



Enhancing EducAtion, TraininG and Communication Processes for Informed Behaviors and Decision-making ReLAtEd to Ionizing Radiation Risks

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Report from the 4 National Workshops

Authors:

Daniela Diaconu, Marin Constantin, Alina Constantin (RATEN ICN) – *Romania*

Claire Mays (Symlog) and Geneviève Baumont (IRSN) – *France*

Grażyna Zakrzewska-Kołtuniewicz, Agnieszka Miśkiewicz (INCT) – *Poland*

Nadja Železnik, Milena Marega, Blanka Koron (REC) – *Slovenia*

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Project Context

<http://eagle.sckcen.be>

In Europe today, institutions, media and the general public exchange information about ionising radiation (IR) and associated risks. The 2011 Fukushima accident demonstrated the need for further improving this communication. EAGLE is a coordination project under FP7-EURATOM that aims at clarifying information and communication strategies to support informed societal decision-making.

Education, training and information to the public are key factors in the governance of ionising radiation risks, as are opportunities for dialogue and stakeholder involvement in decision making. EAGLE assesses the current dissemination of ionising radiation information to the public and provides practical guidance tools for best practice to support the ideal of a participative, citizen-centred communication. A network of stakeholders reviews national and international data, tools and methods as well as institutional work in order to identify education, information and communication needs and coordination possibilities at the European level.

To achieve these objectives, EAGLE brings together representatives of nuclear actors, users of ionizing radiation, authorities, mass and social media, and informed civil society, from a range of European countries employing nuclear power or not. The following work packages are carried out in the three-year project:

- WP1 seeks to improve education, training and information (ETI) material employed in communication about ionising radiation by information sources (industry, experts, authorities, medical field) across EU member states. Tools are assessed through interviews with heads of nuclear institutions along with protocols and questionnaires given through Euratom national contact points. Upgraded ETI material, activities, and communication strategies will be proposed as a coordinated European approach for practical implementation.
- WP2 engages members of information source institutions and practitioners/representatives of the social and traditional media in a series of national and international virtual dialogues (face-to-face and virtual). These dialogues consider information transfer and media handling, as well as the context of institutional, media and citizen discussion of ionising radiation and associated risks. The dialogue groups review existing aids and produce practical guidance tools to improve communication for more informed decision-making.
- WP3 analyses education, training and information (ETI) from the point of view of the final recipients of information – EU citizens. Existing desk research for all EU Member states is analysed along with polls, interviews and the outcome of workshops conducted in select countries. The 'mental model' approach is employed to investigate potential differences between professionals and the public regarding social and cognitive representations of ionizing radiation risks, and identify means to better support informed public decision-making related to this topic.
- WP4 Stakeholder participants comment and provide feedback on project products through two virtual workshops. Additionally, three pilot actions are implemented in three countries to test, evaluate and upgrade communications products.

Information and results are disseminated among stakeholders and the public on an ongoing basis. Sharing of results and communication are facilitated through the web site, social media tools and the "EAGLE Stakeholder Platform." EAGLE electronically publishes its recommendations for improving the education, training and communication processes related to ionising radiation. EAGLE will hold a final International Stakeholder Conference with members of academia, operators' regulators, authorities, medical sector, health organizations, consumers, different associations, traditional media, new media, emergency management and the public to exchange experience, methods, and tools developed throughout the project. The event will

publicize project results and gather feedback from stakeholders on employing these tools to better support European citizens' understanding of ionising radiation.

EAGLE formed a Stakeholder Representatives Group (SRG) and a Stakeholder Advisory Board (SAB). The SRG is a consultation body of representatives from information sources, channels, and receivers from across project countries. The SRG was launched at the first conference "Let's Communicate about Ionising Radiation" held in Paris, France on 26 November 2013. Subsequently, through virtual workshops and other means the SRG reflects on the project working documents and results, and provide feedback regarding their relevance and usefulness in practice. The SRG will also comment on the communication approach, on the envisaged project objectives and their impact on all stakeholder groups as well as on the dissemination of results. The EAGLE Stakeholder Advisory Board is formed of a range of stakeholders and helps to ensure that the project's approach is tailored to the diversity of stakeholders involved in communication processes.

The composition of the EAGLE grant consortium is as follows:

Coordinator: SCK-CEN – Studie centrum Voor
Kernenergie

Partner 2: ARAO – Agencijaza Radioaktivne
Odpadke

Partner 3 : IRSN - Institut de Radioprotection et de
Sûreté Nucleaire

Partner 4:

RegiaAutonomapentruActivitatiNucleareDrobeta

tr. SeverinraSucursalaCercetariNucleare Pitesti -
INR

Partner 5: Institut Symlog

Partner 6: Institut Jozef Stefan

Partner 7: Instytut Chemiii Techniki Jadrowej

Partner 8: Universitatea Politehnica din Bucuresti

Partner 9: Regional Environmental Center for
Central and Eastern Europe – REC

Partner 10: Jaroslav Valuch

Contact information

Email: eagle_secretariat@rec.si

Web: <http://eagle.sckcen.be/en>

EAGLE project coordination:

TanjaPerko, Ph.D

Belgian Nuclear Research Centre SCK·CEN

Boeretang 200, B-2400 Mol, Belgium

Phone: +32 14 33 28 51

E-mail: tperko@sckcen.be

Web:www.sckcen.be/

Table of content

Project Context.....	3
Table of content	6
1. Introduction.....	7
2. Report from the French workshop.....	9
3. Report from the Polish workshop	15
4. Report from the Romanian workshop.....	22
5. Report from the Slovenian workshop	28
6. Recommendations.....	31
7. Conclusions	37
Bibliography	37

I. Introduction

The WP3 - *Recipients of the information: Informed decision making process related to ionising Radiation* was dedicated to "identify approaches to improving ETI activities regarding the understanding of the effects of ionising radiation so as to support the citizens of the EU in making informed decisions related to ionising radiation risks" based on: a comprehensive review of European population perception regarding communication about ionising radiation, an investigation on the analysis of mental models in the general public regarding the effects of ionising radiation, and on the feedback from institutional sources and journalists organized in 4 countries.

