SCK•CEN
STUDIECENTRUM VOOR KERNENERGIE
CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE

BOOK OF ABSTRACTS
SCK•CEN/34296194
BA-0131

RICOMET 2019

International conference: RICOMET 2019

Social Sciences and Humanities in Ionising Radiation Research

Barcelona, July 01-03, 2019, Barcelona Biomedical Research Park, Spain

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

ISGlobal
Barcelona
Institute for
Global Health

Confidence
Coping with uncertainty for improved modelling and decision making in nuclear emergencies

SHARE
Social sciences and Humanities in ionising radiation REsearch

merience

ENhancinG stAkeholder participation ENGAGE in the GovernancE of radiological risks

TERRITORIES

EUROPEAN JOINT PROGRAMME FOR THE INTEGRATION OF RADIATION PROTECTION RESEARCH
CONCERT

SHAMISEN
SINGS
Stakeholder Involvement in Generating Science After Nuclear Emergencies

ERA
European Radon Association

Organising committee:

Tanja Perko, Founding vice president SHARE | SCK•CEN, Belgium
Liudmila Liutsko, Liaison officer | ISGlobal, Spain
Meritxell Martell Lamolla, Founding Secretary SHARE | Merience SCP, Spain
Sonja Ruts, RICOMET Secretariat | SCK•CEN, Belgium

Contact: ricomet@sckcen.be

Management board members:

Susan Molyneux-Hodgson - Founding president SHARE | University of Exeter, United Kingdom
Wolfgang Raskob - CONFIDENCE coordinator | Karlsruhe Institute of Technology, KIT, Germany
Catrinel Turcanu - ENGAGE coordinator | The Belgian Nuclear Research Centre, SCK•CEN, Belgium
Marie Simon Cornu - TERRITORIES coordinator | the National Institute for Radiological Protection and Nuclear Safety, IRSN, France
Elisabeth Cardis - SHAMISEN-SINGS coordinator | Barcelona Institute for Global Health, ISGlobal, Spain
Thomas Jung - CONCERT coordinator | Federal Office for Radiation Protection, BfS, Germany
Horst Monken-Fernandes | International atomic energy agency, IAEA, Austria
Olga German | International atomic energy agency, IAEA, Austria
Meritxell Martell Lamolla – Founding Secretary SHARE | Merience SCP, Spain
Sisko Salomaa - CONCERT WP leader | Radiation and Nuclear Safety Authority, STUK, Finland
Christiane Pölzl-Viol - ENGAGE WP leader | Federal Office for Radiation Protection, BfS, Germany
Pascal Crouail - WP leader, TERRITORIES | Nuclear Protection Evaluation Centre, CEPN, France
Caroline Schieber, WP leader, ENGAGE | Nuclear Protection Evaluation Centre, CEPN, France
James Mc Laughlin | ERA, European Radon Association, Ireland

Early career scientists organisers

Ferdiana Hoti | SCK•CEN
Sergi Lopez Asensio | CIEMAT
Yevgeniya Tomkiv | NMBU

Venue

Barcelona Biomedical Research Park PRBB
ISGlobal, Barcelona Institute for Global Health (Campus Mar), 1st floor
Dr. Aiguader, 88
08003 Barcelona, Spain
http://www.prbb.org/parc

Table of Contents

Programme

Monday, 1st of July	
10:00	**Preconference project meeting TERRITORIES** (Closed meeting for Task 3.5 of the Territories project - the core group working on the deliverable D9.72), Organiser: Marie Simon-Cornu, IRSN. Marie-Curie conference room

12:00	WELCOME DRINK (Meet and greet friends, colleagues and delegates)
12:30	Grand opening of the RICOMET 2019 exhibition: photography, x-ray photography, cartoons, documentary movies *Introduction by Gaston Meskens, SCK•CEN* Exhibitions in inner square
13:00	The RICOMET 2019 conference opening ceremony Marie-Curie conference room
13:15	**Communication about indoor radon and stakeholder engagement in a radon national plan.** Marie-Curie conference room *Chairs: Olga German, IAEA & James McLaughlin, European Radon Association*
	1. James P McLaughlin | Communicating Effective Radon Risk Information: a personal viewpoint 2. Tanja Perko et al. | Should we inform or engage about radon: From Health Behavior Theories to Practices in Stakeholder Engagement 3. Klara Himmelbauer | The Austrian Experience in Radon Risk Communication 4. Ludivine A. Gilli | The mysterious risk: indoor radon and the evolution of its perception in France 5. Marcela Bercikova | Radon information strategy for real estate market 6. Ilma Choffel de Witte et al. | "Radon: let's clear the air, let's meet the challenge" A pilot and participatory program to fight domestic radon in the Haute Vienne region (France)
15:15	REFRESHMENT BREAK (Meet the RICOMET artists and enjoy the exhibition)
15:30	**Holistic Approach on the Management of Long-Term Exposure situations** Marie-Curie conference room *Chairs: Marie Simon-Cornu, IRSN & Horst Monken Fernandes, IAEA* Oral presentations (15 minutes with discussion included)
	1. Christine Fassert | Facing long term contamination: decisions of inhabitants in the aftermath of the Fukushima accident 2. Marie Simon-Cornu et al. | TERRITORIES: a holistic approach of long-lasting radiological exposure situations 3. Jelena Mrdakovic Popic | Analysis of uncertainties in decision-making process for long-term exposure situations on examples of two Norwegian legacy sites 4. Roser Sala et al. | Participatory MCDA workshop to involve stakeholders in the remediation of a NORM site. Experience from the phosphogypsum ponds in Huelva, Spain 5. Sergii Mirnyi | Chernobyl tourism. Post-radiation-accident tourism

	6. **Poster:** Alena Nikalayenka | Radiation monitoring of foodstuffs and public exposure doses after the Chernobyl accident. Transition phase from emergency to existing exposure situations 7. **Poster:** Alena Nikalayenka | Efficiency of the approach to management of radioactive waste generated during remediation activities in the Chernobyl contaminated areas
16:45	**Workshop: Bringing Theory to Practice in Environmental Remediation Projects - based on a real ongoing remediation project from Kyrgyzstan** Marie-Curie conference room and Rita Levi room *Moderators: Meritxell Martell, MERIENCE; Horst Monken Fernandes, IAEA & Tanja Perko, SCK•CEN* Introduction to the project, socio-political and economic challenges in a long term exposure situation by the TERRITORIES special guest Mr. Bakai Zhumakadyr from State Regulation Center on Environment Protection and Ecological Safety of the State Agency on Environment Protection and Forestry of the Government of Kyrgyz Republic 1. Bakai Zhumakadyr | Mailuu-Suu
18:00	RECEPTION (Extend your network of SSH in ionizing radiation research and get inspired by art)
	Kindly invited to admire our art exhibition & meet our artists | open during whole RICOMET Conference ! Inner patio & film room **X-ray photography** | Arie van 't Riet https://www.x-rays.nl/WebGalerie_e.htm **Documentary photography** | Shuji Akagi | presented by Joke Kenens https://twitter.com/akagishuji P**hotography |** Sergii Mirnyi http://mfrphoto.blogspot.com/p/after-chernobyl.html **Cartoons |** Michael Van Oudhesden | Joke Kenens | Hans Boeykens **Documentary films from :** Lise Autogena and Joshua Portway Sergii Mirnyi **Exhibition of subjects** from a tourists tours in Chernobyl | Sergii Mirnyi **News report:** BS11 Weekly News feature story by Arthur Binard: Interviewing Japanese #12 | Fukushima Prefecture Akagi Shūji (aired on 13.3.2016) **https://www.youtube.com/watch?v=wrBopDra51c**

Tuesday, 2nd of July	
08:30	**SHAMISEN SINGS workshop** Marie-Curie conference room *Chairs: Liudmila Liutsko, Adelaida Sarukhan & Elisabeth Cardis, ISGlobal* open to congress participants / stakeholders, will present the project's key results and gather feedback on mobile APP proposals to enhance citizen participation in radiation measurements and health studies
10:00	BREAK (Get challenged: exhibition, documentary movies and artists presenting ionizing radiation from different perspectives)
10:30	**Early career researchers in the field of social science and humanities related to ionizing radiation (presentations of research and round table discussion about feelings, experiences, frustrations and satisfactions)** Marie-Curie conference room **(session sponsored by CONCERT)** *Chairs: Ferdiana Hoti, SCK•CEN, Sergi Lopez Asensio, CIEMAT & Yevgeniya Tomkiv, NMBU*
	Scientific Presentations (15 minutes with discussion included) 1. Yevgeniya Tomkiv | Embracing the complexities: the value of listening to public in nuclear emergency preparedness 2. Sergi Lopez Asensio | Socio-Technical Integration Research (STIR). Spanish Case Study 3. Ana Rita Melo | Radiation risk perception mental models in the Portuguese context 4. Joke Kenens | Learn as you go: social science-in-the-making in post-disaster Fukushima 5. Florian Abraham | Why is uranium so controversial? 6. Marika Hietala | "You are but a trainee scientist": Participant-Observation in a Materials Science Laboratory
	Round table discussion (12:00) **Discussants** 1. Yevgeniya Tomkiv 2. Sergi Lopez Asensio 3. Ana Rita Melo 4. Joke Kenens 5. Florian Abraham 6. Marika Hietala 7. Fontaine Gauthier ***Discussion with the audience (questions/interactions are possible before as well)***
13:00	LUNCH: Eat, chat and admire (Posters) - Inner square
13:45	***Management of socio-psychological impact of radiation emergencies*** Marie-Curie conference room *Chairs: Zhanat Carr, WHO & Elisabeth Cardis, ISGlobal*
	1. Masaharu Maeda | Fukushima Nuclear Disaster: Multidimensional psychosocial issues and challenges to overcome them 2. Zhanath Carr et. al | WHO Framework for management of mental health impact of radiation emergencies 3. Robin Goodwin | Cultural dimensions and effective risk communication

	4. John Lindberg | The need for, and the challenges to, normalizing radiation in a post-trust, post-truth world 5. Elisabeth Cardis et al. | SHAMISEN and SHAMISEN-SINGS – lessons learned and recommendations 6. Yevgeniya Tomkiv et al. | Ethical challenges and implications of dosimetry and health APPs – results of a consensus workshop 7. **Poster:** Takashi Ohba | Development of a mobile phone application for interactive support of residents returning after a nuclear accident 8. **Poster:** Liudmila Liutsko | The role of individual differences in reduction of negative consequences of nuclear accidents on health and well-being 9. **Poster:** Sonia Brescianini | An approach to Cost-Benefit Analysis of citizens' engagement in ionizing radiation measurements
15:15	**Participation in radiological protection: from formal to informal (and back)** Marie-Curie conference room *Chairs: Catrinel Turcanu, SCK•CEN, Azby Brown, SAFECAST (Japan)*
	1. Vasiliki Tafili et al. | Interested parties' involvement in the transposition of the BSS directive: the national experience 2. Liudmila Liutsko et al. |Medical exposure to ionizing radiation: Communication, justification and optimization of radiological risks in dental clinics and for X-rays preventive procedures 3. Axelle Meyermans | 'Invited' public participation in the R&D of monitoring systems for geological disposal: critical assessment and recommendations 4. Ivana Fojtíková | Case studies of public participation in radiological protection through social media activities and its potential effect 5. Joke Kenens et al. | Locally sourced: bottom-up citizen science and local governments after Fukushima 6. Tanja Perko et al. | Towards improved communication and engagement with publics: Consultation about the IRPA draft guidance with the RICOMET delegates 7. Catrinel Turcanu et al. | Participation in radiological protection – comparing and contrasting three exposure contexts
17:15	REFRESHMENTS BREAK (From formal to informal; from posters to art) - Inner square
17:30	Workshop: **Participation in radiological protection: what makes it meaningful?** Marie-Curie conference room Insights from the EU research project ENGAGE and RICOMET participants' experiences *Moderators: Michiel Van Oudheusden & Abelshausen Bieke, SCK•CEN*
20.00	CONFERENCE DINNER with a social event and magic moments - event not to be missed! **El Cangrejo Loco Restaurant**, Port Olimpic, Moll de Gregal 29-30

Wednesday, 3rd of July	
09:00	**Uncertainties and decision-making in the early and intermediate phases of nuclear or radiological emergencies** Ramon Y Cajal room *Chairs: Wolfgang Raskob, KiT & Tatiana Duranova, VUJE* Oral presentations (15 minutes with discussion included)
	1. Ferdiana Hoti et al. | Are we talking the same language? A systematic review on definitions and types of uncertainty in risk situations 2. Tanja Perko et al. | Uncertainties during a nuclear emergency: Observation of decision makers, affected population and emergency responders 3. Wolfgang Raskob et al. | Approach to visualise uncertainties in decision support systems 4. Azby Brown | System design for mitigating uncertainty in citizen-based data collection 5. Paola Fattibene et al. | An analysis of commercial radiation measurement mobile apps for citizens' use 6. R. Sala et al. | Social uncertainties in the preparation and planning of the transition phase. Findings from ten national stakeholders' panels 7. Vanessa Durand et al. | Involvement of French stakeholders in the decision-making process in the context of uncertainties – The methodological approach 8. Mélanie Maître et al. | Involvement of French stakeholders in the decision-making process in the context of uncertainties – Presentation of the results 9. Friedo Zölzer | Evacuation in case of a nuclear power plant accident – some ethical considerations 10. Gauthier Fontaine | Epistemological analysis of uncertainties linked to the conception and the use of models in environmental assessment 11. **Poster:** Dritan Prifti | Safety and Security Interface of RPMs use to Broaden Radiological Protection in Albania 12. **Poster:** Kozeta Tushe | Human Factors Engineering - An Overlooked Aspect in Specifications for Radiation Detection Equipment's
11:30	BRUNCH
12:00	**The art and culture of radiological protection** Ramon Y Cajal room, Inner patio and Rita Levi room *Chairs: Susan Molyneux-Hodgson, University Exeter and Michiel Van Oudheusden, SCK•CEN*
	1. Azby Brown | Application of accessible popular culture and fine art languages to social communication in Japan after the Fukushima NPP disaster 2. Lise Autogena | Kuannersuit; Kvanefjeld 3. Sergii Mirnyi | From tragedy to comedy: Comparison of Holocaust and Chernobyl reflection in movies 4. Shuji Akagi | Fukushima through my eyes 5. Behnam Taebi | Ethics Beneath the Surface 6. Michiel Van Oudheusden et al. | Ways of not forgetting: Japanese citizen scientists' artistic responses to the 2011 Fukushima disaster 7. Arie van 't Riet | Colored X-rays
14:30	Finger food BREAK (*Don't touch the RICOMET exhibition – enjoy it from a safe distance*)

15:00	**Radiation protection culture** Ramon Y Cajal room *Chairs: Caroline Schieber, CEPN & Christiane Pölzl-Viol, BfS* Oral presentations 15 minutes with discussion included)
	1. Sergi López-Asensio et al. | Identification of mental models of uncertainty management in emergency situations 2. Liudmila Liutsko et al. | Radiation protection culture in practice: Insights from people's behaviour in areas contaminated by the Chernobyl and Fukushima accidents 3. Jean-Marc Bertho et al. | A citizen science approach for dose rate mapping in a contaminated territory: dose rate results, analysis of participants' comments and perspectives 4. Wouter Schroeyers | Integration of soft skills, employability skills and SDG's in radiation protection: the Erasmus+ project 'train the future trainer' 5. Vasiliki Tafili et al. | Exploring societal perception and safety culture of radiation in Greece 6. Karla Petrová | The improvement of public communication on actual radiation situation after disinformation campaign in the Czech Republic 7. Siti Farizwana Mohd Ridzwan | Radioprotection and radiation monitoring culture among Malaysian medical radiation workers: A nationwide survey 8. Friedo Zölzer | Ethics of the use of non-ionising radiation 9. **Poster:** Bénédicte Geffroy | Exposure to low doses by health professionals in nuclear medicine: A relationship to differentiated risks 10. **Poster:** Siti Farizwana Mohd Ridzwan | Development and validation of a web-based survey to asses medical radiation workers' behaviour of using personal dosimeter for occupational radiation monitoring
17:30	CLOSURE of the RICOMET 2019 conference GOODBYE and WELCOME DRINK (warming up for the first General Assembly of the SHARE platform) - Inner patio

Session 1: Communication about indoor radon and stakeholder engagement in a radon national plan

Chairs: *Olga German, IAEA & James Mc Laughlin, European Radon Association*

Exposure to indoor radon is one of the main causes of lung cancer worldwide. The World Health Organization recommended in 2005 that comprehensive radon programmes should be developed. The the European Basic Safety Standards directive (2013/59/EURATOM) as well as revised General Safety Requirements of the IAEA, GSR Part 3 (IAEA, 2014) require from Member States to develop National Action Plans to address long-term risks from radon exposures. Among others, these plans should include the development of a "*strategy for communication to increase public awareness and inform local decision makers, employers and employees of the risks of radon, including in relation to smoking*".

This session invites presentations about ongoing radon communication plans, their challenges, effectiveness and recommendations for successful radon communication and stakeholder engagement lead to conducted radon measurements and mitigation actions.

Communicating Effective Radon Risk Information : a personal viewpoint

James Mc Laughlin
European Radon Association

james.mclaughlin@ucd.ie

Abstract

The three principal objectives of most national radon risk communication campaigns targeted at the public are to raise awareness of the risks, to encourage householders to measure radon in their homes and to remediate their homes where necessary. This strategy for a number of reasons has been very ineffective in particular with regard to the last two objectives. Experience in many countries have shown that even well designed public radon risk communication campaigns have had a very low success rate in encouraging householders either to measure radon in their homes or to remediate their homes if found to be above the national reference level. There is ,however, evidence that targeting of decision makers at local and national level may be more effective in reducing radon risk to the public than by just targeting the public. This approach is also in keeping with EU Basic Safety Standards recommendations.

