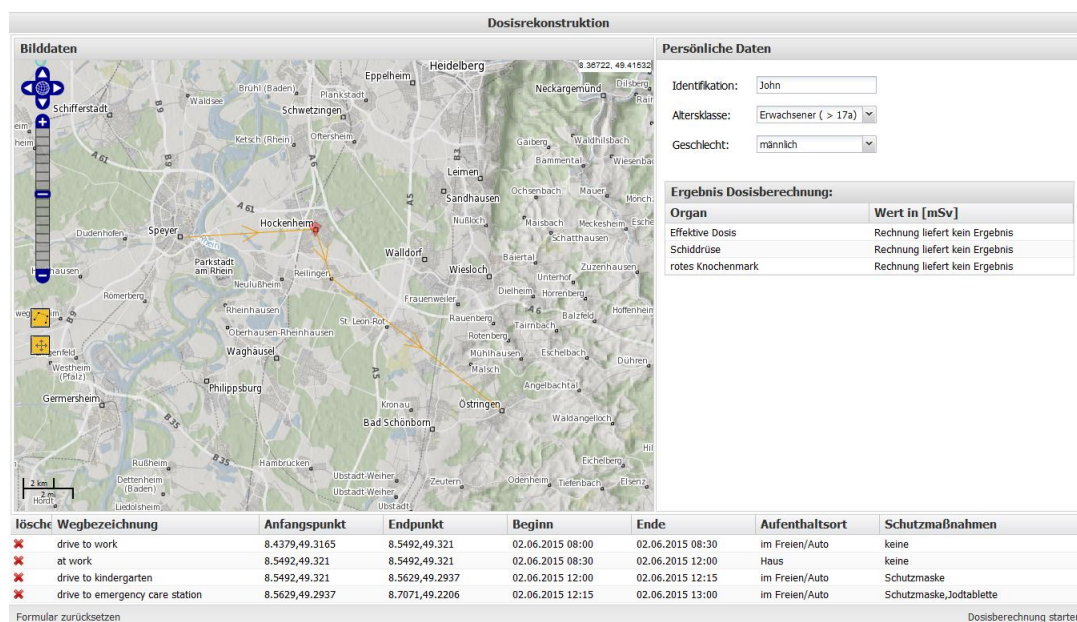


Fig. 1: Screenshot of the German prototype system for individual dose reconstruction. The yellow line shows the pathway of an individual out of a fictitious contaminated area. It is comprised of four parts with specified by start, end, duration, type, and protective measure.



## Communicating Uncertainties regarding Radiological Risks via News Media: the Effectiveness of Numerical and Narrative Messages

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### Abstract

Some uncertainties that people face before, during and after a radiological emergency are addressed by risk communication. Sound risk communication drives people's attention, is well understood by lay people, crucial information is remembered and recalled when needed and, most importantly, people will agree with it and follow the advised behaviour. Unfortunately, experiences from different emergency responses and studies show that sound communication about radiological risks is difficult to achieve. This study investigates what kind of communication is most effective and what kind of communication achieves better response by a population in a radiological emergency. More specifically, we look at whether communicated messages containing numbers (e.g. *"20 to 40 percent less protection if iodine pills taken too early"*) or narrative messages (e.g. *"Reduced protection if iodine pills taken too early"*) are more effective.

Within a representative face-to-face survey of the Belgian population (N=1086), conducted over a 3-month-period from December 2017 to February 2018, the authors ran two parallel experiments: The French-speaking language group was exposed to a pre-emergency news article manipulation targeting uncertainties related to *waiting for instructions for the intake of iodine pills*, the Dutch-speaking group to a post-emergency news article manipulation targeting uncertainties related to the *safe consumption of food from Fukushima*. The two experiments consisted of 3 experimental conditions each (1 numerical message, 1 narrative message (personal testimony), 1 combined message); control questions were included in the respective other conditions. Each participant read one news article and answered post-test questions regarding their recall and acceptance of the message, their message ratings, and their behavioural intentions regarding the uncertainty communicated. In addition, the authors tested whether the effectiveness of different messages differs for people with different predispositions (e.g. sociodemographics, preference for numbers, empathic score).

First results revealed that for post-emergency communication on the consumption of food from Fukushima, numerical messages were perceived as more effective than narrative or combined messages, and that numerical messages led to higher message acceptance than both other conditions. In the case of the iodine pills, no statistical significance has been observed between the experimental groups. The more extensive results of the experiments can aid in setting up effective, targeted communication strategies to reduce uncertainties for pre- and post-nuclear emergency situations that take into account the predispositions of different population groups.

Acknowledgements The study has been conducted in the context of the CONFIDENCE project, which receives funding from the H2020 CONCERT <http://www.concert-h2020.eu>, and research at the University of Antwerp.

## **New technologies for public service: Would their use help engage people in radiation protection and preventive health behaviour? (SHAMISEN SINGS project)**

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### **Abstract**

#### **Intro**

Information technology and communication tools have evolved quickly over the last decades, allowing access to internet via mobile devices by a wide range of populations. Multiple applications (Apps) can be installed in these devices, including those that help evaluate certain health outcomes, control physical activity and even measure external doses of radiation. The SHAMISEN SINGS project seeks to identify Apps that populations may use in case of a radiation accident and provide guidelines for developing new ones if necessary,

#### **Methods**

SHAMISEN-SINGS will perform two main tasks: 1) review and analyse existing Apps and devices for performing dose measurement and monitoring related health outcomes and 2) explore stakeholders needs and expectations for such type of Apps in order to improve them if possible and address the ethical challenges related to their use.

#### **Expected results and practical applications**

The final output of the project is to provide a concept/guideline for one or more APPs that could be used to monitor radiation exposure, log behavioural and health information and provide a channel for practical information and feedback. This citizen-science approach, whereby the public participate in designing the tools, and in gathering and sharing data, will allow the development of a radiation protection culture in the population, provide data for use by local authorities for effective decision making (for example, in giving or lifting evacuation orders), serve as a basis for surveillance study (with appropriate ethics and informed consent) and provide local populations with real time reliable information.

#### **Acknowledgements**

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#### **Key words**

SHAMISEN SINGS; nuclear accidents; citizen science; dosimetry measurements; health and well-being