The *Report the public views across EU on education and information in the post-Fukushima context* performed in the beginning of the project showed a modest level of knowledge related to ionising radiation issues among EU citizens both in nuclear and non-nuclear countries and indicated that the major source for their information remains the TV, despite the low trust in journalists [1]. A predominant lack of trust in nuclear authorities and nuclear industry, correlated with higher risk perception of IR applications in energy, is contrasting with a certain confidence in independent scientists and international organisations [1].

Investigation of the mental models of the general public regarding the effects of IR, and how IR is perceived by the general public across EU was intended to deepen our understanding on the differences, gaps, understandings and perceptions in the general public compared with the ones formulated by professionals in the nuclear area [2]. The major findings of the four analyses of the interviews done in France, Poland, Romania and Slovenia are summarized in the paper *Lay public mental models of ionizing radiation: Representations and risk perception in four European countries* expected to be published in 2016 in *Journal of Radiological Protection* (expected 2016)[3].

All these findings represent the input for four national workshops intended to inform institutional sources and media on the mental models and help them to shape the dedicated survey sections and improve the future communication and information programs. These workshops were organized in the same four countries where the mental models were investigated (France, Poland, Romania and Slovenia) with the aim "to facilitate the debate between institutional sources and the media participants on whether the mental models are "good enough" and whether authorities and media can change anything in their practices to improve the current situation".

The workshops were designed as a dialogue space where institutional sources and media, together with EAGLE participants could share thoughts, look for responses and discuss programs already built around similar concerns.

All national workshops were followed a common format consisting in:

- Presentation of the EAGLE project objectives and most important outcomes, with particular focus on WP3

- Presentation of the mental models as resulted from the EAGLE interviews in the respective country and their analysis.
- Open discussions moderated by an EAGLE participant

The workshops were organised during June 2015 and January 2016, each country choosing the context and the moment according to the national agenda. Therefore,

- the Slovenian and Romanian workshops were organized jointly with international conferences hosted by these countries (RICOMET 2015 in Slovenia, and SIEN 2015 in Romania) taking advantage on the large participation of relevant actors in these events
- the French and Polish workshops were organised individually and benefited on the participatory practice widely developed in France and respectively on the high interest of the sources and media on the nuclear energy in Poland.

The participants in these workshops were engaged to prepare their conclusions and recommendations to be discussed during the international activities in WP4, such RICOMET 2016 Conference. Their comments, suggestions and advices, reported in this document, are considered for the elaboration of the EAGLE guide of good practices for education and information of the population on IR aspects. Since bad practices have been also mentioned as frequently occurring in the current practice, they have been equally recorded to be included as well in this guide, as a contrast to what should be done.

The recommendations gathered from each workshop are collected in section 6.

2. Report from the French workshop

In France, findings of the French Mental Models interviews were discussed with representatives of a civil society organization having a public communication mandate.

On 11 February 2016, members of the volunteer board and the secretariat of the Local Information Committee (CLI) associated with France's Gravelines Nuclear Power Plant met with Claire Mays (Symlog) and Geneviève Baumont (IRSN). The meeting took place in the CLI's offices in Gravelines, close to Dunkirk in Northern France, close to the Belgian border.

The CLI was happy to meet with the EAGLE partners in particular because:

- A member of the CLI, Mr. Yves LHEUREUX, is also an EAGLE Advisory Board member representing civil society as national delegate of ANCCLI (the national federation of local information committees attached to nuclear sites).
- The CLI had previously participated in the EAGLE Pilot Action on education, by hosting the traveling exhibit on ionizing radiation developed by IRSN and the Nuclear Safety Authority ASN. This was a successful trust-building collaboration well-viewed by the CLI and by local school science teachers.

A summary of the French findings was presented, and some comparative results from Poland, Romania and Slovenia were shared when pertinent. The lively discussion lasted 2.5 hours and produced general recommendations as well as tailored advice for future CLI communication activities.

2.1 Invitation

A two-page invitation issued to the CLI members presented EAGLE and the mental models research, contained a brief summary of the major MM research findings, and explained the offer of a discussion seminar in these terms:

The EAGLE project does not promote the 'deficit model' of risk communication, according to which a supplement of information is needed to fill up gaps or correct errors in public understanding. Technical knowledge is not the only pertinent dimension. Risk perceptions are also constructed on the basis of trust, familiarity, links and pertinence to everyday life, the possibility of participating in decisions... Moreover, cultural references and "archived" experience or knowledge can emerge when citizens start to think and talk about ionizing radiation risks. In order to access a richer understanding of these dimensions, and of their impact on the communication and management of risks, EAGLE recognizes the need to talk with members of Local Information Committees deeply involved in their territory.

Institut Symlog and IRSN, as partners in EAGLE, propose to present the French findings to the Gravelines CLI. The discussion will allow an examination of the data in the light

of CLI members' experience and the local people's information needs as observed by the CLI.

The objectives of the seminar were stated as follows:

1. Learn about fellow French citizens' mental models.
2. Verify if the findings 'correspond' to your own observations and experience.
3. Highlight the impacts on communication processes.
4. Consider certain key issues facing the CLI.
5. Formulate recommendations for the European Commission.