In the case of the public there are complex psychological and socio-economic reasons behind the difficulty to motivate them to take action on radon but one of the biggest barriers to be overcome appears to be apathy. The core messages used to raise radon awareness can themselves contribute to such apathy. It has,for example, long been the practice in radon risk communication to describe radon as a natural occurring substance that has always been a ubiquitous part of our environment. Stating this trueism can,however, be counterproductive to any national strategy aimed at reducing risks from indoor radon. Emphasising the natural origin of radon helps to create the impression that exposure to radon is unavoidable and more importantly that no one is to blame. A more effective core message would be to emphasise the reality that enhanced radon levels in homes or workplaces are not natural but are anthropogenic phenomena due to the ways in which we design, construct and use our indoor enclosed spaces. Following on from this it should be stressed that it is technically possible to construct and manage dwellings and workplaces in ways such that unacceptable radon exposures are avoided.

Should we inform or engage about radon: From Health Behavior Theories to Practices in Stakeholder Engagement

Tanja Perko and Catrinel Turcanu
Belgian Nuclear Research Centre, SCK•CEN, Mol, Belgium

Tanja.perko@sckcen.be

Abstract

Studies and experiences related to radon mitigation provide evidence that changing health behaviour, in the sense of testing radon concentrations and applying mitigation actions such as the renovation of one's house, is challenging. This indicates that radon risk remediation is not a scientific or technical problem, but may be a socio-political and psychological one, indicating a 'value-action gap'. This refers to a situation where the values or attitudes of an individual do not correlate to his or her actions. Enhanced risk communication and stakeholder engagement may address this gap and save peoples' life.

This contribution summarises main results of health behaviour models important for radon risk communication. It substantiates the need for higher levels of stakeholder engagement on radon issues that go beyond simple provision of information and argues that engagement through internet may be a valuable opportunity to support behaviour change in terms of radon risk mitigation.

An exploratory literature review has been conducted, enriched with practical experiences from the radon field. Moreover, a systematic review carried out of internet pages, from a stakeholder engagement perspective.

Results show, that both academic studies and practical experiences have focused in the past decades on informing stakeholders about risks from living in radon prone areas. However, higher levels of engagement of broader publics are nowadays called for in several areas of radiological protection, including radon risk mitigation. The need for enhanced stakeholder engagement in radon mitigation is supported by both normative considerations, as well as empirical evidence.

Moreover, results show that availability of radon information on the internet in radon prone areas is often limited and poor, leaving radon information seekers at risk.

The analysis is concluded with a synthesis of good practices for communication practitioners, which should support radon risk mitigation, and contribute to improving public health particularly decreasing the numbers of lung cancers.

This work has been carried out in the framework of the ENGAGE project. ENGAGE is part of CONCERT. This project has received funding from the EURATOM research and training programme 2014-2018 under grant agreement No 662287.

The Austrian Experience in Radon Risk Communication

Klara Himmelbauer, Angelika Kunte, Wolfgang Ringer
Austrian Agency for Health and Food Safety (AGES)

klara.himmelbauer@ages.at

Abstract:

It is a well-known fact that indoor radon composes a serious health hazard to the population. Radon communication is a challenging task, as there are many different target groups and communication tools.

Providing information about radon will be included in the national radon control strategy of Austria. It is the primary objective to reduce the exposure of the population to radon. To satisfy legal requirements, communication measures are conducted either by federal or national authorities. To fulfil the information duties, the Austrian National Radon Centre developed a Radon Risk Communication Strategy.

This comprehensive concept describes the radon situation in Austria and compiles information on communication tools and specific ideas for future projects and measures. The communication goal of this concept is to provide profound and easy to understand knowledge on radon that leads to action.

Examples in Upper Austria show that raising awareness and providing cost-free radon measurements in dwellings, even combined with financial support for remediation and prevention, is not sufficient for that a large number of citizens take action on the radon problem.

It is a long way from risk perception to taking action when necessary. Distinctive communication is needed as well as comprehensive stakeholder engagement.

This presentation will give insights into the Austrian Radon Risk Communication Strategy. Experiences will be presented, pointing out some lessons learned but also some challenging aspects and what we can learn from them.

"The mysterious risk: indoor radon and the evolution of its perception in France"

Ludivine Gilli, Sylvie Charron
Bureau for Innovation, Strategic Intelligence, Foresight and Studies (BIIPE)
IRSN - DSDP/SCOSI/BIIPE, France

ludivine.gilli@irsn.fr

Abstract

For over 30 years the French Institute for Radiation Protection and Nuclear Safety (IRSN) has been following the evolution of risk perception in France, with a particular focus on the risks associated with nuclear power. A public opinion survey is conducted every year among a sample of 1,000 people representative of the French population. It includes a core of questions which are kept from one year to the other and allow the study of the perception of different risks and their evolution over time. As such, it is a valuable tool to analyze the evolution of risk perception by the French population.

In the 2018 IRSN Barometer, 35 risks are questioned from three different angles: the seriousness of these risks, the trust towards the authorities to manage them and the credibility of the information given about them. One of the risks taken into account is "indoor radon". Others include NPPs, chemical installations, but also air pollution, alcohol consumption, or domestic accidents.

The results regarding the perception of "indoor radon" are telling. It ranks 35th (and last) in terms of seriousness of risk, 31st in terms of trust in the authorities and 28th regarding credibility. Radon also appears as the "mysterious risk", the most unknown of all the risks studied: it records by far the highest scores of "don't know" responses on all three aspects (seriousness, trust and credibility), above 20%. These levels are very high and give pause. While the IRSN Barometer does not specifically target radon affected areas but France as a whole, they may lead to question effectivity of communication actions on this issue. But actually, these scores show a strong improvement compared to the 40% or more recorded in the 1990s when the question was first asked, maybe pointing to a communication effectiveness.

Radon information strategy for real estate market

Marcela Berčíková
State Office for Nuclear Safety, Prague, Czech Republic

Marcela.Bercikova@sujb.cz

Abstract

The State Office for Nuclear Safety recently noticed several lawsuits concerning the sale and purchase of family houses of the START type (built in the past from building material with higher concentration Ra 226). The lawsuits were discovered based on legal actions filed by the buyers who demanded a reduction of the purchase price or withdrawal from the purchase contracts. The main argument of the actions, as indicated in the judgments, was a hidden defect reported by the buyers - the volume activity of radon and the gamma dose rate about which the buyers had not been informed prior to purchase.

The courts granted the actions and, based on measurements and opinions provided by the experts appointed by the court, issued judgements which recognized the actions as justified and confirmed the presence of volume activity of radon and gamma dose rate as a hidden defect.

The State Office for Nuclear Safety identified this risk of legal action as a strong motivation for sharing this information with relevant stakeholders - in this case for real estate agents, lawyers, buyers and sellers. A decision was made to prepare a communication strategy supporting the sale and purchase of real estate in relation to volume activity of radon. The overall aim being to avoid, as much as possible, such legal cases as mentioned above.

The communication strategy has several possible steps, including a targeted information campaign, a web site with information of the radon, an offer of free detectors for measurement, on-line webinar and presentations on special conferences or meetings.

We have to be prepared so to react quickly with a new approach if we find one step works poorly and does not support the targets. We will concentrate with on-line communication strategies more intensely than direct face-to-face communications to ensure effectiveness.

The target of the strategy is to encourage the stakeholders to act in making the topic of radon measurement a part of every real estate transaction. This is accomplished by sharing knowledge and measurement results when properties are for sale on the real estate market. The results have to be shared based on proof of facts, the best way is the inclusion of these results in the contract of sale. The active, involved stakeholders, with right information about the radon levels, can make educated purchase decisions on the real estate that include the consideration of the risk of radon on health.

"Radon: let's clear the air, let's meet the challenge" - A pilot and participatory program to fight domestic radon in the Haute Vienne region (France)

Marie-Pierre Bigot, Didier Gay, Ilma Choffel De Witte
Nuclear Safety and Radiological Protection Institute (IRSN), France

Ilma.choffel-de-witte@irsn.fr

Abstract

In March 2014, a case of very high exposure to radon was brought to light in a house in the Haute-Vienne region, during Orano's investigation campaign identifying sites re-utilizing tailings. The concentrations recorded exceeded 10,000 Bq.m3. This case, attracted intense media coverage locally and was immediately taken care of by the Prefect. The radon situation led to the relocation of the family concerned, the demolition of the house and the removal of mining residues in the surrounding area.

Regardless of its mining history, Haute-Vienne is one of the regions most affected by radon risks. Concentrations in dwellings are thus on average nearly ten times higher than those found in Ile-de-France (the Paris Region). Therefore, IRSN proposed to elected officials of the sector to initiate a radon screening program in the habitat.

For a period of nearly 2 years, this program, entitled "radon: let's clear the air, let's meet the challenge", was carried out in two phases, first a radon measurement campaign followed by remediation actions when necessary. From mid-December 2015 to the end of February 2016, more than 800 radon measurement kits were distributed free of charge to interested inhabitants of the participating municipalities. The second phase of the program, dedicated to remediation, took place from May 2016 to mid-2017 and benefited from the support of elected officials and the local High School for Construction and Building Skills.

A multi-channel communication system for the population mixing media relations, meetings on the work in progress and workshops set up to accompany the project.

This program was innovative in many ways, firstly by its multi-disciplinary aspect: radon experts, building professionals but also stakeholders' engagement specialists and communication experts. The program implemented within several municipalities covering a specific territory resulted in a strong engagement from the inhabitants. Based on volunteering, they were informed guided and encouraged to go through the various stages of risk management by themselves: initial radon measurements, search for remediation solutions, completion of works and control measurements afterwards.

Session 2: Holistic Approach on the Management of Long-Term Exposure situations

Chairs: *Simpon Cornu Marie, IRSN & Horst Monken Fernandes, IAEA*

Management of contaminated sites that can lead to long-term environmental exposures to radiation covers a wide range of situations including sites contaminated by NORM, former sites that hosted nuclear facilities, former uranium production sites and even sites affected by nuclear or radiological accidents. These sites are designated as existing exposure situations in the scope of the prevailing international standards and due to their long-lasting exposure characteristics decisions on end-states, future use and clean-up levels will demand the engagement of different stakeholders in a sometimes long and arduous process of decision-making provided that different approaches can be made available. In this session, we intend to discuss how this process has been (or could be) implemented in different circumstances, the existing gaps and challenges to be dealt with by scientists, practitioners, regulators, decision and policy-makers.

Facing long term contamination: decisions of inhabitants in the aftermath of the Fukushima accident

Christine Fassert
IRSN, France

christine.fassert@irsn.fr

Abstract

This communication presents some results of the SHINRAI project (IRSN, Sciences PO and University of Tokyo Tech). The presented analysis is based on an intensive field work with inhabitants of Fukushima Prefecture and accident management stakeholders. For 5 years, about 120 interviews have been completed during 8 missions of 2 to 3 weeks, mainly with inhabitants of three locations in the Fukushima prefecture: Kawauchi and Naraha, two evacuated villages, and Watari, a district of Fukushima city.

We focus in this presentation on a categorization of inhabitants according to their decisions to return or not after the lifting of the Evacuation Orders. Six types of "decisions" have been identified; this categorization allows for an account of the variety of inhabitant reactions and judgements regarding their situation after the nuclear accident.

The issue of ionizing radiation (the dangers it presents - or not - for each type of category) was always spontaneously evoked during interview, and is a central element in decision-making. It was also a very dividing issue (Slater, 2015, Kimura, 2016). The points raised show that the decision to return or not involves balancing a whole range of reasons, (infrastructures availability, return of other villagers, …), making a *personal* and intimate decision, but that it is also a way of responding to government 'pressures' and incentives. To this extent, whether to return or not can also be framed as a *political* stance on the part of residents, which mobilizes their broad assessment of the government's post-accidental policy.

These results allow to compare the concrete situation in Fukushima with a number of principles that underlies international post accidental policy and recommendations.

TERRITORIES - A holistic approach of long-lasting radiological exposure situations

Marie Simon-Cornu[1], Bieke Abelshausen[2], Stéphane Baudé[3], Sylvie Charron[1], Pascal Croüail[4], Julien Dewoghélaëre[3], Silvia German[5], Andrei Goronovski[6], Jérôme Guillevic[1], Gilles Hériard-Dubreuil[3], Ferdiana Hoti[2], Sergi Lopez-Asensio[5], Astrid Liland[7], Dolores Mäekivi[5], Mélanie Maître[4], Ståle Navrud[8], Christian Oltra[5], Danyl Perez-Sanchez[5], Tanja Perko[2], Roser Sala[5], Thierry Schneider[4], Keiu Telve[6], Alan Tkaczyk[6], Catrinel Turcanu[2], Michiel van Oudheusden[2]

[1]IRSN, France
[2]SCK•CEN, Belgium
[3]Mutadis, France
[4]CEPN, France
[5]CIEMAT, Spain
[6]University of Tartu, Estonia
[7]DSA, Norway
[8]NMBU, Norway

marie.simon-cornu@irsn.fr

Abstract

Background: TERRITORIES, part of the H2020 Program CONCERT, is a 3-year-project (2017-2019), involving 11 partners, from 8 European countries. The scope of this project includes existing exposure situations due to NORM, and due to nuclear accident (long-term).

Methods: All deliverables are published on the TERRITORIES website, https://territories.eu/. Among them, 7 were due end of June 2019:

- **D9.63:** Guidance about exposure scenario (not developed here, *cf.* a case-study presented by Bertho *et al.*, RICOMET session 10),
- **D9.64:** Social and ethical aspects linked to monitoring and modelling: a Socio-Technical Integration Research approach (*cf.* part of the work also presented by Lopez-Asensio *et al.*, RICOMET session 3),
- **D9.66:** Results of a stakeholders panel about an hypothetical post-accidental situation,
- **D9.67** and **D9.68:** Results of 2 stakeholders panels about NORM situations (*cf.* part of the work also presented by Sala *et al.*, RICOMET session 7, and a related review by Popic *et al.*, same session),
- **D9.69:** Results of a Pathway Evaluation Process (PEP) session organized with stakeholders about an hypothetical post-accidental situation,
- **D9.70:** Framework for socio-economic analysis, i.e. Cost-benefit Analysis (CBA) and Multi-Criteria Decision Aiding (MCDA)

Results: Holism (from Greek ὅλος "all, whole, entire") is the idea that a system and its properties should be viewed as a whole, not just as a collection of parts. In the context of the TERRITORIES project, this is for example understood as:

- a multi-disciplinary approach, e.g. having social scientists and scientists involved in monitoring and modelling working together, for their mutual benefit, *cf.* D9.64,
- assessing as a whole all of the decision criteria (or costs and benefits, including non-monetary ones) for decision-making about remediation, *cf.* D9.70,
- engagement of all stakeholders, through various tools to structure dialogue, *cf.* D9.66 to D9.70,
- considering all aspects of life in contaminated territories, including quality of life (*cf* D9.66), dignity of life (*cf.* D9.69), or recovery of sustainable socio-economic activity (*cf.* D9.66).

Analysis of uncertainties in decision-making process for long-term exposure situations on examples of two Norwegian legacy sites

Jelena Mrdakovic Popic
Norwegian Radiation Protection and Nuclear Safety Authority (DSA), Bæreum, Norway

Jelena.Popic@dsa.no

Abstract

Holistic approach in the management of long-term exposure situations has been developed in Norway in years after the Chernobyl accident. In last two decades, it has been adopted in management of other sites, with all complexity and challenges that this approach encompasses.

In the current work, experience of the main national regulatory body, Norwegian Radiation Protection and Nuclear Safety Authority (DSA, formerly NRPA), and lessons learned concerning the main uncertainties in the decision-making processes at NORM existing exposure situations is being presented. A review work has been done as a contribution to the TERRITORIES project (To Enhance unceRtainties Reduction and stakeholders Involvement TOwards integrated and graded Risk management of humans and wildlife in long-lasting radiological Exposure Situations) within a European Joint Programme CONCERT.

Decision-making in radiation protection is a case specific process requiring comprehensive information and the assessment of many factors, including present hazards and problem formulation, acceptable technical solutions, social and economic factors and risk communication. The general adopted decision-making process sets out what should be looked at, but each site must be considered in its own right, with a holistic view being taken and with realistic data being applied to support decision-making.

National policy, legal and regulatory framework, hazard characterization and problem formulation, radioecological analyses and assessments, identifying appropriate clean-up actions, financial decisions, risk perception and communication and stakeholder involvement were analysed by reviewing the decision making processes for two cases of legacy sites: former niobium (Nb) mining site and former disposal site of alum shale. Both sites present typical examples of persistent environmental pollution with identified risk for humans and biota.

Key uncertainties and challenges were, in presented case studies, related to responsibility assignment, hazard characterization and integrated risk assessment, choice of remediation options and risk perception. Analysis results and main differences regarding uncertainties and specific solutions at these two cases will be presented.

Participatory MCDA workshop to involve stakeholders in the remediation of a NORM site. Experience from the phosphogypsum ponds in Huelva, Spain

Roser Sala, S. Germán, S. López-Asensio, C. Oltra, D. Pérez
CIEMAT – Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas, Madrid, Spain

roser.sala@ciemat.es

Abstract

Background: WP3 of TERRITORIES project is aimed at analysing the decision-making processes in long-lasting radiological exposure situations, taking into account stakeholder concerns, preferences and needs. In Spain, the case of the phosphogypsum ponds in Huelva, contaminated with NORM (Naturally Occurring Radioactive Material) from the 1960s, was selected as a case study. We tested a participatory methodology to allow stakeholders to express their preferences on the relevance of various criteria for decision-making around the remediation of contaminated sites.

Methods: Alternative prototypical remediation strategies were framed and discussed with stakeholders by means of a participatory MCDA workshop. The goal was to discuss about the main criteria to be incorporated into the decision-making process about remediation, as well as to understand stakeholders' concerns, preferences and values. A sample of 14 representatives from universities, research centres, industry, environmental organizations, and local and regional authorities attended a one-day workshop that was held in Huelva. After the workshop, the discussion was transcribed and the questionnaires were processed. Both quantitative and qualitative analysis were carried out.

Results: The analysis identified, defined, and weighted different technical, environmental, economic and social criteria and sub-criteria that, in the views of participants, should be considered when making a decision on the remediation strategy of a NORM site. Particular emphasis was placed on social criteria. The results show that the health and safety of the affected population and workers together with radiological risk are, according to participants, the most relevant criteria to take into account when evaluating a potential remediation option. Ex-situ remediation was assessed as the worst of the proposed remediation options. Some critical issues, such as the legislation framework, were also identified. The level of agreement among stakeholders on the importance of criteria was relatively high.

Conclusions: The findings can contribute to the improvement of future decision-making processes of contaminated NORM sites.

Acknowledgements: This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287.

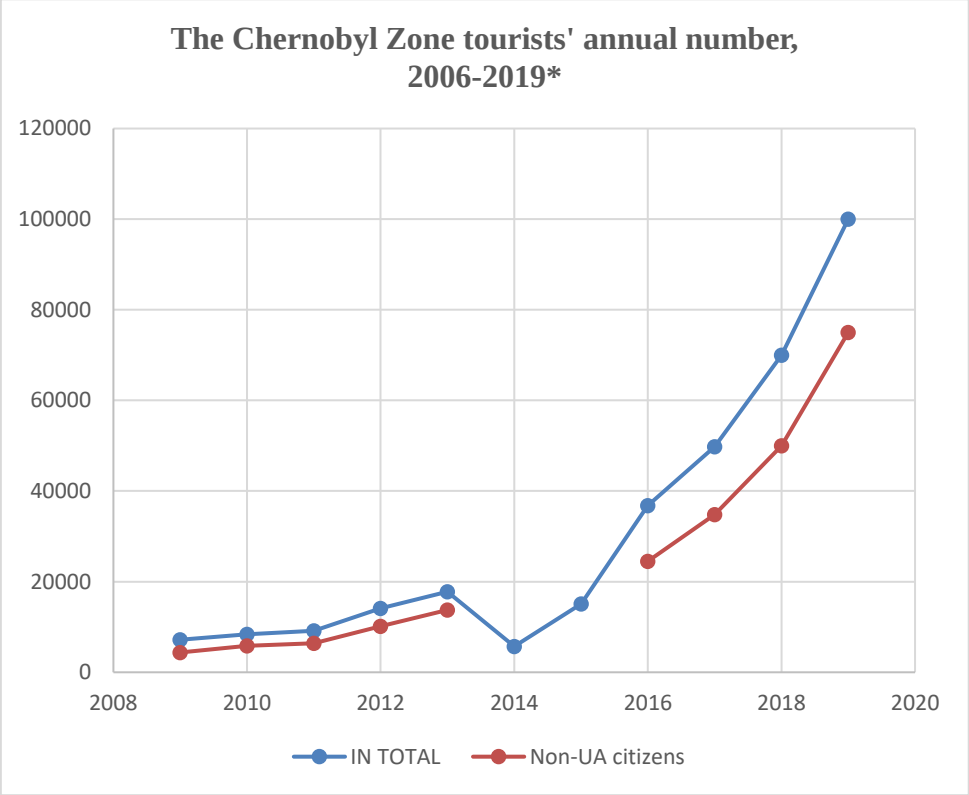
Chernobyl tourism. Post-radiation-accident tourism

Sergii Mirnyi
"CHERNOBYL TOUR", Chernobyl Tourism Association, Ukraine

s.mirnyi@gmail.com

Abstract

The Chernobyl tourism is likely to be a driving force for the next stage of the Chernobyl recovery. The annual number of visitors of the Ukrainian Chernobyl zone rapidly grows: in 2018 – 70000, in 2019 - ~100,000.



*2008-2018 - the Zone Administration data, 2019 – the author's forecast

The phenomenon is principally new for the civilization: its concept was derived two decades ago, and the term coined a decade ago by the author. The notion has turned out to be quite productive: it has evolved into the two new, more general, concepts of post-radiation-accident tourism (after the Fukushima NPP accident) and into the notion of existential tourism (which can change the individual's life values and priorities).

Tourism to the affected areas (that is, into the closed zone and adjacent inhabited areas) has proved to be a mandatory means of their sustainable recovery and development. The post-radiation-accident tourism has five main functions in the comprehensive system of mitigation of and recovery after the accidents. It:
1) revives economy and society of the regions affected;
2) cures psychological trauma of the populations affected;

3) informs and educates the general public and professionals;
4) is a psychologically-curing symbol of overcoming the mishap;
5) stimulates the Zone recovery from the extraordinary, militarized, closed (and thus, in the long run, inefficient) state – to an ordinary, opened civil sustainable state.

Next logical steps of the Chernobyl tourism development appear to be, in particular:

- diversification of the routes and types of tours, including integration of the in-Zone and beyond-Zone routes and opening of new checkpoints;
- creation of joint Ukrainian-Belorussian system of Chernobyl tourism;
- granting the UNESCO World Heritage Site status to the objects and locations of the Chernobyl-Disaster.

Radiation monitoring of foodstuffs and public exposure doses after the Chernobyl accident. Transition phase from emergency to existing exposure situations.

Alena Nikalayenka
Scientific Practical Centre of Hygiene, Belarus

nikolaenko_ev@tut.by

Abstract

The explosion at the Chernobyl NPP on 26th April 1986 contaminated 46 500 km^2 and in 2017 year – 27 900 km^2 of the Republic of Belarus by Cs-137 with density of more than 37 kBq/m2 and also by Sr-90 and Pu-238, 240.

On the early post-accidental stage the remediation activity in the contaminated areas was firstly aimed at guarantee that the foodstuff produced in the contaminated areas were within the republican permissible levels (RPL), and annual effective dose to local inhabitants was lower than 1 mSv/a.

More than thirty years after the accident the methodology and requirements to monitoring and control, reference levels of radionuclides in food and feed produced in the contaminated areas have been reviewed several times following the evolution of the radiation situation. For example on last year (2018) the permissible level of c Cs-137 in milk are exceed only in 2 and Sr-90 in 1 villages and only 82 settlements were the dose can be 1 mSv/y or more.

The paper presents studies of this evolution process based on the analysis of consumption of locally produced products and permanent assessment of the dose of exposure of population. The studies create a scientific framework for update of radiation control and radiation monitoring procedures and justification of measures on optimization of radiation protection of the population. The studies show the reasonability to use a graded approach to radiation control requirements, which are to be selective for different groups of the contaminated localities depending on their location, average public exposure dose, and density of radionuclide contamination. It is emphasized, that in the existing exposure situation the radiation monitoring on the contaminated areas is preferable than by the radiation monitoring accordance with RPL.

Efficiency of the approach to management of radioactive waste generated during remediation activities in the Chernobyl contaminated areas

Alena Nikalayenka
Scientific Practical Centre of Hygiene, Belarus

nikolaenko_ev@tut.by

Abstract

The management of contaminated sites, affected by radiological accidents should not only be aimed at addressing the health concerns, but also a wide range of other issues, including ensuring appropriate management of the remediation waste and gaining the public trust in safety of the associated activity.

After the Chernobyl accident Belarus faced a problem of managing thousands tons of low-activity remediation wastes (RemW) disposed in occasional open sites during the clean-up of contaminated areas. The public, environment agencies, state authorities, mass media and other stakeholders insisted strictly on relocation of this waste to specially constructed concrete vaults, that was totally baseless from safety and economical point of view.

The objective of the presented study was to create a scientific basis to justify the appropriate management option for resolving above stated problem. The detailed field investigations were undertaken to assess the potential radiological hazard of the most dangerous RemW sites for the public. Verification of the used multibox model was carried out by comparison of the calculation results with output of the other models, independent Swedish investigations and available results of the field monitoring. Most of input data for calculation were taken from the real laboratory and field investigations. This strong validation of the investigation results was demonstrated to the stakeholders, who believed in the end that any dozes, associated with the RemvW sites are small compared to the doses associated with the surrounding soil.

Based on the results of the investigation the appropriate management option was developed and specified in special radiation-hygiene regulation on management of RemW (SPOOD)
The paper suggests the regulatory approach on management of RemW, bearing in mind the need for harmonization of policies for regulatory control and remediation actions, and ensuring the public confidence in safety of the RemW for human health.

Workshop: Bringing Theory to Practice in Environmental Remediation Projects - based on a real ongoing remediation project from Kyrgyzstan

Moderators: *Meritxell Martell, MERIENCE & Horst Monken Fernandes, IAEA)*

Participants of the conference will be asked to discuss in groups different societal and ethical aspects of a real on-going environmental remediation project. The project and it's challenges will be presented from a first hand of the project implementer. Participants of the conference will be able to select one challenge, e.g. decision-making process, communication and stakeholder engagement, ethical aspects etc. , to discuss in group the remediation project from the selected aspect point of view and prepare ideas on how to address the specific challenge in practice.

Mailuu-Suu

Bakai Zhumakadyr

bakaykgz@gmail.com

Abstract

In territory of the Kyrgyz Republic is located 92 objects of toxic and radioactive waste from mining production. Tailings has been closed in 1966-1973 years. All these objects were located within the settlements. During designing and laying tailings, long-term measures for protection from natural processes were not taken into account.

The current climate change is accompanied by the exacerbation of dangerous natural phenomenon, in particular mudflows and floods, the development of landslide processes in the areas where radioactive waste storage sites are located, and, accordingly, the threat of their destruction increases with environmental consequences of a transboundary scale.

Currently, Kyrgyzstan does not have sufficient financial and technical capabilities to ensure proper maintenance and rehabilitation of radioactive waste storage facilities, contaminated areas.

The Government of the Kyrgyz Republic regularly raises this issue to determine as priority at different international meetings and events.

In this regard, by a core group of the Coordination Group on Uranium Legacy Sites (CGULS) has prepared this Strategic Master Plan for Environmental Remediation of Uranium Legacy Sites in Central Asia and signed on 2017 at General Conference of the IAEA in Vienna.

The core group comprises representatives of the European Bank for Reconstruction and Development, the European Commission, Kyrgyzstan, the IAEA, the Russian Federation,Tajikistan and Uzbekistan.

The uranium sites of Mailuu-Suu covered by the Strategic Master Plan and it has high priority to conduct relevant works and events for remediation.

On the territory of Mailuu-Suu city, Jalal-Abad district there are 23 tailings (total wastes volume - 2 million cubic meters) and 13 dumps (total wastes volume - 1 million cubic meters) with uranium production wastes.

The World Bank's Disaster Hazard Mitigation Project supported the remediation of high risk objects at Mailuu-Suu in the period 2004–2013. A geologically unstable tailings facility on the banks of the Mailuu-Suu river was moved to a more secure and stable location, and a waste rock dump on the banks of the Kulmen Say creek was similarly relocated. Another waste rock dump on which homes had been built was also relocated, requiring the resettlement of the residents. This project demonstrated that remediation work at uranium legacy sites of Soviet period can be successfully implemented in the region.

The total cost of the Project was 12 million US dollars, of which the directly for rehabilitation of tailings in the Mailuu-Suu was 8.4 million US dollars.

Currently, with funding from the European Union and the support of the IAEA, in frame of the Strategic Master Plan implementation , at the Mailuu-Suu tailings works is underway to develop the "Environmental Impact Assessment" by Wisutek, the beneficiary of which is the Ministry of Emergency Situations of the Kyrgyz Republic and Systematic and comprehensive evaluations of the risks and

remediation options will be conducted. Above mentioned activities are at the stage of technical study of the options for rehabilitation, negotiation of options with the Beneficiary.

Also, the Ministry of Emergency Situations is carrying out to maintain the hydrotechnical and protective structures of these tailings in working condition.

Session 3: Early career researchers in the field of social science and humanities related to ionizing radiation (presentations of research and round table discussion about feelings, experiences, frustrations and satisfactions)

Chairs: *Ferdiana Hoti, SCK•CEN, Sergi Lopez Asensio, CIEMAT & Yevgeniya Tomkiv, NMBU*

This panel understands itself as a space for and with early career researchers which aims to stimulate reflection and discussion in ionizing radiation for all researchers. The main goals are to create a platform for early-career researchers to discuss, share and reflect on research related to ionizing radiation and what doing research in ionizing radiation entails; how to deal with specificities and challenges of this field; share practices and stakes of building bridges between soft and hard sciences as well as the public; reflect on the social stakes that might that their research might entail; discuss practices on methodologies to deal with research on ionizing radiation in social sciences as well as talk about the existing uncertainties and the ways to communicate about them amongst different stakeholders and the public. Therefore, we call for abstracts from early-career researchers on the above-mentioned aspects of ionizing radiation in order to discuss different topics of presentation, create a network and put the work of early-career researchers on spotlight as well as discuss different aspects that research in this field entails.

Embracing the complexities: the value of listening to public in nuclear emergency preparedness

Yevgeniya Tomkiv[1,2,*], Deborah Oughton[1,2], Brian Wynne[3]

[1]Norwegian University of Life Sciences
[2]CERAD Centre for Environmental Radioactivity
[3]University of Lancaster

yevgeniya.tomkiv@nmbu.no

Abstract

Aging nuclear power plants in Europe, transport of nuclear waste along the Norwegian coast and heightened risk of terrorist attacks, increase the probability of nuclear accidents affecting Norwegian territories. In order to improve the governance of nuclear or radiological accidents, it is crucial to understand people's concerns, motivations, beliefs and value judgments that underlie individual decision-making in an emergency situation. This understanding would help develop appropriate protective and communications strategies, and encourage actions to reduce the consequences of a potential nuclear accident.

In this study, we present results of discussion in 6 focus groups that were conducted with members of the general public in a relevant locality. The discussions were based on two hypothetical scenarios of a nuclear accident that would affect the areas where participants resided. The results of this study demonstrate some useful insights into the ways public construct: i) their perceptions of risk; ii) their relationships with emergency actors and sources of knowledge; and iii) their responses to emergency management. The paper will present the results of the discussions and point out potential challenges that would need to be addressed by the emergency preparedness actor(s) as well as recommendations for possible change in current practices.

Socio-Technical Integration Research (STIR). Spanish Case Study

Sergi López-Asensio and Roser Sala
CIEMAT – Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas

Sergi.Lopez@ciemat.es

Abstract

Background: Socio-Technical Integration Research (STIR) is a methodology with the aim of incorporating social and ethical aspects to scientific-technical researchers' daily work. It also intends to grow researchers' reflexive perspective towards every step of their usual decision-making processes and help them to raise social awareness of their research.

Methods: In the Spanish case, the unit studied was an environmental radioactivity analysis lab from CIEMAT. The sample consisted of two researchers selected to be the participants of the study while the head of the unit was interviewed to obtain contextual information. The protocol was applied in an iterative way via phone or videoconference interviews during different periods. The interactions were audio recorded in order to analyse them. The protocol was applied until the maximum number of modulations were obtained.

Results: The modulations showed uncertainties from different fields. Technical uncertainties include, among others, lack of technical support or how the results can be used in a practical way. In the case of material uncertainties, aspects such as economic and bureaucracy appeared. Regarding the social ones, motivation issues, political changes and communication aspects appeared as important dimensions. Therefore, the integration of social aspects in technical research can enhance positive values like curiosity, creativity, or enable a broader scope for the research objectives. These could generate positive outcomes such as novel ideas in the specific field or improvement of the performance or the results.

Conclusions: This methodology allows technical scientists to think about the social and ethical considerations that surround their work. At the same time, social scientists become more aware of the difficulties in research. As a result, this technique produces reciprocal positive outcomes both for social and technical scientists.

Acknowledgements: TERRITORIES is part of the CONCERT project. This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287.

Perception of Radiological Risk Mental Models in the Portuguese Context, in the past and present

Ana Rita Melo[1], Décio R. Martins[1], Rui C. da Silva[2], José M. Palma-Oliveira[3]
[1]Centre for Physics of the University of Coimbra
[2] Institute for Plasmas and Nuclear Fusion, Técnico Lisboa
[3] Faculty of Psychology, University of Lisbon

rita.melo.pt@gmail.com

Abstract

The history of radiological risk perception shows moments of fascination with the discoveries of X rays, radioactivity and their applications, interspersed with moments of uncertainties and fears when ionizing radiation's harmful effects became evident. Nevertheless, apparatus such as the pedoscope, a shoe-fitting machine using ionizing radiation, was still used in the 1970s, demonstrating general perception of low risk regarding X rays. This happened even though some pedoscopes carried a health warning suggesting customers to have no more than 12 shoe fittings a year, as one used from 1930 to 1955.
The research under way intends to delineate a historiographic study and to contribute to the field of social science and humanities related to ionizing radiation by analyzing the appearance of the concept of radiological risk perception and its evolution in Portugal, a country without nuclear energy production, in the light of social psychology models. The research contemplates the period of 1895, when Röntgen discovers the X rays, to present date. Diverse methodologies, from documentary research to the collection and analysis of quantitative data, are used to encompass the complexity of the topic under study. Presently, an expert model of ionizing radiation risk is being created, integrating the contribution of eight experts and illustrating the intricacies involved in a phenomenon that brings together knowledge from physics, chemistry, biology, health physics and many other scientific fields. As an exemplification of expected results, the project foresees the construction and comparison of radiological risk perception mental models in the Portuguese context, in the past and present, as well as to use lessons taken from history to reflect about radiological risk education and communication.

Learn as you go: social science-in-the-making in post-disaster Fukushima

Joke Kenens
(KU Leuven, SCK•CEN)

joke.kenens@sckcen.be

Abstract

"What do you think of nuclear energy?" is a question I have been asked frequently when visiting bottom-up citizen radiation measuring centers in Japan. My research on the potential of citizen science in nuclear incidents, accidents and post-disaster situations takes me to Fukushima prefecture, which has been contaminated by radioactive materials after the nuclear accident of 2011. During fieldwork (February-March and November-December 2018) I interviewed citizen science organizations, NGO's supporting citizen science in Japan, researchers and local governments and observed citizen science organizations while they are collecting data and sharing information on ionizing radiation with the local community.