2.2 Presentation

A slide deck briefly presented the EAGLE project, the mental models research method and study sample, and the objectives of the CLI seminar. Then, particular findings were presented, selected for this purpose from the full French study report because they are unambiguous and striking, which would facilitate their discussion by persons seeing the data for the first time. The presented findings included: mental models of natural vs. artificial radiation; example of exposure in a mountain setting; therapeutic applications; public information processes. Furthermore, two categories were chosen because the findings could be of special interest to this committee:

- Nuclear Technology (viewed by mental model interviewees as the primary source of artificial and accidental irradiation). The findings could be particularly relevant to the experience of this committee mandated to inform about an NPP.
- Impacts of nuclear accidents. This topic is pertinent as of the first trimester 2016 when all CLIs are cooperating with the Nuclear Safety Authority (ASN) and other national and regional authorities in the renewal of the 5-year Stable Iodine Distribution Campaign to French households, businesses and other public venues located within 10 km of NPPs. Mental models data should typically be used when preparing or improving information campaigns.

2.3 Discussion

CLI members confirm that like the people interviewed for the EAGLE study, persons residing near the Gravelines NPP often make a distinction between natural and artificial radiation, perceiving these as produced by two different phenomena. Natural radiation is viewed as less harmful. Medical applications of radiation are viewed positively.

On the other hand, there is a very negative perception of radiation associated with the atomic bomb, and this influences the perception of radiation associated with nuclear power plants. This prompt negative perception exists even in the case of more highly educated individuals accustomed to managing risk. The example was given of executives from local industries unrelated to the nuclear sector, who tend to believe that even authorized releases

of radiation from an NPP could instantly and severely harm individuals. The CLI is obliged to “explain a very long time” because these executives “are not easily convinced”.

The memory of the Chernobyl accident continues to be a major reference in the area. Any thyroid disease is immediately interpreted as being due to Chernobyl. Doctors explain that thyroid disease is better detected and recorded now (such that "more cases" seem to emerge in recent years), but this does not convince the population or some local elected people. Questions about thyroid cancer caused by Chernobyl are asked at all public meetings.

The CLI members reflected that the age of interviewees must play a role in the formation of their mental models: the Chernobyl accident took place all of 30 years ago, and a person under age 30 cannot have the same images or memories as older persons. Still, one idea at least is very strongly anchored across the population: everyone knows that in April 1986 the Chernobyl radioactive cloud officially “stopped at the border”, as it is ironically said, before it could cross from Germany to France. Today, even young high school students have retained that the nuclear and public institutions “lied” to the population at the time of Chernobyl. This is revealed in comments by adolescents when the IRSN makes classroom presentations. Conspiracy and secrecy are major themes among this age set (even their favorite television series and video games reflect this).

It has to be recognized unfortunately that official practices at the time of Chernobyl tended to minimize public information, if they did not actually support secrecy. One CLI official, employed in 1986 by the Environment Ministry, confirmed that orders were indeed given not to communicate about the cloud in order to avoid creating panic. Similarly, the DGSNR (the 2001 predecessor to today's Nuclear Safety Authority) used a handbook on "how to talk to the press" that did not encourage openness. Government officials tended in the past to have the motto "*bien faire et laisser dire*" (do your work correctly and leave the talking to others – implying also that they are too stupid to understand). The CLI board recognized that today, attitudes have changed: the motto at ASN could be "*bien faire et le laisser savoir*" (do your work correctly and make your work understood around you).

CLI members noted that the simple fact of introducing risk information triggers suspicion in many listeners of any age. These listeners interpret that “there must be something behind it – a hidden threat”.

Presently, CLI members notice that the Gravelines area population does not generally express fear that a nuclear accident may take place. Instead, local people, reacting to the terrorist events in France in 2015, express more fear that terrorists could use a "dirty bomb". This brought up discussion of whether it is appropriate to compare such different risks when talking with the public.

In reference to the 5-year iodine distribution campaign, the CLI states that extremely simple explanatory information about the use of iodine tablets in case of nuclear accident is needed. Just as much effort should be devoted in years to come to publicizing where that information can be found. People may easily forget what they learn at the time of the distribution.

How can the CLI communicate when people – young or old – have almost no personal background or schooling in the issues of ionizing radiation and its risks? How can an interest in the topic be created? CLI members note that in everyday circumstances, it is quite normal that people don't seek out information. However, when an unusual and/or threatening event takes place, people are more eager to get information.

Gravelines' big neighbor, Dunkirk, is France's third-largest harbor and a highly industrialized city. It has 17 different Seveso sites including steel and chemical factories, oil refineries, food processing and ship-building installations. In such a context there is a lot of risk communication to be done. The regional "Permanent Secretariat for the Prevention of Industrial Pollutions" (SPPPI, which hosts the CLI) runs regular campaigns to inform local people about the major risks of these sites. One popular approach is a two-hour bus ride that tours the area. Visitors see all the industrial sites, meet the authorities as well as the industrial agents who manage the risks, and measure the short distance between a factory and a fire station. They gain a sense of how risk prevention is organized, and develop a feeling of confidence in this management. This information exercise functions well if it is led by neutral persons, who listen to questions and don't try to sell the idea of faultless safety.

The CLI also recommends visiting local community groups on their own ground. Conversations about ionizing radiation risks can be gradually created by listening to what is important to people and by adjusting information to their particular interests.