As the decontamination process is moving forward, families are slowly returning to the affected regions. Yet the memories of the accident are revisited through interviews, unveiling the ongoing struggles of citizens and communities. A strong wish not to be forgotten permeates conversations, as in the minds of many citizen scientists the nuclear accident is still not over.

Moving around as a social scientist in the realms of a post-accident environment brings along challenges. Topics such as nuclear energy, recovery and citizen science are contested and framed within differing perspectives and contexts. Understanding the frustration and hardships, while bridging language, cultural and societal gaps, is not an easy task. How to overcome these challenges? This presentation addresses the messiness of fieldwork in a foreign country, in an area struck by multiple disasters. By reflecting on social science research and methodology, it aims to open a debate and discussions on how to negotiate between cultures, on issues of (un)learning and on challenges when choosing a position as a social researcher in addressing disasters and controversial topics.

Keywords: social science research, Fukushima, bottom-up citizen science, fieldwork

Why is uranium so controversial?

Florian Abraham
University of Exeter, United Kingdom

f.abraham@exeter.ac.uk

Abstract

The proposed Kvanefjeld mine in southern Greenland is estimated to be one of the largest Rare Earth Elements (REEs) deposits in the world. These REEs are entangled with of other commodities such as zinc, but also the two radioactive elements uranium and thorium. Protests led by environmental NGOs emerged due to the potential impacts uranium extraction could have on the environment and the people.

Part of my research focuses on how the controversy emerged and why it mobilised on uranium. I am investigating why uranium triggers concerns, while other radioactive elements such as thorium for instance do not.

In November 2018 I conducted my fieldwork in Greenland, and I was able to meet key stakeholders of the projects, such as the mining company, protest groups, or environmental consultants working on behalf of the Greenlandic government.

For this conference I will present my first findings, showing how uranium has played such a big role in the controversy and also what other parameters influenced its development.

"You are but a trainee scientist": Participant-Observation in a Materials Science Laboratory

Marika Hietala
Institution University of Exeter, United Kingdom

m.hietala2@exeter.ac.uk

Abstract

In this paper I will discuss the role of a social scientist in technical fieldsites and some of the challenges of managing that role. I draw on Myers' (2008) notion of 'body-work' as an idiom for participant-observation.

For Myers, the body has a central role in generating new forms of knowing and things that are known. Understanding participant-observation as body-work, I trace how body-work enabled me to generate a rich set of data, but also how my active participation in the field influenced the development of my role therein.

My discussion draws on a completed project on the implementation of geological disposal in the UK and Finland, and in particular on a 7-month ethnographic fieldwork period in a UK university research laboratory involved in nuclear waste disposal research. My project focused on the making of the science underpinning nuclear waste disposal. Of particular interest was on everyday knowledge production practices and on how the absent – nuclear waste and distant futures – were made present in the lab through different kinds of material engagements in the laboratory.

To explore these questions, I engaged in body-work that enabled me to generate 'hands-on' data through participation in the daily life of the laboratory as a 'trainee scientist'. While this allowed for new ways of 'seeing' in the field, it also involved negotiations and had its limitations. By tracing some of these benefits and limitations of this 'tactic', this paper speaks directly to the themes and concerns of this panel.

Session 4: *Management of socio-psychological impact of radiation emergencies*

Chairs: *Zhanat Carr, WHO & Elisabeth Cardis, IsGlobal*

Lessons learned from past incidents and accidents show that the social and psychological impacts can exceed by far the health hazards due to radiation exposure in the event of a radiological emergency. Such impacts may be triggered not only by the event itself, and the inherent safety concerns and communication gaps, but also by the emergency or recovery measures adopted, the disruption of normal living conditions and the potential stigma associated to the affected areas. Identifying, clarifying and addressing these impacts is therefore paramount to recovery efforts.
The contributions to this session are expected to address psycho-social impact management after radiation emergencies and connected issues such as risk communication, local community engagement, citizens' radiation monitoring networks and other self-help measures.

Fukushima Nuclear Disaster: Multidimensional psychosocial issues and challenges to overcome them

Masaharu Maeda, M.D., Ph.D.,
Institution Department of Disaster Psychiatry, Fukushima Medical University, School of Medicine, Japan

masagen@fmu.ac.jp

Abstract

The Great East Japan Earthquake and the Fukushima Daiichi Nuclear Power Plant accident damaged mental health conditions among people in Fukushima, inducing long-term, multidimensional psychological consequences. Previous studies conducted for evacuees from Fukushima disaster have shown that they have been suffering from various types of psychiatric problems such as posttraumatic stress responses, depression, alcohol abuse and even suicide. Different, inconsistent information and rumors, furthermore, yielded multiple discordance of community, which could reduce community resilience. Risk perception of radiation among evacuees and the public in Japan remains unchanged in recent years, whereas active risk communication has brought some improvement in risk perception. Association between risk perception of radiation and depressive symptoms, which was clarified by our study, is considered key in figuring out causality of different mental health issues and stigmatization of people in Fukushima. Considering the current mental health situation of people affected by the disaster and the potential for burnout or exhaustion among workers in Fukushima, establishing a long-term mental health care system is necessary.

Framework for management of psychological and mental health impact of nuclear emergencies

Zhanath Carr, Fahmy Hanna, Olvido Guzman, Matthias Zahringer, Wolfgang Weiss
World Health Organization WHO, Department of Public Health and Environment (PHE), Genève, Switzerland

carrz@who.int

Abstract

Available experience from Chernobyl and Fukushima clearly demonstrate that nuclear emergencies may result in low and very low exposure levels, at which psychological and social effects among the affected population will dominate over the actual biological effects of ionizing radiation. International protection standards and guidelines request, that both radiological and non-radiological health consequences have to be considered in preparedness and response to an actual emergency and there is a need to broaden the radiation protection system's philosophy beyond the metrics of radioactivity and radiation dose. During the past decade a number of multidisciplinary projects were set up with the aim of evaluating management options according to social, economic and ethical criteria, in addition to technical feasibility to achieve this goal. WHO and partners from the Inter-Agency Standing Committee Task Force on Mental Health and Psychosocial Support in Emergency Settings have developed a comprehensive framework and guidelines, which can be applied to any type of an emergency or disaster regardless of its origin. There is a need to include the available scientific expertise and the technical, managerial and personal resources to be considered within a similar decision framework that will apply to radiation emergencies. Key areas of the required expertise needed to develop such a framework are radiation protection, medical support (especially primary care and emergency medicine, mental health support), social sciences (anthropology, psychology, ethics), and communications experts. The implementation of such a multi-disciplinary concept in the operational world requires education and training well beyond the level currently available.

Cultural dimensions and effective risk communication

Robin Goodwin
University of Warwick, United Kingdom

robin.goodwin@warwick.ac.uk

Abstract

Background: Following a radiation emergency a wide range of responses are possible from both formal and informal agencies and the broader population. Many of these reactions are heavily predicated on cultural beliefs, values and broader societal expectations. However communication researchers dealing with nuclear events have made little use of the cross-cultural psychological research literature to guide them when coping with challenging radiation events. An understanding of this literature can be also key to understanding local citizen engagement, particularly in situations of high uncertainty.

Methods: In this talk I will draw on 4 sets of cultural dimensions: Hofstede's classic work (originally aimed at business settings but now widely more applied, Hofstede, 2001) Schwartz' Value Theory (Schwartz, 2006), the World Values Survey (Inglehart, 2018) and culture-level dimensions of social axioms (Bond et al., 2004). I illustrate the potential implications of these through our own work following the earthquake/tsunami/nuclear leak in Japan in March 2011 (> 160,000 surveys collected between 2011 and 2016), the Chernobyl nuclear incident, as well as other nuclear emergencies across the globe.

Results: illustrate common cultural variations across the major schemata presented. Key themes include variations in the structure of intergroup relations, the nature of hierarchy and power, the embracing or avoidance of uncertainty, the prioritisation of nature over technology, the embracing of traditional vs. secular beliefs and the society's level of social cynicism. I draw out the distinct implications of each for effective risk communications following a radiation event.

Conclusions: An understanding of key cultural dimensions are a handy additional tool for communication scientists dealing with radiation events.

The need for, and the challenges to, normalising radiation in a post-trust, post-truth world

John C.H. Lindberg MA, MA (Hons), FRSA
King's College London/Imperial College London, United Kingdom

John.Lindberg@kcl.ac.uk

Abstract:

Radiation holds a unique position in human imagination and its invisibility to the senses, the relationship with cancer and strong emotional response elicited has made radiation a classical case in risk literature. The failure to normalise humankind's relationship with radiation - which has been especially evident during accidents – has, and will continue to lead to the loss of life, the uprooting of communities and stigmatisation of those affected. This presentation it will offer reflections on how the current post-trust, post-truth environment - which current political discourse operates within – poses significant communications challenges for the management of socio-psychological impacts of a radiation emergency. This presentation will also be exploring the considerable socio-political challenges that the normalisation of radiation would encounter, underpinned by regulatory standards and cultural narratives. It will draw upon path dependency and risk management literature to offer reflections on the barriers that would make it a considerable challenge to modify the current radiological risk paradigms, even if scientific developments would justify such an alteration. It will be shown how institutional path dependencies perpetuate the current understanding of radiation risk, even if the mitigation of said risks are considerably more damaging that the radiation itself.

Ethical challenges and implications of dosimetry and health APPs – results of a consensus workshop

Deborah Oughton[1], Charles Ess[2], Yevgeniya Tomkiv[1], Paola Fattibene[3], Sara Della Monaca[3], Thierry Schneider[4], Liudmila Liutsko[5], Vadim Chumak[6], Joan Francesc Barquinero Estruch[7], Elisabeth Cardis[5]

[1]NMBU, CERAD, Aas, Norway
[2]University of Oslo, Oslo, Norway
[3]ISS, Rome, Italy
[4]CEPN, Fontenay-aux-Roses, France
[5]ISGlobal, Barcelona, Spain
[6]NRCRM, Kyiv, Ukraine
[7]Universtetat Autonoma de Barcelona, Spain

deborah.oughton@nmbu.no

Abstrract

The SHAMISEN-SINGS project aims to enhance preparedness for and recovery from a radiation accident through development of dosimetry and health surveillance APPs to support data collection on radiation measurements, health and well-being indicators. While these tools have great potential for communicating about public health issues and fostering citizen empowerment, there are also ethical challenges. These include issues of confidentiality, use (or misuse) of big data in surveillance and changing notions of privacy. Sharing of health and dosimetry data, and linking between the two, could greatly support epidemiology and health surveillance, but also raises issues of consent and the potential discrimination of affected populations. The future is likely to bring further challenges from Artificial Intelligence and the Internet of Things.

In order to address some of the ethical challenges and implications of dosimetry and health APPs, and citizen science applications, a consensus workshop was organized in Oslo, Norway in May 2019. The workshop aimed at fostering co-reflection between natural and social scientists, authorities and other stakeholders, inviting, therefore, participation from a wide range of backgrounds, including from Ukraine, Belarus and Japan.

The workshop output includes the key ethical issues that would need to be addressed, including terms of service for prototype applications and recommendations.

Acknowledgements: SHAMISEN-SINGS is part of CONCERT. This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287 as well as the Norwegian Research Council, grant nr 263856.

Development of a mobile phone application for interactive support of residents returning after a nuclear accident

Takashi Ohba[1], Yuliya Lyamzina[1], Aya Goto[1], Michio Murakami[1], Hironori Nakano[1], Yujiro Kuroda[1], Makoto Miyazaki[1], Atsushi Kumagai[1], Tetsuya Ohira[1], Liudmila Liutsko[2], Adelaida Sarukhan[2], Koichi Tanigawa[1,3], and Elisabeth Cardis[2]

[1]Fukushima Medical University, Fukushima 9601295, Japan
[2] ISGlobal (Instituto de Salud Global de Barcelona), Barcelona 08003, Spain
[3] Futaba Medical Center, Fukushima, 9791151, Japan

tohba@fmu.ac.jp

Abstract

Purpose: Residents returning home after the Fukushima Daiichi nuclear power plant accident (FDNPP) obtained most of the information on living conditions only from local government officials and few other stakeholders. This approach however was not very effective among the concerned residents, in part due to lack of interactive support. Our aim is to develop a questionnaire together with a set of most frequently asked "question and answers" (Q&A) for a mobile phone application, based on lessons learned from the FDNPP accident, in order to rapidly implement information sharing and interact to returned residents.

Method: Our methods were the following: 1) selection of indicators to measure well-being; 2) review of different questionnaires and Q&As regarding the FDNPP accident; 3) building a concept for a new interactive application based on the lessons learned after the FDNPP accident.

Results and Discussion: The concepts developed provides information about physical activity, health condition, mental status, occupational/financial condition, and improvement of daily life conditions. Information on physical activity was taken from "Fukushima Kenmin Card". The referred questionnaire and Q&A were based on the Fukushima Health Management Survey, a booklet with basic information about possible health effects of ionising radiation, and the booklet about daily life "Kurashi no Tebiki". The proposed mobile application will target not only particularly vulnerable populations such as children, pregnant women, and elderly but will also include ethical considerations regarding the sharing of personal information between residents and stakeholders. Our results provide a possible way for local government officials and other stakeholders to work with communities and to establish an interactive support based on this new concept.

Acknowledgement: This work is supported by Research on the Health Effects of Radiation (2019-2021) organized by Ministry of the Environment, Japan. in cooperation with SHAMISEN-SINGS project.

The role of individual differences in reduction of negative consequences of nuclear accidents on health and well-being

Liudmila Liutsko[1-3], Elisabeth Cardis[1-3]
[1]ISGlobal, Barcelona, Spain
[2]UPF, Barcelona, Spain
[3]CIBERESP, Barcelona, Spain

liudmila.liutsko@isglobal.org

Abstract

Background: The main effects on mental health aspects related to the Chernobyl Nuclear Power accident (ChNPP) were listed by Havenaar and other researchers (Havenaar; Bromet & Gluzman, 2016; Yevelson, I., Abdelgani, Cwikel & Yevelson, S., 1997) with prevalence of stress and anxiety. Stress symptoms and anxiety levels were higher in residents of contaminated areas; moreover, radiation exposure was perceived to be the most dangerous compared to social and economic risks. Stress disorders had peaks due to lack of relevant information in post-accident period (1989) and after magnifying its negative consequences in reports (1993) (Yevelson et al., 1997). Parkes (1997) concluded that both individual differences and environmental together with situational factors are crucial for stress scoping styles and scores.

Method: Bibliographical review of scientific and mass media publications related to the consequences of major nuclear accidents was performed, also considering testimonies from affected populations (Chernobyl and Fukushima).

Results and Conclusions: Age, education and previous knowledge on radiation, family status (mothers with children as more vulnerable population), stress coping strategies are crucial in mediation of nuclear accidents effects on health and well-being.

Though it is difficult to make clear separation of direct radiation effects on health vs. to psychological ones; the behavioural maladaptation was observed in post-accident period, related to reaction on external influences and other individual differences that can minimize or maximize stress effects. Nuclear disasters are complex in their effects; however, both health and well-being can be improved or protected by constructive adaption to changes occurred and resilience that depend also on individual differences.

Acknowledgements
ISGlobal is a member of the CERCA Programme, Generalitat de Catalunya. ISGlobal is a part of CONCERT.

This work was elaborated during the SHAMISEN (Grant Number 604984, OPERRA (Open Project for Radiation Research Area) of the European Union Seventh Framework Programme and supported by research and training programme 2014-2018 grant agreement No 662287 (EURATOM).

Keywords: nuclear accidents; individual differences; stress; perception; health; well-being

An approach to Cost-Benefit Analysis of citizens' engagement in ionizing radiation measurements

Sonia Brescianini, Paola Fattibene
Istituto Superiore di Sanità, Rome, Italy

sonia.brescianini@iss.it

Abstract

Background. In the framework of the Shamisen Sings project, an economic evaluation of the citizen engagement in the aftermath of an accident is being performed. This paper describes the model chosen for such an evaluation and the parameters identified for the cost and benefit monetization.

Methods. The economic evaluation was performed in terms of cost benefit analysis. The estimate of costs of the proposed strategy was quite straightforward, whereas the monetization of benefits was mainly based on the literature of citizen science in environmental monitoring projects. A sensibility analysis looking at different scenarios was carried out.

Results. As far as costs are concerned, these include (but are not limited to): Staff salaries for project planning and development, coordinating and supporting volunteers, validation of collected data; storage of the collected information; citizen training for the use of the apps both for technical issues and for information interpretation; IT system development and maintenance; developing (or buying existing ones) apps for monitoring citizen's health and exposure to radiation; reimbursement to volunteers.

The evaluation of benefits focused on the benefits of: saving staff costs; reaching citizens more promptly; increasing education and skills; overcome language barriers using pictures, videos, etc.; growing sense of community; increased interest in capabilities of citizen scientists; increased credibility of government given the transparency of procedures involved; increasing health and well-being.

Conclusions. In this preliminary study a list of parameters suitable for the cost benefit analysis where taken from the scientific literature on citizen science. Further research is needed to identify costs and benefits for the specific scenarios of citizen science in ionizing radiation emergencies and to monetize them.

Funding. SHAMISEN-SINGS is part of CONCERT. This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287.

Session 5: Participation in radiological protection: from formal to informal (and back)

Chairs: *Catrinel Turcanu, SCK•CEN, Azby Brown, SAFECAST (Japan)*

Risk regulators, non-governmental organizations, radiation protection practitioners and experts are currently seeking to develop specific mechanisms to engage the active participation and ownership of relevant stakeholders in various aspects of radiological protection. Formal mechanisms comprise actions such as public awareness raising activities, workshops, or consultations, with the aim of involving a wide variety of stakeholders in the governance of radiological risks. These formalized, top-down imperatives co-exist with informal, "uninvited," or unruly forms of participation. The latter include for instance, public protests, grassroots citizen science activities, or individual actions taken up by private citizens. Such forms of participation are not well documented and generally remain under-researched – with public protests as a notable exception.

The session invites presentations from the radiation protection field, or more broadly relating to nuclear technologies, to reflect on the following and related questions: How can we identify informal participation? What is the relation between formal and informal participation? Where are the boundaries between formal and informal? How do we draw a distinction between them, conceptually and in practice? What recommendations can be drawn across these different forms of participation, with the aim of enhancing radiological protection?

Interested parties' involvement in the transposition of the BSS directive: the national experience

Eleftheria Carinou, Sotiris Economides, Costas Hourdakis, Christos Housiadas, Constantinos Potiriadis, Vasiliki Tafili
Greek Atomic Energy Commission (EEAE)

vasiliki.tafili@eeae.gr

Abstract

Interested parties' involvement is widely acknowledged as an important component of the decision-making process in radiation safety. Radiation protection policies can be successfully implemented only if they are connected with the social context.

Aim of this paper is to outline the strategic planning and the approach adopted by the national radiation safety authority, Greek Atomic Energy Commission (EEAE), during the long-term process of BSS Directive 2013/59/Euratom transposition in terms of interested parties' contribution in the formulation of the new Radiation Protection Regulations. The objective of this strategy was to ensure wide acceptance of the new regulatory framework and strengthen the trust towards the policy makers, including the regulatory body. The added value of this strategy is the successful implementation of the new regulatory framework in the country.

The main characteristics of EEAE strategy are the following:

- Timely communication of all relevant information to the interested parties in order to give their opinion through the official process that is already established in the Greek legislative platform;
- Flexibility in making room for informal participation of interested parties' involvement in favor of a win-win situation;
- Inclusiveness in defining interested parties, based on openness and equal access;
- Commitment in establishing long-term gain.

The interested parties of the national radiation protection ecosystem were invited in an unprecedented process of essential involvement. The process began in 2013 with their mapping and the identification of their characteristics; their involvement the period 2013-2018 included three main phases: information, consultation and active participation.

In the late phases of this process, the results of a safety culture survey, carried-out by EEAE, played a significant role in the final decision-making.

This work summarizes our experience in planning and acting strategically towards the interested parties' involvement in a major legislative change in Greece due to the transposition of the European BSS Directive.

Medical exposure to ionizing radiation: Communication, justification and optimization of radiological risks in dental clinics and for X-rays preventive procedures

Liudmila Liutsko[1-3], Marie-Claire Cantone[4]; Christiane Poelzl-Viol[5], Catrinel Turcanu[6]
[1]ISGlobal, Barcelona, Spain
[2]UPF, Barcelona, Spain
[3]CIBERESP, Barcelona, Spain
[4]UMIL, Milan, Italy
[5]BfS, Munich, Germany
[6]SCK•CEN, Mol, Belgium

Liudmila.Liutsko@isglobal.org

Abstract

Background: The ENGAGE project through documents and case studies, analyze the challenges related to stakeholders' involvement in the governance of risks from ionizing radiation (IR) and the application of the EUROATOM/2013 Directive in European countries. Medical exposures to IR is one out of three areas considered in the ENGAGE project. Local case studies help to observe how prescriptions and recommendations on radiological protection provided by European and national frameworks are performed in real life.

Methods: Based on a review of Internet Forums, observations (in Spain) and document analysis, this paper investigated stakeholder involvement in radiological protection and information provided to patients in the procedures: 1) in dental clinics (Spain), and 2) driving license applications (post-Soviet countries), which require breast X-ray (fluorography) for obtaining the medical revision certificate.

Results & Conclusions:

1) Despite of having career courses on IR, dental workers showed low and confused knowledge on it and on doses provided by the apparatus in the dental clinics and related health risks. This leads to their incapacity to provide relevant information to patients; neither justify or optimize the use of IR. 2) Although the processes of justification and optimization are discussed officially, the obligatory use of breast X-rays in post-Soviet countries as a prevention against of tuberculosis is still prevailed. A debate created on an Internet Forum shows how people actively discuss and search the possibility to avoid a fluorography for obtaining a drive license.

The two case studies suggest two complementary findings. In the first one, formal education proves insufficient to enable adequate communication with, and the engagement of patients, and the consistent application of the justification and optimization principles. In the second case, informal, non-institutional engagement is enacted as a reaction to the lack of engagement in formal decisions on the use of IR for driving license procedures.

Acknowledgements: ENGAGE is part of CONCERT. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 662287.

Keywords: medical exposure; X-rays, dental clinics; case studies; public information; justification; optimization; ENGAGE project

'Invited' public participation in the R&D of monitoring systems for geological disposal: critical assessment and recommendations

Axelle Meyermans
Universiteit Antwerpen – Centre for Research on Environmental and Social Change (CRESC), Belgium

Axelle.meyermans@uantwerpen.be

Abstract

Since the 'participatory turn', the non-expert public is increasingly being invited to engage in various nuclear waste management processes, including those dealing with the research and development (R&D) of advanced technologies for nuclear waste disposal. So too in the Modern2020 project in which active engagement of local citizen stakeholders in the R&D of monitoring strategies and technologies for geological disposal is formally requested upon by the project consortium. As social scientists we were called upon to both realize and evaluate these participatory initiatives. Drawing on four years of participatory observation of project interactions between local stakeholders and technical experts, the organization of various workshops in the local stakeholders' home communities, and an online Delphi survey to which all participating citizens and project participants have been invited, this paper critically assesses public engagement in monitoring R&D and aims at presenting some recommendations for local stakeholder engagement in future R&D projects.

Besides introducing the – oftentimes – wide-ranging views of local stakeholders and technical experts on why, when, how and where public engagement in monitoring R&D should be done and who it should include, we pay particular attention to how the invited, 'laboratory-like' participation (Bogner, 2012) of local stakeholders in an area in which they would otherwise remain inactive, relates to their spontaneous, yet often institutionalized, engagement in nuclear waste management affairs at home. Our preliminary results show that even though local stakeholders perceive their participation to the project to be informative and enriching, they do raise doubts as to what extent they are included as 'true partners' within the project. This not only refers to practical issues of available resources to overcome certain barriers, but also to fundamental questions of how local experiences and understandings of nuclear waste management relate and can be transferred to a European-level R&D project.

References

Bogner, A. (2012). The Paradox of Participation Experiments. Science, Technology, & Human Values, 37(5), 506-527.

Case studies of public participation in radiological protection through social media acitivities and its potential effect

Ivana Fojtíková
National Radiation Protection Institute (SÚRO), Prague

ivana.fojtikova@suro.cz

Abstract

Contemporary society is more and more interested in personal participation in decision processes regarding health and safety protection issues, including the radiation protection. Despite of the fact that the individuals of the society are often not educated and competent in these topics, they generate their own strong attitudes regardless of the information from official institutions. These personal positions are shared with others on social media, thus having a substantial impact on public opinion. Sometimes, the common sense of the public works flawlessly. Often, the disrespect to experts can lead to risky behavior in many fields, also in radiation protection. It is important to follow such instances, and where it is necessary, react quickly and communicate clearly and sensitively the controversial topic to extend the knowledge base of laypeople and avoid potential harm. Case study presenting this phenomenon is shown in the presentation.

Locally sourced: bottom-up citizen science and local governments after Fukushima

Joke Kenens[1,2] (KU Leuven, SCK·CEN), Ine Van Hoyweghen[2] (KU Leuven)
[1] Belgian Nuclear Research Centre, SCK•CEN, Mol, Belgium
[2]KU Leuven, Leuven, Belgium

joke.kenens@sckcen.be

Abstract

Under the banner "the promotion of co-created science and technology innovation" (共創的科学技術イノベーションの推進; Cabinet Office, 2015**)** the central Japanese government seeks to tap into the potential of citizen science to promote an innovation society. In the aftermath of the Fukushima nuclear accident the Japanese authorities recognized the existence of measurement activities organized by non-experts, including NGO's, schools and individuals. Guidelines were published to help citizens to improve their data quality and instruct citizens on correct measurement methods (MEXT, 2011; Ministry of Environment, 2013). Contrary to the citizen science projects encouraged by the national government, these uninvited forms of citizen participation challenge the scientific authority of formal institutions. Eight years after the accident bottom-up citizen science groups measuring ionizing radiation continue their activities in Fukushima prefecture. As these groups are initiated by local community members and operate within the Fukushima region, their identity is closely related to the local situation. In areas where decontamination is the responsibility of the local government, this context also depends greatly on the local authorities. Fieldwork conducted in the Fukushima region (February-March and November-December 2018) has demonstrated that the relation between citizen science organizations and local governments is diverse, ranging from cooperative to disruptive.
This presentation focuses on the localities of bottom-up citizen science by mapping relations of cooperation and disruption between local governments and citizen science initiatives. It wants to showcase the diversity of responses and opportunities taken by citizen science groups and local governments. The presentation builds upon fieldwork conducted in Japan and elaborates on different understandings of citizen science (Irwin, 1995), and concepts such us 'scientism', 'measuring on the margin' (Kimura, 2017).

Keywords: bottom-up citizen science, radiation measurement, Fukushima, local government

References:

Irwin, Alan (1995). Citizen Science: A Study of People, Expertise and Sustainable Development. New York: Routledge.

内閣府 (Cabinet Office) (2015). 第5期科学技術基本計画（2017-2021）(*dai go ki kagaku gijutsu kihon keikaku (2017-2021),* Eng.: Fifth Science and Technology Master Plan 2017-2021). Available at: http://www8.cao.go.jp/cstp/kihonkeikaku/5honbun.pdf.

Kimura, Aya H. (2017). Citizen Science in Post-Fukushima Japan: The Gendered Scientization of Radiation Measurement. *Science as Culture*: pp.1-24.

文部科学省(Ministry of Education, Culture, Sports, Science and Technology) (2011). 学校における放射線測定の手引き (*gakkō ni okeru hōshasen no tebiki*, Eng.: A guide to radiation measurements at schools). Available at: www.mext.go.jp/component/a_menu/.../1305069_2.pdf.

環境省 (Ministry of the Environment) (2013). 第五部 放射能濃度等測定方法ガイドライン (*hōshanō nōdo nado sokutei hōhō gaidorainu, Eng.:* Guideline concerning measurements methods of the concentration of radioactivity). Available at: https://www.env.go.jp/jishin/attach/haikihyouka.../mat02_2.pdf.

Towards improved communication and engagement with publics: Consultation about the IRPA draft guidance with the RICOMET delegates

Tanja Perko[1], Hiroko Yoshida[2], Pete Cole[3] and Roger Coates[4]
[1]Belgian Society for Radiation Protection
[2]The IRPA Task Group on Public Understanding of Radiation Risks leader, Japanese Radiation Protection Society, JHPS
[3]The Society for Radiological Protection U.K., SRP
[4]President of IRPA

Tanja.perko@sckcen.be

Abstract

International Radiation Protection Association (IRPA) is aware that risk communication in modern society should be seen as an important form of stakeholder engagement, and one that stresses dialogue and two-way communication rather than a simple provision of information. IRPA states that early engagement of relevant stakeholders should be a formal part of the early planning of any program related to radiation protection. This can be, for instance, an open and transparent discussion between doctor and patient about medical application of ionizing radiation, or engagement of authorities within a local community after an accidental contamination.

The IRPA *Task Group on Public Understanding of Radiation Risk* is setting out the **IRPA Guidance for Efficient Communication and Stakeholder Engagement** of the IRPA associated societies (AS). The guidance informs AS on why they have to communicate and engage and how they can do this. The best communication and stakeholder engagement practices plus the tools developed and used by IRPA AS are collected and shared in order to: To increase the recognition of an IRPA Associate Society as a key stakeholder in decision-making related to radiation protection; To identify the key stakeholders of IRPA AS and map possible interactions; To support AS in their development of communication and stakeholder engagement strategies; To share good practice, ideas and resource material for communication and stakeholder involvement.

During the development of these guidelines the IRPA TG has considered good practices of IRPA AS collected at dedicated workshops including RICOMET 2018, previous IRPA publications and scientific papers related to radiological risk communication, reports from a variety of organisations, as well as examples of best practice that are already being employed in similar domains around the world. The RICOMET contribution will inform delegates on the draft guidelines and consult with the conference participants about possible improvements of the guidelines in order to better support radiation protection experts in their communication and stakeholder engagement with different publics.

Participation in radiological protection – comparing and contrasting three exposure contexts

Catrinel Turcanu[1], Michiel Van Oudheusden[1], Bieke Abelshausen[1], Tanja Perko[1], Gaston Meskens[1], Christiane Pölzl-Viol[2], Nadja Zeleznik[3], Caroline Schieber[4], Tatiana Duranova[5], Liudmila Liutsko[6], Marie-Claire Cantone[7], Diana Savu[8], Catherine Fallon[9], Sylvie Charron[10], Sotiris Economides[11], Regine Gschwind[12]
[1]SCK•CEN, Belgium
[2]BfS; Germany
[3]EIMV, Slovenia
[4]CEPN, France
[5]VUJE, Slovakia
[6]ISGlobal, Spain
[7]University of Milan, Italy
[8]NIPNE, Romania
[9]University of Liège, Belgium
[10]IRSN, France
[11]EEAE, Greece
[12]Université Franche Comté, France

cturcanu@sckcen.be

Abstract

Stakeholder engagement nowadays is recognized as an essential ingredient in the governance of radiological risk. But how is stakeholder engagement achieved? Whom does it include and why? How can it inform radiological protection practices and decision making?

The ENGAGE project ("ENhancinG stAkeholder participation in the GovernancE of radiological risks for improved radiation protection and informed decision-making") set out to investigate *why*, *when* and *how* stakeholders –including wider publics- are engaged in radiological protection. ENGAGE examines in detail three fields: medical exposures to ionizing radiation, post-accident exposures, and exposure to indoor radon. These contexts differ both in terms of risk characteristics (e.g. deliberate/voluntary vs. involuntary exposure, natural vs. artificial radioactivity), as well as the justification criteria for exposure to ionising radiation.

Case studies in the three aforementioned fields help to highlight how participation draws boundaries on who should/can be involved, what the issues at stake are, and how the outcomes and processes of participation are crafted. It takes into account that invited participation by institutional actors is only one part of a more complex "ecology of participation," alongside citizen-led initiatives. The main research questions addressed in the project are: What mandates, demands, or expectations commend the engagement of stakeholders in radiological protection? What forms of real or potential engagement can be observed in practice? What is the role and potential benefit of radiation protection culture in facilitating stakeholder engagement and informed decision-making?

This contribution discusses preliminary results, based on an analysis of international guidelines and requirements, their implementation at national level and the practical experience and lessons learned from case studies.

ENGAGE (2017-2019) is part of the CONCERT project. This project has received funding from the EURATOM research and training programme 2014-2018 under grant agreement No 662287.

Session 6: Uncertainties and decision-making in the early and intermediate phases of nuclear or radiological emergencies

Chairs: *Wolfgang Raskob, KiT & Tatiana Duranova VUJE*

Decision making to protect the population in the early and intermediate phases is challenging. Uncertainties often were considered implicitly but not addressed explicitly by simulation models or decision support systems. Within ongoing research projects, uncertainty handling and decision making under high uncertainty is addressed. In this session, we intend to discuss ideas evolved so far and invite scientists and practitioners to present their view on the above defined topic.

Are we talking the same language? A systematic review on definitions and types of uncertainty in risk situations

Ferdiana Hoti[1, 2], Tanja Perko[1, 2], Peter Thijssen[2], Ortwin Renn[3]
[1] Study Center for Nuclear Energy (SCK•CEN), Belgium
[2]University of Antwerp, Belgium
[3]University of Stuttgart, Germany

ferdiana.hoti@sckcen.be

Abstract

Uncertainty can be both a perception and a message trait. A person can feel uncertain (based on results or situation) and a message can raise uncertainty (Jensen, Krakow et al. 2013). While much attention is lately drawn to the debate about whether or not uncertainties should be communicated and finding the right approach in doing so, there has been no analysis of the scientific literature related to the differences in types of uncertainties across different stakeholders. We therefore conducted a systematic overview of the scientific literature (1984-2018) on definitions and types of uncertainty in risk situations.

The main objective was to first inductively identify *which are the existing definitions and types of uncertainty in literature as well as the stakeholder category they belong to*. We then analyzed the differences amongst them as well as the impacts this discrepancy can have for uncertainty communication.

Based on the analysis of 60 peer-reviewed articles, we came to two conclusions: First, the majority of the articles is focused on the uncertainties presented by scientists and experts, and ultimately also by decision-makers, while those of the public receive much less consideration; Second, results emphasize that these stakeholders deal with very different types of uncertainties. For instance, the uncertainties of the scientists are more related to the accuracy of the results, while those of the public involve more uncertainties due to lack of trust or ambiguity.

Following these findings we argue that uncertainties, similarly to risk, are different across different stakeholder groups. Ignoring this discrepancy and focusing only on the uncertainties of the scientists goes in the opposite direction of the primary goal of uncertainty communication, namely to contribute to informed decision-making. We therefore recommend that future research shifts focus towards public's uncertainties in order to understand what information they want and need in order to make informed decisions.

Acknowledgement: This work is partially supported by the CONFIDENCE project, which received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 662287.

References

Jensen, J., et al. (2013). "Against conventional wisdom: when the public, the media, and medical practice collide." BMC Medical Informatics and Decision Making **13**: 1-7.