Symlog described the mental models interview process as a conversation which is in some ways similar. At the beginning, respondents often protested that they knew and understood nothing about ionizing radiation. However, with patience, they were able in the course of the interview to dig deep into their memories about radiation, to make their ideas explicit, and test their archived images and understandings. This was interpreted by Symlog as a sign of active engagement and intelligence. The laypeople interviewed for the study made an effort to understand and wanted to put together the disparate pieces of information they possessed into a coherent whole. Even if they create an incorrect mental model, the individuals still were willingly employing a valuable cognitive process. According to Symlog, this willing process could represent an opportunity for the CLI. If dialogue is established with local residents, the CLI can engage with them in the intellectual work of examining existing ideas, and in gradually constructing a more pertinent model of ionizing radiation risks.

Taking the time to hear people's ideas and questions, respecting this as a starting point and slowly helping them to construct a more complete idea of risk, is an approach welcomed by the CLI. Discussion continued on how this advice could be useful for the organization of the CLI's required annual public information meeting.

2.4 Outcomes

At the end of the seminar, board members asked the EAGLE partners for specific communication advice rooted in the Mental Model findings. They were particularly interested in obtaining advice for:

Designing the CLI's yearly public meeting with the local population.

The French national Energy Transition Law includes new requirements for the CLIs associated with energy installations. All are required to conduct a large-scale public

information meeting yearly. Based on MM observations the following suggestions were discussed:

- Prepare the yearly meeting by first going to local meeting places and community activities to explain that the meeting will take place and explicitly gather people's expectations and questions.
- When the meeting is announced, also announce that it will reply to the questions that have been gathered from the community.
- Remember that people have different mental models, different background knowledge, and different interests and preferences. At the meeting, plan to offer diversified information formats that can attract all the different types of individuals and allow each one to participate comfortably and in confidence. To reflect this variety, the meeting can be organized like a "fair" with different stands to be visited.
- Both adults and children probably enjoy "hands-on" exhibits and the opportunity to handle iconic objects like a clicking Geiger counter.
- Short presentations or discussion events with experts can take place during the fair at announced times. The discussion events should be varied in order to enable participation by different types of persons: those who are quieter, or who are more active and talkative; those who are more knowledgeable or who (like many Mental Models interviewees) need more time to unfold their understanding.
- In any case, a theater arrangement with "podium" should not be the first choice since it emphasizes inequality between experts and other people.
- Likewise, avoid long presentations and prefer discussion and exchange.

Reinforcing the CLI's information to the schools population.

The CLI board expressed interest in the renewing travelling exhibit about radioactivity which was recently brought to high schools in the area by the IRSN. CLI members continue to meet with high school teachers to give them information for use in their classes. The IRSN confirmed that the exhibit remains available, along with documentation and quiz materials that have proved very popular after a visit to the exhibit to reinforce memory and understanding among the students.

2.5 Follow up

The seminar PowerPoint presentation plus three handouts were given to the CLI to disseminate as they wished.

The *Journal of Radiological Protection* article on EAGLE Mental Model findings in four countries (Železnik et al., expected 2016) was requested by the CLI participants, and may be translated into French for this purpose by the IRSN.

The French Mental Models full report (a 67-page annex to EAGLE Del. 3.2) authored by Symlog may also potentially be submitted for translation into French by the IRSN, so that it becomes accessible to CLI readers.

Finally, several persons expressed interest in the RICOMET 2 conference (June 2016, Bucharest). The invitation was forwarded to them, and all the CLI participants were registered on the EAGLE stakeholder list. Mr. Yves Lheureux, EAGLE Advisory Board member, on the basis of this successful seminar agreed that EAGLE could issue a formal invitation to the president of ANCCLI to make a keynote speech at RICOMET 2.

Subsequent to the discussion seminar, one board member wrote in an email: *"I wanted to thank you for holding this meeting with the CLI of Gravelines. It was a very interesting presentation and which provided very useful lessons for our communication with the population"*.

3. Report from the Polish workshop

In Poland the national workshop “*Mental models of ionizing radiation as a tool for building communication with the public - assessment of research conducted as part of the EAGLE project*” was organized by INCT on 27 January 2016.

3.1 Context

In the framework of EAGLE Task 3.2, mental models on understanding of ionizing radiation for the lay public in Poland were identified. The interviews were conducted according to the common protocol developed in EAGLE project.

The main aim of the workshop hosted by the Institute of Nuclear Chemistry and Technology was to provide knowledge about the mental models and the information about the results of the survey in Poland to Polish stakeholders, representing especially information sources and media. The audience invited to the meeting were mainly the representatives of the institutions using ionizing radiation in their statutory work and journalists cooperating within EAGLE project.

The institutional sources and the media were invited to assess the mental models identified in the project and their relevance to the situation observed. Are the mental models found to be representative of Polish lay public views? Is it possible with the obtained results to influence the practices used by authorities and media at present? Can this practice be improved? These were the questions to the audience.

Like previous EAGLE meetings this workshop created the opportunity to share the thoughts, observations, and responses which underlie common communication practices in the source institutions. Improvement of communication with the public, and elaboration of the EAGLE guide of good and bad practices (Del. 3.3) are the main goal of the actions taken in the framework of the WP3 of EAGLE project.

3.2 Minutes from the workshop

The meeting was opened by *Grażyna Zakrzewska-Kołodziej* from the Institute of Nuclear Chemistry and Technology, coordinator of the activities within EAGLE project in Poland. She welcomed the guests: representatives of the media as well as stakeholders representing information sources and the public. The meeting was attended by representatives of the media: *Wiktoria Niedzińska*—a journalist cooperating for many years with the Polish Radio and Polish Television, author of many popular science programs; *Paweł Wójcik* - publisher of magazines associated with environmental protection: “Środowisko” [“Environment”], “OdpadyiŚrodowisko” [“Waste and Environment”] and “Prawo i Środowisko” [“Law and Environment”], and *Stanisław Latek* - editor in chief of “Postępy Techniki Jądrowej” [“Progress in Nuclear Technology”], journalist, previously a longtime employee and spokesman of the National Atomic Energy Agency.