Uncertainties during a nuclear emergency: Observation of decision makers, affected population and emergency responders

Tanja Perko[1], Vasiliki Tafili[2], Roser Sala[3], Tatiana Duranova[4], Nadja Zeleznik[5], Yevgeniya Tomkiv[6], Ferdiana Hoti[1], Turcanu Catrinel[1]
[1]Belgian Nuclear Research Centre, SCK•CEN, Mol, Belgium
[2]EEAE
[3] CIEMAT, Spain
[4] VUJE
[5] EIMV
[6] NMBU

Tanja.perko@sckcen.be

Abstract

In order to identify uncertainties that decision makers, affected population and emergency responders may face during a nuclear emergency, this research focuses on the behavior of people involved in emergency exercises. It provides insights into the way uncertainties are addressed and handled during emergency exercises, by looking at the information flow and communication between actors, as well as the assumptions and decisions made under emergency exercise conditions. The methodological approach relies on nonparticipant observation as a technique for the systematic study of human behavior The observers recorded actual behavior under almost completely natural conditions. In order to enhance and deepen the understanding of uncertainties in emergency management, a constructivist approach has been applied with special attention to authenticity, trustworthiness, reflexivity, particularity and subjectivity (takes into account biases), and triangulation across data sources (capturing and respecting multiple perspectives). The objective was to maintain the integrity of unique cases/findings, to crystallise rather than generalize, and contribute to theory and dialogue about nuclear emergency management under uncertainties. 11 national exercises were observed in 6 countries, as well as one international exercise, with a total of 29 observation points. The observers recorded in conventional language the various behaviors of the emergency exercise participants and the conditions under which they occurred .

Results demonstrate a gap between theory and practice as well as specifics related to a nuclear emergency management. In theoretical typologies, uncertainty is usually categorized as: aleatory (ontic/ stochastic) resulting from factors which are unpredictable, random or stochastic in nature; epistemic uncertainties, caused by limited or lack of knowledge and/or information; and uncertainties due to ambiguities. However, the non-participatory observation of exercises reveals uncertainties that cannot be readily placed in the above-mentioned categories.

The following dilemmas, causing uncertainties or being caused by uncertainties have been defined: How to coordinate cross-border aspects?; Is there a gap between legislation and reality?; How will coordination among emergency response actors be achieved?; How to deal with time pressure?; How to deal with technical aspects during the early phase of the emergency (e.g. source term)?; When is the time of the beginning of the release?; Which areas will be affected?; How to decide on protective actions?; How to implement protective action?; Which protective actions to apply?; Is radiological assessment consistent?; How serious is the accident?; Are the emergency actors familiar and trained to use equipment?; Are all emergency management actors familiar with their roles, procedures and plans?; Are the available resources adequate?; How to deal with long-term consequences?; Will people follow the instructions or recommendations given?; Are social considerations taken into account

concerning emergency actors?; What is the origin of the first information?; Is the information exchange sufficient?; Which tools of information exchange are reliable?; Which factors impact information exchange?; How is information understood by different stakeholders?; Is information consistent?; Are all emergency actors informed timely?; How to communicate negligible impacts?; Is ICT reliable?; Which information is public and which should be restricted to the emergency management actors?; How will communication needs be addressed effectively?; How to interpret atmospheric dispersion and deposition maps produced by models?; etc.

Identification of uncertainties contributes to creating awareness about potential challenges and improving decision-making under uncertainty in nuclear emergencies.

Acknowledgements: We wish to thank observers of the exercises for their contribution to this research: Glesner Colin, Jantine Schröder SCK•CEN, Belgium; Dimitris Mitrakos, EEAE, Greece; Monica Dobbertin, NRPA, Norway; Jarmila Bohunova, VUJE, Slovakia; Christian Oltra, Sergi López-Asensio, Silvia German, CIEMAT, Spain.

This work has been conducted for the European project CONFIDENCE, which is part of CONCERT and received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 662287.

Approach to visualise uncertainties in decision support systems

Wolfgang Raskob, Tim Müller and Dmytro Trybushnyi
Karlsruhe Institute of Technology (KIT)

wolfgang.raskob@kit.edu

Abstract

Introduction. Decision making under high uncertainties is a challenge and requires supporting mathematical tools. Within the CONFIDENCE project, methods and tools are under development to describe uncertainties in the various phases. One key aspect that need further discussion is the visualisation of these results to decision makers and other stakeholders.

Methods. Decision support systems such as JRODOS (JAVA based real-time on line decision support) have been expanded to consider e.g. meteorological ensembles and a set of source terms to generate concentrations and doses in the vicinity of a release location. Assuming an ensemble of 20 weather realisations and the application of 3 source terms, 60 realisations will be calculated. The presentation of 60 individual results to a decision maker is not feasible. Therefore, typically probability maps are generated, indicating areas of high or low overlapping of results. In addition, indicators are under development to show the uncertainty of the result maps displayed.

Results. The visualisation of probabilities and the selection of appropriate indicators require intense discussion with all relevant actors. This paper presents ideas and first results from stakeholder communication. Visualisation schemes considered are

- Probability maps
- Probability maps of isolines exceeding a certain threshold
- Heat maps
- Uncertainty indicators based on traffic light principles
- Uncertainty indicators based on classification of consumer products

Conclusions. Visualisation of uncertainties of products from decision support tools is an important step forward in dealing with uncertainties in the decision making process. However, different users may require different schemes which complicates the visualisation process.

Acknowledgement. We want to acknowledge members of works packages 1, 5 and 6 of CONFIDENCE in supporting and facilitating the discussion with stakeholders

System design for mitigating uncertainty in citizen-based data collection

Azby Brown
Safecast, Japan

azby@me.com

Abstract

All measurement systems have inherent uncertainty. The uncertainty of most radiation measurement devices used in research and professional contexts is expected to be characterized and taken into account when evaluating results. Such expert-deployed radiation measurement systems are generally used under the assumption that false measurements due to operator error will be negligible due to the training level of the users. Citizen-directed measurement systems, such as the Safecast system, on the other hand, do not assume expert operators. Rather the goal is to design a foolproof system that can be correctly operated with a minimum of training but which provides useful and credible results. The possible additional uncertainties and sources of error this might introduce can be effectively mitigated by the application of an overall system design strategy that includes hardware checks and verification, automated anomaly detection, and trained and experienced data moderators. In addition to these, the Safecast system uses social media and discussion forums for communicating best practices, and takes advantage of repeated measurements with identical devices to improve statistical accuracy. These aspects of the Safecast system will be described, and the implications for the improvement of other radiation measurement systems, particularly in terms of minimizing operator error, discussed.

An analysis of commercial radiation measurement mobile apps for citizens' use

Paola Fattibene[1], Cinzia De Angelis[1], Sara Della Monaca[1], Cristina Nuccetelli[1], Jean Francois Bottollier-Depois[2], Francois Trompier[2], Joan Francesc Barquinero[3], Vadim Chumak[4], Liudmila Liutsko[5-7], Elisabeth Cardis[5-7]
[1]ISS, Rome, Italia
[2]IRSN, Fontenay aux Roses, France
[3]UAB, Barcelona, Spain
[4]NRCRM, Kyiv, Ukraine
[5]ISGlobal, Barcelona, Spain
[6]UPF, Barcelona, Spain
[7]CIBERESP, Madrid, Spain

paola.fattibene@iss.it

Abstract

Background. Fukushima experience has demonstrated that self-made measurements of radiation may become a part of the institutionally organized or institutionally independent citizen engagement in accident preparedness and response. With modern technologies these measurements can be performed using mobile devices and dedicated apps. The present work focused on mobile apps which convert the mobile phones camera in a radiation detector. The scope was to evaluate if these tools can be adequately used by the citizens.

Methods. A preliminary analysis of several apps developed after the Fukushima accident was performed. They were firstly tested against professional dosimeters under laboratory conditions in regards to properties such as dependence of the response on sensor temperature, battery load and exposure to visible light. Then the apps were tested in a EURADOS exercise on 15 models of mobile phones. Opinions from participants on the app use were also collected through a survey.

Results. Most developers, except two, did not keep their products up to date when the emergency period stopped. Generally, the instructions provided together with the apps were insufficient for a correct use from an untrained person. The main difficulty was found to be the ungiven or difficult-to-install calibration factors which are necessary to convert the cpm to dose. This is especially important because the knowledge of dose helps to build a general awareness of the situation seriousness. Other findings were related to: minimum detection level, erroneous filtering from visible light, and temperature changes at the sensor.

Conclusions. The findings demonstrated that various improvements are still needed to make these apps adequate for the use by a completely untrained person. Based on this analysis, recommendations for a correct use of such apps are provided. These recommendations are organized in chapters addressed to different stakeholders: app developers, citizens, and authorities.

Funding: SHAMISEN-SINGS is part of CONCERT. This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287.

Social uncertainties in the preparation and planning of the transition phase. Findings from ten national stakeholders' panels

Roser Sala[1], M. Montero[1], C. Trueba[1], García-Puerta[1]; S. Germán[1], B. Abelshausen[8]; J. Bohunova[9], M. Capucho[11], S. Charron[5], P. Croüail[2], V. Durand[5], T. Duranova[9], C. Hilliard[3], MJ. Madruga[11], M. Maitre[2], D. Mitrakos[4], O. Monteiro Gil[11], P. Nunes[10], J. Oliveira[10], I. Paiva[11], L. Portugal[10], T. Schneider[2], L. Skuterud[6], V. Smith[3], V. Tafili[4], H. Thorring[6], C. Turcanu[8], C. Twenhöfel[7], E. Van Asselt[12], P. Vaz[11]
[1]CIEMAT – Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas, Madrid, Spain.
[2]CEPN – Centre d'étude sur l'Evaluation de la Protection dans le domaine Nucléaire, Fontenay-Aux-Roses, France.
[3]EPA – Environmental Protection Agency, Dublin, Ireland.
[4]EEAE – Greek Atomic Energy Commission, Athens, Greece.
[5]IRSN – Institut for Radioprotection and Nuclear Safety, Fontenay-Aux-Roses, France.
[6]DSA – Norwegian Radiation and Nuclear Safety Authority, Østerås, Norway.
[7]RIVM – Rijksinstituut voor Volksgezondheid en Milieu, Bilthoven, The Netherlands.
[8]SCK•CEN – Belgian Nuclear Research Centre, Mol, Belgium.
[9]VUJE – VUJE a.s, Trnava, Slovak Republic.
[10]APA – Agência Portuguesa do Ambiente, Amadora, Portugal.
[11]IST-C2TN – Instituto Superior Técnico, Centro de Ciências e Tecnologias Nucleares, Lisbon, Portugal.
[12]RIKILT – Institute of Food Safety, Wageningen University & Research, Wageningen, The Netherlands.

roser.sala@ciemat.es

Abstract

Background: In the course of a nuclear emergency, the transition phase presents particular challenges that require coordination among the authorities and other involved stakeholders. In the framework of WP4 of CONFIDENCE project, stakeholders' panels were organized to obtain stakeholders' views and preferences regarding the preparedness and response during the transition phase. The ultimate goal was to improve preparedness and response of this phase.

Methods: Stakeholders' panels were organized in ten different countries (France, Spain, Ireland, Greece, The Netherlands, Norway, Belgium, Slovakia, Portugal and Norway) and relevant stakeholders of each country were involved. The methodology consisted in a semi-structured protocol of discussion that included a table-top exercise, simulated scenarios and different problem structuring methods. The main topics of discussion were the challenges and critical aspects of the transition phase as well as the main uncertainties. Panel members met once or twice at the national level to discuss about the proposed topics.

Results: The qualitative analysis of the discourses from the panel meetings allowed obtaining a very broad view of all aspects of interest for a better planning of transition phase. The specific analysis of uncertainties pointed out that there are several important uncertainties in the transition phase. Most of these uncertainties appeared in the different studied countries, so there seems to be something common beyond the different national contexts. These uncertainties can be classified in different ways. According to the French et al. approach, they can be mainly classified as uncertainties related to ambiguities and socio-ethical uncertainties.

Conclusions: Social aspects play a relevant role in the management of the transition phase and should be taken into account when planning and preparing it. The more and better we can consider and assess all these uncertainties when preparing the plans and strategies for the recovery, the better decisions will be taken.

Aknowledgements: This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287.

Involvement of French stakeholders in the decision-making process in the context of uncertainties – Themethodological approach

Vanessa Durand, Mélanie Maître, Pascal Croüail, Sylvie Charron, Sylvain Andresz, Thierry Schneider
IRSN, France

vanessa.durand@irsn.fr

Abstract

The European Research Project CONFIDENCE[1] WP4, aims to identify and reduce uncertainties which could emerge in decision making processes, in order to improve the preparedness and response during the early and transition phases of a nuclear accident. To that end, stakeholder panels have been set up in different European countries. In France, a panel has been created gathering several decision makers involved at the national and local levels of the French postemergency responsemanagement system. In this context, this paper aims to present the overall methodology implemented to identify and challenge the uncertainties in the decision-making process during the early and the transition phases.

Two panel meetings have been organised by IRSN and CEPN in 2018. The first one focused on the emergency phase. The objective was to understand and evaluate how decision-makers are making decision in such a context of uncertainty. The second meeting focused on the transition phase. The aim was to assess the influence of prior decisions made during the emergency phase over the medium to long term. During both meetings, the panel focussed on two protective actions: i) the evacuation and temporary relocation of populations and, ii) the restrictions on food consumption and distribution.

To consider the inherent uncertainties about a real situation, the methodology introduced a fictitious nuclear accident at the French Dampierre NPP. The idea was to consider proposals made by CONFIDENCE WP1 team who provided a set of maps for several forecast periods -output from dispersion simulation models - which represented the probability of exceeding different threshold criteria. For the first panel meeting, WP1's outputs were presented together with other maps highlighting socio-economic issues of the (affected) territory. For the second meeting, a synthetic map of "real measurement data" provided by WP1 showed the differences between forecast data available during emergency andmeasurements data.

The results of this study will be detailed in the presentation of M. Maître *et al.*[2].

[1] This project has received fundings from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 662287.
2 M. Maître *et al., Involvement of French stakeholders in the decision-making process in the context of uncertainties – Presentation of the Results.*

Involvement of French stakeholders in the decision-making process in the context of uncertainties – Presentation of the results

Mélanie Maître, Vanessa Durand, Pascal Croüail, Sylvie Charron, Sylvain Andresz, Thierry Schneider
IRSN, France

melanie.maitre@cepn.asso.fr

Abstract

In the framework of CONFIDENCE[1] WP4, a French panel has been created gathering several decision makers involved at the national and local levels of the French post-emergency response management system in order to identify and evaluate uncertainties which could emerge in decision making processes. Based on the methodology presented by V. Durand et al.[2], this paper aims to present the results of the work conducted with the French stakeholders' panel.

Both panel meetings have clearly highlighted the following findings and outputs: i) displaying the evolution of the situation over time is confirmed to be useful for decision-makers; ii) beyond radiological issues, decision-makers need various information, notably geographical and socioeconomical ones; iii) the fact that the transition from emergency to post-accident phases is a challenging period; iv) ownership of the decisions will not rely only on local level, but would also be a political challenge at national or international levels. Besides these elements, panel meetings allowed to identify and highlight various types of uncertainties which have been classified according to S. French et al.[3]. Indeed, the highlighted uncertainties are whether associated with the production of information (modeling, field measurements, etc.) or with the use of information (related to the decision itself, to its implementation and governance, social and economic uncertainties, etc.). Transversal issues, such as the support of information to be delivered to the decision makers which have also been emphasized, will also be presented.

Based of these lessons learned, some guidelines and recommendations will be discussed with the stakeholders panel next June, especially to see how to improve the preparation of the decision making processes management. These elements will be detailed in the last part of this presentation.

[1]This project has received fundings from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 662287.
[2]V. Durand et al., Involvement of French stakeholders in the decision-making process in the context of uncertainties – The methodological approach.
[3]S. French et al., The Various meanings of uncertainty.

Evacuation in case of a nuclear power plant accident – some ethical considerations

Friedo Zölzer
Faculty of Health and Social Sciences, University of South Bohemia in České Budějovice,
Czech Republic

zoelzer@zsf.jcu.cz

Abstract

Although the probability of a nuclear power plant accident in the Czech Republic is considered to be extremely low, authorities and citizens have to be prepared. An important part of emergency preparedness is the provision of clear guidelines for the possible evacuation of people from areas of radioactive contamination. In this context, different types of questions need to be addressed: What are the health risks that people remaining in a contaminated area would have to face? When are people to be evacuated, i.e. which radiation levels warrant action? Who is to be evacuated first, i.e. which groups, if any, should take precedence? What are the ethical principles that determine the when and who? This latter question is addressed here. The paper looks at the guidance given by the relevant public documents and identifies a number of ambiguous and contradictory points. It recommends that decision-makers are provided with additional information and are made aware of the ethical aspects of their decisions. It suggests that classical ethical theories such as utilitarianism and deontology can be taken into consideration, but that in an age of globalization a cross-cultural approach may be more appropriate.

Epistemological analysis of uncertainties linked to the conception and the use of models in environmental assessment.

Gauthier Fontaine
IRSN, France

gauthier.fontaine@irsn.fr

Abstract

Assessment of radiological contamination impact in the early, intermediate and long-term phases after a nuclear accident mainly relies on the use of models and simulations. Nowadays, numerous models, projects or platforms about the dispersion forecast or the impact of radionuclides on the biosphere exist. The Fukushima Daiichi accident gave the opportunity to validate these models in different ways to assess the consequences of a radioactive release. Taking an approach stemming from philosophy of science, this work aims to study the processes of designing and using models to assess post-accidental contamination in this very specific context.

Using the IRSN archives, IAEA technical reference documents and interviews with researchers and experts, we aim to achieve a genealogy of post-accidental contamination models, considering the many conceptual or institutional issues at stake, in order to understand the evolution factors, may they be external (accidents, experimental projects) or internal (conceptual drifts, misuse).

Through the analysis of some crucial but controversial parameters such as the distribution coefficient (which quantifies the mobility of radionuclides in soils), we focus in this presentation on the various difficulties encountered in the assessment of radionuclide transfer to the environment, the associated uncertainties, the induced representativeness of models, and the different ways to tackle these issues. The brief history of this coefficient depicts diverse approaches adopted by modelers when the expected results do not match with reality, depending not only on both scientific and practical arguments, but also on philosophical and institutional positions, that have to be made explicit in order to solve the conceptual problems that can arise.