After greeting the guests, *Grażyna Zakrzewska-Kołodziej* briefly presented the subject and the objectives of the EAGLE project to introduce this issue to persons unfamiliar with the

project. She discussed the activities undertaken so far by the consortium pursuing the project and the events that took place in Poland.

One of the purposes of the EAGLE project is to improve communication between information sources which share knowledge on ionizing radiation (e.g. such institutions as National Centre for Nuclear Research, National Atomic Energy Agency, Institute of Nuclear Chemistry and Technology, Radioactive Waste Management Plant), the media and the main recipient of this information - the general public. The project is carried out by 10 partners from different countries and it is coordinated by SCK-CEN from Belgium. *Grażyna Zakrzewska-Kołodziej* discussed the tasks completed since the project inception, namely:

- a detailed analysis of information and training materials following the Fukushima disaster was performed and a survey was conducted among the information sources concerning the information culture (as part of the WP1 package);
- dialog groups were created, meetings were organized with representatives of the media (as part of the WP2 package);
- an analysis of educational and training programs was conducted and mental models of the perception of risk related to ionizing radiation were analyzed, workshops were organized in Romania, Slovenia, Poland (now), France (as part of the WP3 package);
- a group of stakeholders registered on the project web site was created, the EAGLE project kick-off conference as well as virtual workshop was organized and pilot actions were conducted - media in the aspect of implementation of the Polish Nuclear Power Program (as part of the WP4 package).

Moreover, as part of the EAGLE project 3 meetings were held with the participation of all consortium partners, as well as the kick-off conference in Paris, titled: "Let's Communicate Ionising Radiation!". As part of this project, a large conference called RICOMET 2015 was organized in cooperation with OPERRA and PREPARE projects. This conference took place on June 15-17, 2015 in Slovenia. It was attended by approx. 100 participants, including 6 participants from Poland. 60 papers were presented during this event. *Grażyna Zakrzewska-Kołodziej* informed about the next edition of the RICOMET conference. The conference will be held on June 1-3, 2016 in Bucharest (RICOMET2016; <http://ricomet2016.sckcen.be/>).

Further on, pilot actions were discussed. They were held in Slovenia, Romania and Poland. In Poland, as part of the EAGLE project, 3 meetings were organized with representatives of the media, sources of information and their recipients. One of them was the pilot test "Mass media and the information regarding the implementation of the Polish Nuclear Power Program".

At the end of her address, *Grażyna Zakrzewska-Kołodziej* presented the meeting agenda and the idea behind development of mental models of perception of the ionizing radiation, which may result in identification of good and bad practices in education and information for various public groups. The starting point is the evaluation of the status quo in education, trainings and information. The identification of mental models of perception of the ionizing

radiation and accompanying phenomena by the general public may allow for a more detailed analysis, which constitutes a step for further social research and findings helpful for sources of information and the media. These objectives were to be met by conducting interviews with a selected target group.

Next, *Sylwester Sommer* from INCT made a presentation which aimed to introduce the meeting participants to the knowledge on mental models and methods of developing them. The mental model, or the internal symbol or presentation of the external world, created through experience, has a significant influence on further learning of the world, perception of phenomena in the environment, reasoning and deducing as well as decision making. In other words, this is a method/pattern how we see, understand and comprehend the external world and different occurring phenomena. Every human, even unaware of it, is using many mental models and creates the image of the external world on their basis. Very frequently, these models differ from the reality, are inaccurate, subconscious and difficult to change. *Sylwester Sommer* gave a few examples of mental models and discussed the methods of analyzing them. Then, he presented potential possibilities of using mental models, and among them: for developing computer software, analyzing the perceived risk of different activities and preparing information and communication strategies for risky activities and projects. Using mental models in the subject matter related to ionizing radiation started in 1992, when effects of radon in rooms were analyzed. More recently, the models were used in the context of radioactive waste and during site selection of the repository for such waste in Slovenia.

As a result of the presentation given by *Sylwester Sommer*, a discussion was held, in particular concerning the possibility of using mental models. The participants considered whether they may only relate to controversial issues, or also to ordinary, everyday matters, like issues of operation of technical equipment. The discussion was summed up with the finding that mental models are useful, as they allow individuals to make a decision quickly and the results of analysis of these models may also be used to fine tune communication materials to respond to the public's opinions and assessments, which are often mistaken, and in consequence involve sometimes a certain danger.

The next presentation was given by *Stanisław Latek*. The presentation covered the analysis of EAGLE interviews with representatives of the Polish public, aimed at identifying mental models of ionizing radiation. The first part of presentation discussed the procedure of the research, including: questionnaire structure, selection of participants, presentation of the interviewers as well as discussion of questions and obtained answers. The presentation heavily focused on findings from the analysis of conducted research. They were as follows:

- knowledge about ionizing radiation among the Polish public is rather low;
- the public accepts the treatment methods offered by nuclear medicine, however their acceptance is based on trust in doctors, and not on understanding of the phenomena related to ionizing radiation.
- most respondents accept nuclear power and benefits arising from using nuclear power;

- most respondents believe that the decisions concerning the use of ionizing radiation and construction of a future nuclear power plant should be made by experts and government officials;
- media are not considered independent, and the information they provide is often unprofessional;
- knowledge about ionizing radiation depends on age, but not on place of residence, gender or educational background.

Further in his presentation, *Mr. Latek* discussed the general findings resulting from the comparison of results of research conducted in various countries. The analysis of these results identified some differences in perception of ionizing radiation by the general public and by experts involved in development of nuclear technologies. It was also noted that some questions were considered incomprehensible or too difficult. When summarizing his presentation, *Mr. Latek* pointed out that the research works carried out as part of the project were only an introduction to further, more detailed studies. The results of such studies would be helpful when developing the social communication strategy. They would allow to avoid misunderstandings, confusion of terms and gaps in the knowledge.

In the wake of the presentation, a discussion was held concerning the assumptions of the discussed research.

Paweł Wójcik questioned the correctness of research based on a sample of 15 persons, often selected at random. The discussion was joined by *Katarzyna Iwińska* from Collegium Civitas, who asked about the purpose of the research and about whether the obtained results actually contributed to obtaining new knowledge on perception of ionizing radiation by the public in Poland. These questions were answered by *Grażyna Zakrzewska-Kołodziej*, who explained that the objective of both the research and the whole project is to improve communication concerning the ionizing radiation, and the results of the research hardly surprised the researchers, as public knowledge on this subject was expected to be rather limited. The knowledge about mental models functioning in the public may be helpful to both the institutions which group experts producing information about the ionizing radiation, and to the state administration and the media. *Katarzyna Iwińska* also noted that during the research, it would appear that knowledge was tested, rather than the method of perception and understanding of the respondents. Another issue discussed was the method of asking questions, introduction of the so-called "in-depth questioning" and the person of the interviewer. It was unanimously noticed that all these factors may have a great influence on obtained results of the research. *Katarzyna Iwińska* said that the idea of such research was very good, however she challenged the method, suggesting that the interviewer might influence, often unconsciously and unintentionally, the obtained answers. The sociologist argued that when assessing the educational system, it would be more favorable to conduct opinion poll type semi-quantitative research. She stressed, however, that opinion polls result in general, sectional knowledge rather than full insight. On one hand, the research conducted as part of the EAGLE project was an "in-depth interview" and a sample of 15 persons was sufficient for this type of research. On the other hand, the complexity of

questions turned out to be a problem, as it caused the lack of openness of the respondents. Despite this fact the results showed that the level of knowledge about ionizing radiation is more than average. *Grażyna Zakrzewska-Kołodziej* added that in her opinion, this level was not lower than the level of replies obtained, e.g. in surveys conducted in France, the country where nuclear power industry is very well developed. The discussion was also joined by *Tomasz Jackowski* from the NCNR who added that the selection of respondents was also of great importance. He mentioned that interesting results could be obtained if a similar survey was conducted among physicians, as his experience shows that their knowledge about ionizing radiation is very limited. *Jacek Michalik* from INCT noticed, on the other hand, that knowledge about ionizing radiation should be shared from the angle of nuclear medicine, which is accepted by the public. On the example of the changed strategy of nuclear power communication in France *Tomasz Jackowski* demonstrated the great value of openness and trust in such activities. Meanwhile, *Aneta Maszewska*, EURATOM National Contact Point noted a problem with access to information on research concerning nuclear power and a program of works in this scope among representatives of local governments.

Subsequently, *Grażyna Zakrzewska-Kołodziej* directed the discussion towards the issue of assessing the need of such social research from the perspective of the work of journalists. The question about whether such research would be helpful to journalists was answered by *Mr. Wójcik*, who said that the research would be very useful, if more detailed and providing the representation of the social structure. Only such research can be the basis of a strategy of communication with the public.

Further on, a question about benefits from social research was addressed to representatives of sources of information. *Lukasz Koszuk* from NCNR, the president of the FORUM ATOMOWE Foundation and initiator of many informational projects, for instance the mobile lab "Atomic Bus", told the participants about his experiences gained during presentations about ionizing radiation and nuclear power among children and youth from primary and secondary schools. He believes that in order to disseminate knowledge about ionizing radiation, grassroots initiatives should be carried out, namely among children as they are the easiest to reach with the message. Adults are not much interested in learning about radiation. *Mr. Koszuk* also noticed that physics teachers do not mention nuclear power or applications of ionizing radiation even though this subject is included in the teaching curriculum. This situation may result from the fact that it is not easy to show to children something interesting on this subject. *Grażyna Zakrzewska-Kołodziej* summed up this part of the discussion saying that even the best education curricula will never replace the teacher's good will and knowledge. She also reminded that as part of the EAGLE projects, education curricula were compared with respect of ionizing radiation teaching in various countries. The analysis of the curricula showed that in Poland, we have very good textbooks. Further, the discussion related to the issue of trainings for teachers, whose knowledge in ionizing radiation is often insufficient, too. It was noted, however, that the offer of teacher trainings is too poor as well. *Sylwia Ptaszek* from INCT mentioned that one hour dedicated to "Physics" at junior high school per week is insufficient and therefore the physics curriculum is very much cut down by the teachers.

Grażyna Zakrzewska-Kołodziej asked the participants about the mental model of experts. *Jacek Michalik* noted that actually, there is a division among the experts between those who

have the knowledge and those who popularize the science. He believes that in order to be efficient, one has to teach young people in a modern way, even controversial sometimes. Professor Łukasz Turski, Chairman of the Programme Council of the Copernicus Science Center was referred to as an example of an expert with good communication skills.

Further on, the floor was given to *Wiktor Niedzicki*. Mr. *Niedzicki* referred to the problem of lack of motivation of the teachers to deal in more detail with the issues related to ionizing radiation. The journalist believes that people, including teachers, have to be convinced that ionizing radiation is needed. Moreover, the use of any type of available teaching aids, e.g. models and radiation meters, simple G-M tubes, at presentations or during Physics or Chemistry classes should be very beneficial to raise interest. *Wiktor Niedzicki* also pointed out to the need to undertake organized information and educational measures and to implement the public's participation in the project before making a decision about building the nuclear power plant.