Safety and Security Interface of RPMs use to Broaden Radiological Protection in Albania

Dritan Prifti[1], Charles Massey[2], Elida Bylyku[1], Brunilda Daci[1], Kozeta Tushe[1],
[1]Institute of Applied Nuclear Physics, Tirana, ALBANIA.
[2]International Atomic Energy Agency, Vienna, Austria

berati77@yahoo.com>

Abstract

The basic law for radiation protection in the Republic of Albania is Law no. 8025, dated 11.01.1995 "On protection against ionizing radiation" amended No. 9973, July 28-th 2008 , which establishes basic safety standards to protect health of workers and the general public environment against the dangers arising from the ionizing radiation.

In support of safe radioactive material transport oversight, a Memorandum of Understanding (MOU) has been signed by the Albanian General Custom Directorate (GCD and the Institute of Applied Nuclear Physics (IANP). IANP is responsible for the safe and secure management of radioactive waste and DSRS at the national level, and is involved in the detection and management of unauthorized radioactive material shipments.

To address the security risks associated with illicit trafficking of nuclear and other radioactive materials out of regulatory control, Albania has undertaken significant effort to equip the main border points (BPs) with radiation portal monitors (RPMs). While the main purpose of the RPM at the different BPs in Albania is related to nuclear security and the detection of illicit trafficking of nuclear materials, the RPMs can serve other vital safety roles. First, the RPMs can detect unauthorized shipments of radioactive materials and their transit through Albanian territory, thereby increasing the radiological protection for the people and the environment. Secondly, the RPMs can detect consumer goods, such as food stuffs, that may be contaminated with radioactive materials above safety/regulatory limits. Considerable IAEA support has been provided to Albania in relation to border monitoring and illicit trafficking.

This paper will discuss the present situation on safety and security interface of radioactive materials in Albania, in respect to the current management practices and regulatory control for the safety and security of both authorized and unauthorized radioactive material shipments.

Keywords: Security of Radioactive Materials, Radiation Portal Monitors, Standard Operating Procedure.

Human Factors Engineering - An Overlooked Aspect in Specifications for Radiation Detection Equipment's

Kozeta Tushe[1], Charles Massey[2], Dritan Prifti[1], Elida Bylyku[1], Brunilda Daci[1], Merita Kaceli Xhixha[3]
[1]Institute of Applied Nuclear Physics, Tirana, ALBANIA.
[2]International Atomic Energy Agency, Vienna, Austria
[3]University Aleksandër Moisiu Durrës, Faculty of Professional Studies, Albania

kozetabode2002@yahoo.ca

Abstract

This paper will provide an overview of an ongoing study that addresses some aspects of analysis on the form factor and weight of radiation detection equipment. From experience in using radiation detection equipment in the field, an often overlooked aspect for design is the actual weight, form factor, and other human factor use attributes. In some cases performance (detection sensitivity, battery life, etc.) of the instrument has been sacrificed to reduce weight. The use of equipment under field conditions should match the detection needs and physical capabilities of the expected users.

Since 2016 Albania has participated in a Coordinated Research Project (CRP) J02012 "Advancing Radiation Detection Equipment for Detecting Nuclear and Other Radioactive Material out of Regulatory Control" organized by International Atomic Energy Agency. Starting in 2018, the Institute of Applied Nuclear Physics has been collecting data from a large number of research experiments examining different form factors and weights of radiation detection equipment under various use conditions. This paper provides the results of the preliminary review for factors, including but not limited to, holding time, angle of holding, sex, age, weight, height, and form factor of instrument (weight distribution).

The results of the experiments are providing important results that could be used when specifying radiation detection equipment for field operations. These results show, for example, the increases in weight that can be tolerated for certain measurement conditions. This is important to understand as the weight is typically directly correlated to the detector "size" and its sensitivity. If for short periods of time a heavier and much more efficient instrument gives a usable "reading", this would inform specifications better than some standard recommendations that result in a light instrument which perhaps be held up longer but never provides a result.

Keywords: Radiation Detection Instruments, Equipment Specifications, Research Experiments

Session 7: The art and culture of radiological protection

Chairs: *Susan Molyneux-Hodgson, University Of Exeter & Michiel Van Oudheusden, SCK•CEN*

This panel observes radiological protection through the lenses of creative and oral history, multimedia art techniques, visual representation, film, photography, sculpture, and sensory experiences other than the visual. Bringing together artists and researchers from across and beyond the nuclear sciences and technologies, its aim is to provide a vibrant and dynamic setting for wide-ranging transdisciplinary research and lively debates on the following questions:

- How do artists and creative scholars engage with radiological protection?
- What can radiological protection research learn from art and film – and vice versa?
- What types of discussion emerge from these narrations and representations, and how are they similar to, and different from, those initiated by conventional research publications, such as academic texts?
- Which approaches, methods and theories are most generative for research in/on radiological protection?

We invite creative presentations, such as documentaries, soundtracks, and multisensory interactive methods that engage with one or more of the above questions and open space for joint consideration of the art and culture of the radiological.

Application of accessible popular culture and fine art languages to social comunication in Japan after the Fukushima NPP disaster

Azby Brown
Safecast, Japan

azby@me.com

Abstract

Japanese society responds well to information conveyed in the familar and accessible forms of popular culture, such as manga and anime, as well as to emotionally evocative works of art. *Manga* cartoons, which are nearly ubiquitous in Japan, have been effectively deployed for decades as entertainment, but also to communicate and educate about complex issues, from science to history to economics. It is not surprising that they have played a role in communication efforts following the March 2011 Fukushima NPP disaster. Notably, this visual language has been utilized for social communication by both government and those opposed to government policies, with the products generally appearing very similar despite their divergent messages. On the government side, notable efforts include pamphlets and other visual material intended to inform the public about decontamination policies and procedures. On the critical side, citizen groups involved in food monitoring and related activities have produced risk-communication material in the form of *manga*. Seen togther, such efforts exhibit a surprisingly coherent design language. On the other hand, to date the most notable efforts at conveying the impacts of the Fukushima disaster in a fine art context have generally sought to communicate more ambiguous emotional responses to the disaster and its consequences with little pretense to conveying actual information. These have nevertheless generally formed critiques of official policies and actions and highlighted the sense of risk. Efforts include well-received exhibitions of artwork by Japanese and international artists placed inside the Fukushima exclusionary zone, “guerrrila” style interventions in public space, and art exhibition components of anti-nuclear conferences. These developments will be presented and their relationships and impacts discussed.

Kuannersuit; Kvanefjeld - a film-based exploration into the development of the Kvanefjeld mine and the questions it poses about long-term decision-making in Greenland

Lise Autogena
Sheffield Hallam University, United Kingdom

L.Autogena@shu.ac.uk

Abstract

Kuannersuit; Kvanefjeld (2016) by Lise Autogena and Joshua Portway is a film-based exploration into the development of the Kvanefjeld mine in South Greenland and the questions it poses about long-term decision-making in Greenland.The film was commissioned for Nuclear Culture, a research programme that explores how contemporary art may inform a wider international debate on nuclear issues. It was exhibited in *Perceptual Uncertainty/ Contemporary Art in the Nuclear Anthropocene* at Bildmuseet in Sweden in 2016 and has been touring international museums and film festivals. The film portrays a Greenland divided on the issue of uranium mining at Kvanefjeld, one of the largest deposits of uranium and richest rare earth mineral resources in the world, located in the middle of an extraordinary cultural landscape, where small- scale farming has provided Greenland's only agricultural industry for generations. The pristine nature, eco-tourism and traditional ways of living from the land and the sea in this region may be threatened by Chinese/Australian investments in the Kvanefjeld mine, which is expected to become one of the largest uranium and rare earth extraction operations in the world. The development of the mine represents a pivotal moment for Greenland, which could radically impact on the economic, social and cultural fabric and entire sense of identity of Greenlanders - however the fast-track exploitation of mineral deposits is seen by many in Greenland as the only viable route to gain national independence from Denmark.

The film portrays conflicting issues of progress and inclusive and informed decision-making, and examines the difficult decisions and tradeoffs faced by an indigenous culture seeking to escape a colonial past to define its own identity in a globalised world.

From tragedy to comedy: Comparison of Holocaust and Chernobyl reflection in movies

Sergii Mirnyi
"CHERNOBYL TOUR", Chernobyl Tourism Association, Ukraine

s.mirnyi@gmail.com

Abstract

Why now, 33 years after the Chernobyl Disaster, the world film industry has failed to produce a movie, which matches in its scope and cultural value to the scope and cultural importance of the event? – The presentation strives to answer this question, comparing the Chernobyl case with that of the Holocaust, the latter being viewed as an arguably most developed, mature case of artistic treatment of mass-traumatic event of global importance.

The answer to the question appears to be located in several domains:

- Novelty of the phenomenon (global radiation accident and its aftermath exhibited more new features than the industrialized, streamlined version of already well-known phenomenon of genocide)
- Multidisciplinarity (comprehension of Chernobyl requires much more – and much more diverse – knowledge than that of Holocaust)
- Immediate post-accident history of the region affected (Europe revived after the Holocaust and WW2 while the Soviet Union and 'socialist' block in Central and Eastern Europe collapsed after Chernobyl and the Soviet Union disappearance; this severely limited the resources available for artistic reflections of the event)
- Relatively short time interval after the event in case of Chernobyl.

Comparison of the evolution of the movies on Holocaust with those on Chernobyl helps understand the present stage of Chernobyl artistic reflections, and suggests benign, psycho-curing approaches to new movie productions about the large-scale radiation accident.

タイトル：僕の見た福島
Fukushima through my eyes

Shuji Akagi
Shirakawa-asahi high school, Fukushima, Japan

akagishuji@gmail.com

Abstract

簡単な説明：福島市在住の高校教員が、事故直後から記録として撮り続けた写真をもとに、実際に身の回りで起きた現象について考察します。
A school teacher, who resides in Fukushima city, reflects on the events that took place around him. His reflections are based on pictures, continuously taken since the Fukushima nuclear accident, as records of the event.

要旨：事故後、国から避難指示が出たのは福島第一原発から北西に45km付近までである。直線60kmの距離にある福島市は、人口30万人の県庁所在地である。福島市は避難指示地区と同じ数値が計測されたにもかかわらず避難指示は出されなかった。その街で、人々がどのように行動したか。講演者本人が、配偶者と、直属の上司とどのように衝突したか。行政が、市民がどのように原発事故に反応したか。一個人の足取りをたどり、70万枚を超える記録写真の中からスライドにしながら考察します。
After the accident the evacuation order from the Japanese government stretched up to 45km northwest from the Fukushima Daiichi nuclear power plant. Fukushima city, 60km from the power plant, has a population of 30,000 people and harbors the prefectural government. Although the same levels of radiation were found in Fukushima city as in the areas designated as evacuation sites, the city did not fall under the evacuation order. How do people live in such a town? How did the presenter clash with his wife and with his superiors? How did the government and citizens react to the nuclear accident? Following the footsteps of an individual, I will consider these issues in a presentation of documentary photographs, selected from over 700, 000 pictures.

Ethics Beneath the Surface. A short documentary about radioactive waste management

Behnam Taebi, Kristine Steenbergh, Katie Crook and Kaweh Modiri

Delft University of Technology, The Netherlands

B.Taebi@tudelft.nl

Abstract

This project is a science-arts collaboration project. Its aim is to create public awareness of the ethical issues surrounding nuclear waste disposal. We intend to make a ten-minute documentary film focusing on Belgium and the Netherlands. With the film we aim to open public discussion on this key matter and create a format useful to policy makers as well. We intend to explore issues such as responsibility, intergenerational aspects, the impact on environment and more.

For instance, in making decisions about technological developments, we need to factor in the long-term technical uncertainties but also the *ethical uncertainties*. That is, technical advancements or societal changes can render a decision acceptable at the moment of decision-making, but be ethically indefensible at a later stage. Our perception of intergenerational justice, our responsibilities towards present and future generations as well as the levels of radiation exposure we find to be acceptable to humans, animals and the environment could change throughout time.

We plan to make this film in Borssele (COVRA, NL) and Mol (HADES, BE). We would like to make an artistic and thought-provoking ten-minute mini documentary on the ethical and social dilemmas that go into making the decision of where and how to bury nuclear waste. We think the images of the sites for nuclear waste (desolate, remote) in the labs, along with those of offices (small, busy) where policies are decided makes for a fascinating visual juxtaposition. We will not just have talking heads, but have the interviewees working, going about their business as they speak to us. Post production will be an important part of the process – it's here that we package the film so that it looks professional, informative and palatable to both the public (our key focus) and policy makers. Creating an exhibition strategy during these months will also be crucial to opening the public debate.

Ways of not forgetting: Japanese citizen scientists' artistic responses to the 2011 Fukushima disaster

Michiel Van Oudheusden, Joke Kenens, Hans Boeykens
Belgian Nuclear Research Centre, SCK•CEN, Mol, Belgium

Michiel.van.oudheusden@sckcen.be

Abstract

Eight years after "3/11," Japan is still coming to terms with the human, environmental, and economic damage wreaked by a deadly earthquake, devastating tsunami and multiple meltdowns at the Fukushima Daiichi nuclear power plant. Whereas some officials in Japan call to put the memories of these disaster to rest, various groups in Japanese society vow never to forget what happened. The latter include local community residents, who to this day monitor radioactivity in the affected areas and communicate about environmental risks. These citizen scientists, as they are sometimes called, use artistic techniques and communication tools (posters, pamphlets, brochures, cartoons, and theatrical art) to convey how radiation has penetrated the everyday lives of citizens, and urge residents to share their experiences in dealing with the effects of radiation from the disaster. In this presentation, we bring into focus these artistic representations and link them to longer traditions of Japanese art culture, including *manga* and the cuteness aesthetic known as *kawaii*. In homage to these traditions, we deploy the burgeoning science-art format known as the cartoon abstract, which transforms academic research into a visually appealing cartoon strip (http://explore.tandfonline.com/page/est/cartoon-abstracts). Our aims are to: 1) acknowledge the value of intimate and imaginative knowledge in the context of long-lasting exposure to radiation, and 2) open up a dialogue among artists, citizens, and scholars who share a normative commitment to *not forgetting*.

Keywords: Art, Cartoon abstract, Citizen science, Fukushima disaster, Japan, Radiation.

Colored X-rays

Arie van ’t Riet

vantrietarie@gmail.com

Abstract

As a medical physicist, involved in the teaching program for radiographers, in the skills lab sometimes I challenged the students to x-ray a thin leafed flower. For me this was the starting point of my x-ray radiography of nature. Later on I specialized in the x-ray radiography of biorama's, a scene made up of animals, plants and flowers. The x-ray images are not made in the hospital. In my studio I have my own x-ray equipment with a licence to x-ray the biorama’s. The animals are dead. In my opinion it is not justified to expose living animals to the risk of x-rays for my purpose. Images are not composed from different layers. It is not assembled from different x-rays. The complete biorama is built, and x-rayed in one session as a whole. Equipment used and x-ray techniques applied to realise these images will be discussed. As well as radiation safety aspects. A number of images will be discussed in detail, to explain dedicated techniques to realise specific effects, to reflect on disappointments and to philosophize about future projects.

Session 8: Radiation protection culture

Chairs: *Chairs: Caroline Schieber, CEPN & Christiane Pölzl-Viol, BfS*

The development of RP culture aims at favouring better decision-making processes regarding the management of exposure situations. RP culture is also essential for a better understanding by the relevant stakeholders of the issues at stake and their own involvement in the protection actions. This session invites presentations dealing with the characterisation of RP culture, the tools and methods contributing to its dissemination according to the types of stakeholder as well as methodologies to evaluate the level of RP culture.

Identification of mental models of uncertainty management in emergency situations

Sergi López-Asensio[1], Nadja Zeleznik[2], Roser Sala[1], Silvia Germán[1], Christian Oltra[1], Ludger Benighaus[3], Tatiana Duranova[4], Vasiliki Tafili[5]
[1]CIEMAT
[2] EIMV
[3]DIALOGIK
[4] VUJE
[5] EEAE

Sergi.Lopez@ciemat.es

Abstract

Background: A study on mental models of uncertainties management in emergency situations was carried out in five European countries (Germany, Greece, Slovakia, Slovenia and Spain) in the framework of the European project CONFIDENCE (COping with uNcertainties For Improved modelling and DEcision making in Nuclear emergenCiEs). This study uses the mental models approach to understand citizens' cognitive representations of nuclear or radiological emergency.

Methods: In each of the five countries, between 15 and 20 interviews were carried out with people living in zones affected by nuclear emergency plans. The total sample was 82 lay citizens. The interviews were audiotaped and transcribed in their original language. The list of codes was derived deductively from the interview protocol and inductively from the discourse of the participants. Cmap Tools software was used to draw the mental model map.

Results: Participants had a general idea about the basic elements of the emergency plan, but only vague knowledge of the specific protective measures. Particularly, we found different ideas about sheltering and a general lack of information about the iodine prophylaxes. Interviewees differentiated two possible situations: a major accident, a situation linked to a fatalistic belief that nothing would help; and a minor accident, associated by participants to radiation contamination and a higher effectiveness for the emergency plan. The main uncertainties identified were what to do, where to go, and how would they be informed.

Conclusions: Radiological emergency plans should consider risk perception, knowledge and understanding of official instructions and trust in information among the affected population.

Acknowledgements: This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287.