Another point of the meeting was a presentation given by *Katarzyna Iwińska* from Collegium Civitas on mental models as seen by sociologists. In the beginning, types of social research and their objectives were discussed. *Katarzyna Iwińska* remarked that in social research, there is no impartiality, the researcher always influences to some extent the answers obtained from the test subject. However, the researcher has to be aware of this fact and has to control the interviewing process. The presentation then proceeded with discussing the origins of mental models. In mental models research, researchers use the term "case" and not "sample", and the case may be a situation, a person, a role, a group or a site. Referring to the research conducted as part of the EAGLE project, *Katarzyna Iwińska* said that there were no surveys, but rather in-depth individual interviews. The sociologist emphasized again the issue of the influence of the interviewer, especially during in-depth questions, on the result of the conducted research. The discussion that followed the presentation on social research was joined, among others, by *Wojciech Głuszewski* from INCT who pointed out the reaction of people to irradiated food. Some respondents (no more than 50%) said that there is a difference in taste of such food compared to food that had not been irradiated. In this point, attention was drawn to the significance of the manner in which the question is asked, as it may be suggestive to some extent. The question asked about the difference caused the respondents to try and identify the difference even if there is none.

The further part of the discussion considered good and bad practices in information and education. The discussion on this subject was joined by *Wiktor Niedzicki* who proposed the controversial idea of using the practices similar to the ones used by nuclear power objectors, even if in the opinion of some people these practices are exaggerated. This idea resulted in animated polemics, among others about whether it is right to approach the subject from the perspective of a fight, and to take measures which are not entirely ethical. *Katarzyna Iwińska* proposed, as an alternative to such measures, the use of educational films which would reliably communicate knowledge about nuclear power and other uses of ionizing radiation. *Grażyna Zakrzewska-Kołodziej* expressed the opinion that it is very important to maintain social credit given to scientists and rejected the option of using unfair practices. *Wiktor Niedzicki* emphasized that he is not an advocate of unfair play; sources of information should focus on reliable use and promotion of knowledge. However the application of the

propaganda measures used by opponents of nuclear power is fully justified and in many cases right.

On the other hand, *Paweł Wójcik* raised the question of costs related to communication of the knowledge and the existing risk that nuclear power opponents, who have more financial resources, would be more visible and efficient; they would be quicker to reach the public with their message than the nuclear power supporters.

Tomasz Jackowski expressed his conviction that negative PR is definitely easier to do than the positive one, which by definition is less spectacular and raising less emotions. In the opinion of the discussant, it is necessary to commence organic work and namely, to convince politicians and provide education at primary level, education of teachers and journalists.

3.3 Conclusions

The meeting was summarized by *Grażyna Zakrzewska-Kołtuniewicz* thanking all the participants for their contribution to the discussion.

Some main findings were summarized:

- The social studies conducted as part of the project concerning the mental models of ionizing radiation perception may be used both by journalists and by information sources; they give some preliminary picture of the perception of IR. However, they need further deepening taking into account the issue of selecting interviewers, formulating less complicated questions and selecting participants;
- The access to reliable information on nuclear power and other applications of ionizing radiation in Poland is problematic;
- The reason of the lack of sufficient information in the media is, among others, excessively slow rate of activities undertaken as part of the Nuclear Power Program for Poland, which results in the lack of more extensive information in the media and subjects related to nuclear power.

She concluded the work by reflecting that in general, the state of information and education on ionizing radiation cannot be considered sufficient, especially in a country that wishes to join the path of the development of nuclear energy. The way in which knowledge is transferred and disseminated is not satisfactory; there is lack of teaching aids at schools and teachers' awareness of the desirability of transferring knowledge on IR. As a good practice one should give an example of activity of FORUM ATOMOWE (atomic forum) and creation of a mobile lab initiative - atomic bus. The bus reaches the remotest corners of Poland, presents knowledge about IR and nuclear energy in a form adapted to the knowledge and abilities of a simple recipient. Another way is to create educational television and radio broadcasts addressed to different audiences; they are not present in the Polish media. A good example would be the television program "Laboratory" led in the past by *Wiktor Niedzicki*, the author of numerous publications popularizing science, showing science problems in a simple and attractive way.

4. Report from the Romanian workshop

The Romanian workshop entitled "*Mental models of the general public on ionising radiation*" was organized on October 17, 2015, in Bucharest, in conjunction with the International Symposium for Nuclear Energy, SIEN 2015.

4.1 Participants

The workshop was attended by representatives of source institutions in Romania dealing with nuclear research, nuclear power production and nuclear waste management; a representative of the nuclear regulator; a journalist from the Romanian national press agency; and a number of international participants in the SIEN2015 conference (from the Bulgarian nuclear industry, from France's CEA, etc.)

4.2 Objectives of the workshop

The objective of the workshop was to obtain a validation of the results of the EAGLE Mental Models investigation performed in Romania, through discussion of the findings.

Starting from the representations people have about ionising radiations and their perceptions on the risks they pose to their health or to the environment, this workshop intended to:

- share the EAGLE findings to be used in improving the content of the information provided by sources or media in order to adapt the content of the information and communication to better reach the population understanding;
- identify together how the entire process of communication about ionising radiation could be improved in order to have at European level a population:
 - o more satisfied with their knowledge
 - o more confident in national sources and journalists
 - o better prepared to take informed decisions in situations involving IR in a way or other (medical applications, nuclear energy production, waste disposal, irradiated food, radon in the house)
 - o able to judge themselves objectively different applications of the IR
 - o better prepared for an informed decision making process when they are facing any kind of situation involving IR effects (using medical investigations, building a NPP, siting a waste repository, living around a NPP, eating irradiated food, radon).