Radiation protection culture in practice: Insights from people's behaviour in areas contaminated by the Chernobyl and Fukushima accidents

Liudmila Liutsko[1-3], Takashi Ohba[4], Aya Goto[4], Yuliya Lyamzina[4], Koichi Tanigawa[4], Paola Fattibene[5], Sara Della Monaca[5], Natallia Novikava[6], Vadim Chumak[7], Mélanie Maître[8], Pascal Croüail[8], Thierry Schneider[8], Yevgenia Tomkiv[9], Deborah Oughton[9], Sylvie Charron[10], Philippe Pirard[11], Adelaida Sarukhan[1], and Elisabeth Cardis[1-3]; SHAMISEN SINGS Consortium
[1]ISGlobal, Barcelona, Spain
[2]UPF, Barcelona, Spain
[3]CIBERESP, Barcelona, Spain
[4]FMU, Fukushima, Japan
[5]ISS, Rome, Italy
[6]ISEI-BSU, Minsk, Belarus
[7]NRCRM, Kyiv, Ukraine
[8]CEPN, Fontenay-aux-Roses, France
[9]NMBU, Oslo, Norway
[10]IRSN, Fontenay-aux-Roses, France
[11]Santé Publique France, Saint-Maurice, France

Liudmila.Liutsko@isglobal.org

Abstract
Background: Lack of knowledge on health effects of radiation, and poor radiation protection culture (RPC) regarding daily life behaviors can lead to a higher risk of external and internal radiation exposure among populations living in contaminated areas. One of the goals of the stakeholders' survey carried out by the EU-funded SHAMISEN SINGS project, was to evaluate the stakeholders's general knowledge on ionising radiation, identify through which sources they obtained such information, and assess awareness through their daily life behavior in order to improve the radiation protection culture.

Methods: The SHAMISEN SINGS stakeholders' survey was performed during 2018 in several European countries and Japan. The participants (N=122) residing in areas contaminated by the previous nuclear accidents were asked about their usual behavior with regards to consumption of local wild products and open air leisure activities (fishing, going to forest). The data were analysed with aim to evaluate knowledge of ionizing radiation and practice of radiation protection culture among this population.

Results: The results showed that, despite of the higher overall knowledge level of responders in areas contaminated by previous nuclear accidents, a small percentage (5%) still did not know what ionizing radiation is. A high percentage of residents of contaminated areas did not follow radiation protection recommendations with regards to fishing, picking wild products, etc. Some slight differences in behavior were observed between groups depending on their country of residence.

Conclusions: The results reflect the practical application of radiation protective behavior among people residing in radionuclide-contaminated territories as consequence of previous nuclear accidents. They show a necessity to make information more accessible about ionizing radiation and its possible risks on human health and RPC in a daily life. Complementary assessment on risk awareness and perception would be also helpful to understand the people's behavior in general.

Acknowledgements: SHAMISEN-SINGS is part of CONCERT. This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287.
Keywords: nuclear accidents; radiation protection culture; risk awareness; human behavior; SHAMISEN SINGS project

A citizen science approach for dose rate mapping in a contaminated territory: dose rate results, analysis of participants' comments and perspectives

Jean-Marc Bertho[1], Mélanie Maître[2], Pascal Crouaïl[2], Andreï Mostovenko[3], Marie Simon-Cornu[4].
[1]IRSN, PSE-SAN/SESANE, laboratoire de radiobiologie et de radiotoxicologie expérimentale, Fontenay-aux-Roses, France.
[2]CEPN, Fontenay-aux-roses, France
[3]Research Institute of Radiology, Gomel, Belarus
[4]IRSN, PSE-ENV/SEREN, Cadarache, France

jean-marc.bertho@irsn.fr

Abstract

In the framework of the TERRITORIES European project, a map of the ambient dose rate of a village, at the edge of the Chernobyl exclusion zone, was made using the OpenRadiation system (www.openradiation.org) by schoolchildren aged 14-17. During a first meeting with the children the functioning of the system was explained and children stared to measure the next day. No specific instructions were given, excepted to avoid taking risks and to describe as possible the way the measurements were made. Children appropriate very rapidly the measurement system since 80 measurements appeared in four days on the map of the web site, and 645 measurements were made in one month.

The measured dose rates were not that much different in the Komaryn village as compared to other places in the world, and especially in France. This showed that the radiological situation in the village is safe. However, some hot spots were identified. Moreover, since all measurements were tagged with GPS positioning, id of the participant and tags provided by the system, it was possible to analyze the way each participant organized the measurements. Results clearly demonstrate gender differences in the way the measurements were organized. Thereafter, on the basis of a questionnaire, it was possible to define more precisely their expectations and feeling with the use of the OpenRadiation system. This showed that they wish to share their measurements and to discuss them with other users of the system. Moreover, they indicate that this experiment allowed us to regain control on their environment. This study demonstrate that even 30 years after the Chernobyl accident, the population already have concerns about the radiological quality of their environment, which in turn asks for the methods to be used to maintain the awareness in a post-accidental situation on the long term.

Integration of soft skills, employability skills and SDG's in radiation protection: the Erasmus+ project 'train the future trainer'

Wouter Schroeyers[1], S. Schreurs[1], D. Mostacci[2], L. Tinova[3], J. Rodenas[4], S. Soares[5], U.W. Scherer[6], S. Economides[7], J. Camps[8], S. Pepin[9], M. Hult[10], G. Mulier[11], H. Schweickert[12], I. Gerardy[13]

[1]UHasselt, CMK, Faculty of Engineering, Nuclear Technology, Agoralaan Building H, 3590 Diepenbeek, Belgium
[2] Alma Mater Studiorum- Università di Bologna, via dei Colli 16, 40136 Bologna, Italy
[3] Czech Technical University, Zikova 4, CZ 166-36 Prague 6, Prague Czech Republic
[4] Universitat Politecnica de Valencia, Camino de Vera, 46022 Valencia, Spain
[5] Universitade de Beira Interior, Convento de Santo Antonio, 6201-001 Covilha, Portugal,
[6] Hochschule Mannheim, Paul Wittsack strasse, 68163 Mannheim, Germany
[7] Greek Atomic Energy Commission (EEAE), at Patriorchou & Neapoleos, PO 60092,Agia Paraski, Athens, Greece
[8] Institute for Environment, Health and Safety, Belgian Nuclear Research Centre (SCK•CEN), Mol, Belgium
[9] Federal Agency for Nuclear Control, Brussels, Belgium
[10] JRC-Geel, European Commission, Geel, Belgium
[11] Tecnubel, ECS, Transnubel (Groupe Engie) Belgium
[12] Zyklotron AG Karlsruhe, Germany
[13] HE2B-ISIB, Laboratory of Radiation Physics, , Rue Royale 150, 1000 Bruxelles, Belgium

wouter.schroeyers@uhasselt.be

Abstract

Integrating the Sustainable Development Goals (SDGs) in radiation protection culture can deepen and strengthen its implementation. In this framework, generic SDGs related skills and soft skills, are becoming of increasing importance for engineers and scientists in the nuclear field and are of great importance for implementing radiation protection culture in practice. However, these skills are barely covered in the regular radiation protection training curricula.

In October 2018 a new Erasmus+ strategic partnership 'Train the future trainers in nuclear technology and radiation protection' was launched by the Cherne network in collaboration with several industrial partners. In the partnership, e-learning modules and on-site training modules in radiation protection and radioecology, developed during a previous Erasmus+ strategic partnership (2015-2017), are expanded with a dedicated approach aimed at **integrating SDGs and soft skills in the training modules.** The new approach incorporates among others work floor learning, professional job training, e-coaching and an SDG workshop as blended learning activities.

Three training schools 'Nuclear reactors and waste management', 'Environmental radioactivity', and 'Radiochemistry and medical dosimetry' are organised in the spring of 2019 using this new methodological approach in close collaboration with all academic and associate partners. In the presentation the implementation of the new methodology and experiences gathered from these training schools are presented. The focus of the presentation will be on options for integrating SDGs in radiation protection: activities from the training schools serve as examples how this can be achieved in radiation protection training.

Exploring societal perception and safety culture of radiation in Greece

Vasiliki Tafili, Eleftheria Carinou, Efthymios Karabetsos, Christos Housiadas
Greek Atomic Energy Commission (EEAE)

vasiliki.tafili@eeae.gr

Abstract

In an attempt to map the radiation protection culture prevailing in Greece, the Greek Atomic Energy Commission (EEAE), the national regulatory competent authority for radiation safety, conducted for the first time a study of both public and professionals opinion in the field of radiation protection. The "terra incognita" of public attitudes and knowledge about radiation and risk perception was explored through a nationwide quantitative study. Elements of the societal perception of radiation along with attitudes towards popular uses of radiation, nuclear energy and radioactive waste management were investigated. In parallel, the aspects of safety culture among professionals were explored by means of a qualitative survey based on in-depth personal interviews.

The outline of the main findings of this two dimensional study includes the following:

- On average, the Greek people seem to be highly concerned about radiation; this concern is mainly related to the electromagnetic fields, the radioactive waste management, as well as the potential risk from nuclear accidents abroad. The findings also indicate lack of trust to the competent authorities, as well as a quest for more information.
- From the group of the professionals it is shown that safety comes up as a self-evident prerequisite and as a well-established parameter in the workplace. As far as the EEAE role is concerned, trust, but also feelings of dependence, were recorded.

In the present work we discuss the methodology and the results of the survey, emphasizing on the assessment made by EEAE in terms of radiation protection culture. Future plans to improve public awareness about radiation and to further promote safety culture among interested parties will also be presented.

Acknowledgment—This work was performed within the AVRA Project through the KRIPIS action of the General Secretariat for Research and Technology. The project is funded by the National Strategic Reference Framework (NSRF, 2017–2019) under the "Action for Strategic Development of Research and Technology Entities" of Operational Programme "Competitiveness Entrepreneurship and Innovation".

The improvement of public communication on actual radiation situation after disinformation campaign in the Czech Republic

Regulatory Experience

Karla Petrová
State Office for Nuclear Safety (SUJB)

Karla.Petrova@sujb.cz

Abstract

The presentation will provide with a brief follow-up of the story presented 2 years ago and describing a situation happened in the Czech Republic after measurement of slightly elevated level of radioactive iodine in air and taken as a good topic by disinformation web sites. We have identified this unofficial sources of information as a new challenge in communication with public in case of emergency or unusual radiation situations. A public survey has been organised with the aim to have an overview how many people could be influenced by this disinformation and how they finally worked with them. We have decided that we must have this new situation in mind and „be better prepared" next time. In case of any event – even negligible radioactivity/contamination detected proactive approach is reasonable. We have organized a national workshop with involvement of all stakeholders including universities, Ministry of Interior, research institutes and we have identified as very important to co-operate within governmental bodies in this field. Since 2018 SUJB publishes a weekly information about actual radiation situation on its web site and Facebook and it is commenting immediately any abnormalities. The experience with this approach will be given in the presentation.

Radioprotection and radiation monitoring culture among Malaysian medical radiation workers: A nationwide survey

Siti Farizwana Mohd Ridzwan, Marzuki Isahak, Nirmala Bhoo-Pathy, Lin Fritschi
Department of Social and Preventive Medicine, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia and Department of Radiology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia

farizwana@siswa.um.edu.my

Abstract

Background: Previous studies reported noncompliance to radiation protection (RP) and radiation monitoring (RM) based on personal protective equipment (PPE) and dosimeter usage. However, seldom the reports were associated with other protection principles the workers might have occupied. This paper aims to describe the holistic RP and RM practice among medical radiation workers (MRWs) in Malaysia for the establishment of the country's national data.

Methods: In April 2019, research coordinators from 50 government hospitals, 8 private hospitals and 3 university hospitals were requested to forward a link of a validated survey to the respective hospital MRWs. The survey applied skip-logic response questions, allowed multiple answer choices when appropriate and randomized answer options to reduce order bias. Descriptive statistic and other analytical parameters were tested, with statistical significance set at p=0.05.

Results: A number of 188 MRWs completed the survey and they showed an almost perfect adherence to the radioprotective apron and ALARA (as low as reasonably achievable) principles. However, only 35% of MRWs reported consistent use of thyroid shield. Among the non-consistent users, 88% ingenuously applied the ALARA principles, while the rest cited 'inadequate' and 'prioritized to others' as reasons for non-use. More than half (64%) of the MRWs complied to the dosimeter use and the non-use reasons captured were 'forgot', 'it might be lost' and 'not necessary/important'. A moderate association between the job title and the use of radioprotective apron were found significant (r=.251, p=0.001). Type of organization also showed a significant moderate relationship with the use of apron (r=.233, p=0.026) and thyroid shield (r=.278, p=0.001).

Conclusions: PPE use is a latter approach in the protection hierarchy. As such, reporting only their non-usages would lead to over-exposure estimation. There should be adequate equipment for minimizing radiation exposure to the neck area since the thyroid is one of the most radiosensitive organs. The utilization of personal dosimeter must be strongly encouraged as monitoring cumulative exposure is vital for every MRW.

Acknowledgement: This study is registered under a PhD Program in the Faculty of Medicine, University of Malaya (MREC: 2016104-4321). This study is conducted during the study leave of the main author under the 2016 Federal Training Scholarship awarded by the Ministry of Higher Education, Malaysia.

Ethics of the use of non-ionising radiation

Friedo Zölzer
Faculty of Health and Social Sciences, University of South Bohemia, České Budějovice, Czech Republic

zoelzer@zsf.jcu.cz

Abstract

Ethical questions of the protection against ionising radiation have received quite some attention over the last few years. The International Commission on Radiological Protection (ICRP) recently published its first report on the topic (ICRP 138). It identifies a number of "core values" which have helped shape the evolution of the ICRP system of radiological protection since the 1920s, namely "Beneficence and non-maleficence", "Prudence", "Justice", and "Dignity". The document also emphasises that these values are common to or at least acceptable for people from different cultural backgrounds, which for an endeavour as global in nature as radiological protection seems to be quite important and appropriate.

By contrast, there do not seem to be any similar efforts concerning the protection against non-ionising radiation. This includes ultraviolet radiation from the sun or artificial sources, laser radiation in the visible and infrared ranges, as well as microwave radiation from mobile phones. Whereas the health effects of solar and laser radiation are well documented, possible risks of mobile phone radiation are still disputed. Each of these exposures certainly has specific ethical aspects, some of which will be discussed here.

If the "core values" mentioned above for ionising radiation are to be applied to non-ionising radiation as well, the following questions pose themselves (among many others): How should we compare pros and cons of an exposure, if the pros are, for instance, cosmetic improvements and the cons are health issues like cancer or neurological dysfunction (beneficence and non-maleficence)? How should we assess risks when epidemiological studies do not provide unequivocal evidence (prudence)? How should we weigh individual risks and societal costs such as costs to the health system (justice)? How should we evaluate self-inflicted risks such as recreational sun exposure or private mobile phone use between the poles of public health and personal freedom (Dignity)?

Exposure to low doses by health professionals in nuclear medicine: A differentiated relationship to risk

Bénédicte Geffroy
IMT Atlantique, Nantes, France

benedicte.geffroy@imt-atlantique.fr

Abstract

This poster presents a research on occupational exposure to radioactivity in the nuclear medicine sector. In nuclear medicine, health professionals are exposed in their professional activity to daily low doses. So this case is interesting because it reflects a situation of uncertainty, in which the logic of precaution is imposed on health professionals. The aim of this research is to analyze the perception of a hypothetical risk and its effects on work practices, in particular how health professionals combine the logic of patient care and cure with that of self-protection. The research is based on a qualitative survey conducted in two nuclear medicine departments and combining semi-directive interviews with in situ observations. Our results show a differentiated relationship to the risk of exposure to low doses according to occupational group and different professional risk management practices.

Development and validation of a web-based survey to asses medical radiation workers' behaviour of using personal dosimeter for occupational radiation monitoring

Siti Farizwana Mohd Ridzwan, Marzuki Isahak, Nirmala Bhoo-Pathy, Lin Fritschi
Department of Social and Preventive Medicine, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia and Department of Radiology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia

farizwana@siswa.um.edu.my

Abstract

Background: The compliance rates of using dosimeters among medical radiation workers (MRWs) were previously captured using surveys. They were sometimes accompanied by the quantification of reasons for noncompliance. Currently, there is no investigation of the key attributes to the actual behaviour of using personal dosimeter among the MRWs. A survey was developed to explain the behaviour of radiation monitoring; hence, this paper documented the processes undertaken to evaluate its psychometric properties and establish its reliability and validity.

Methods: The items used in the survey were grounded from a qualitative study among MRWs and also literature reviews. We hypothesized that this survey would contain five domains: attitude, social factors, perceived behavioural control, perceived ease of use and perceived usefulness; based on the integration of theory of planned behaviour and technology acceptance model. The items were content-validated by six experts and underwent face validation by three academicians before a pilot testing. The 37-item survey was piloted among 31 MRWs and within one-to-three weeks interval, 27 of them completed the test-retest phase. The finalized version of the survey was sent as a link to the research coordinators of the participating hospitals, to be distributed to all MRWs.

Results: The Cronbach's alpha for the pilot study was >0.805 for all items, showing high internal consistency. The weighted-kappa for test-retest ranged from 0.294 to 0.719, indicating slight to substantial reliability. The initial 37 items arranged under the five domains with an item-content validity index of more than 0.83 was accepted, reducing the survey to 31 items by a reduction of nine items and addition of three new items. The survey link was sent and had been clicked-through by a number of 170 respondents; of whom 135 completed the survey with a typical completion time of 13 minutes. Factor analysis yielded seven factors after five items were discarded: "social influence", "perceived usefulness", "ability to perform if facilitated", "self-efficacy", "attitude towards use", "complexity" and "ability to overcome shortcomings". Through the face validation, all suggestions for rewording and rephrasing were taken into consideration for the final instrument.

Conclusions: This web-based survey fulfils previously published validity acceptance criteria and found to represent a reliable and feasible tool for explaining the behaviour of MRWs in radiation monitoring practices in Malaysia.

Acknowledgement: This study is registered under a PhD Program in the Faculty of Medicine, University of Malaya (MREC: 2016104-4321). This study is conducted during the study leave of the main author under the 2016 Federal Training Scholarship awarded by the Ministry of Higher Education, Malaysia.

Arie van ‘t Riet
https://www.x-rays.nl/