4.3 Agenda of the Workshop

The agenda covered presentations of the EAGLE project; of public perception on communication about IR; about the Mental Models investigation conducted in Romania and its findings; debate, conclusions and recommendations. In all, the workshop lasted for more than 2.5 hours.

4.4 Presentation of the mental model findings

Daniela Diaconu (RATEN ICN) welcomed participants and introduced the audience in the EAGLE project, presenting in brief its objectives, structure, activities and the most important results achieved so far in the analyses of the communication strategies of institutional sources and of the communication channels. The presentation focused mainly on the public views regarding the communication and information process. She gave some details on the WP3 approach and on the role and objectives of this workshop in reaching the major objective – improving the communication towards the public for an informed decision making when population is confronted with IR situations.

Marin Constantin (RATEN ICN) introduced to the audience the concept of a mental model that is meant for obtaining some kind of image of representation. Mental models are basic cognitive constructs used by each person for the understanding of the phenomena and abstractions, or for the predicting of the dynamics of the events. As a suggestive example the representation of Earth was used. It is seen either as a sphere, or as a flat disc, rectangular surface, an infinite plane, etc. Images for these representations were used.

The investigation of the mental models is intended to understand these cognitive representations and how they are used in the rationale constructions. Mental models target to reveal what is in the mind of common people.

He explained that the methodology to investigate mental models of ionizing radiation is quite complicated as it deals with a very complex subject, given the range of situations involving ionizing radiation: from cosmic rays to atomic bombs. On the same time the used mental models depend on the education, life experience, and capacity of abstract representation.

It was pointed out that in public debate the interest on the ionizing radiation is different in situation of crisis and in normal time. Therefore some of the mental models may be strongly affected by the crisis. Emotional reactions are dominant in comparison with the residual knowledge remained after the educations received in the schools. There is a common observation of a big gap between sources of information, media and public. Often the sources of information use expert models to construct their messages or at least non-congruent models with the representations of the common people.

Marin Constantin also presented the methodology for investigation the mental models of ionizing radiation which consisted of: the elaboration of a common protocol to be applied in all four countries, segmentation, interviews (collecting and recording the data), analysis, distil the results into a set of mental models.

The structure of the questionnaire contained a warming up part, followed by a section dedicated to the mental models focusing on radiation concept, associated effects and phenomena, risk and protection, followed by some additional questions and a demographics part. An element of novelty was the requirement to draw their representations, for example, how they imagine the interaction of the radiation with the human body and cells, how they represents the propagation of the radiations, and what is the image of the sources of radiations. Also the drawing of the representation of the atoms and molecules was requested.

The study was performed during July 2014, and was based on 15 interviews following demographic criteria (gender, age, education). In parallel similar investigations took part in France, Poland and Slovenia, with 14-16 interviews per country.

The analysis that followed the interviewing part was had as objectives to:

- Reduce the complexity of the data collected
- Produce maps – one per interview
- Use the drawings to produce common suggestive images
- Perform a semantic analysis

The purpose was first of all to introduce all answers in a schematic view, then to produce some mappings aiming to understand the links between different components of the mental models.

The questions and the statistic compilation of the answers were presented in details. *Marin Constantin* also illustrated the public representations for radiation emission. In the view of the respondents the cause of the radiation may be: the instability of matter, the energy escaped from plant, the pollutant released by an installation. In the case of propagation, the representations can be grouped in: like the light, diffusive (like fog, pollutant), convective (atmosphere), waves (electromagnetic, radio), and in the form of clouds.

For entering the body, investigated people indicated that the process may happen by: inhalation of air, consuming contaminated food and drinks, by penetrating the skin similar to the X rays at airports or medical scans, and penetrating sensitive parts of the body like a arrow through the head. The presentation pointed out that, in general, common peoples are aware on the consequences of radiation exposure (mentioning the appearance of the health disturbances like headaches, nausea, and dizziness); causing major diseases; producing cancer, leukaemia, and cell destruction). At the same time they are aware on the protection measures, mentioning reducing the exposure, finding a shelter, not abusing medical investigations, avoiding any ingestion and also maintaining a healthy skin as a barrier against radiations. The drawings representing internal effects depicted deformed cells, localized damage, damage of the liver, and splitting of DNA.

Regarding behaviour, generally people are afraid to eat irradiated food, are afraid of external radiation but in a greater extent for the internal radiation, and they express precaution on medical investigations. It seems they are more against radioactive waste than on nuclear power plants.

Marin Constantin insisted on the graphical representations resulted from the analysed data and on the need of feedback from the audience. This feedback should be focused on the resulted mental models and how can be used in communication of sources with the general public. On the other hand he invited to discuss how media channels can interact with the target public by understanding the expert models on IR and converting into untreatable messages. If the given information conflicts with the mental models of the receivers the distortion of the message will be great.

4.4 Discussions

Veronica Andrei (Nuclearelectrica, Nuclear Safety Department) mentioned that as member of the Romanian Association for Nuclear Energy AREN she participated together with INR experts in IPPA project on public participatory approaches regarding radioactive waste management which was a very interesting experience. She expressed the concern of the nuclear energy actors (owner, operator) for the continuous improvement of their communication to the public and the public perception on IR after Fukushima is particularly of interest. She remarked in the mental models presentation the positive perception of the population regarding the medical use of IR. The perception of radiation is very different among general public according to the type of IR application. For example, people using medical investigations are very open to these investigations, they go very fast to NMR, tomography. In Romania, it is a trend to have CT scans. Doses received per investigation could reach 80 mSv per CT investigation while occupational doses for nuclear workers should not exceed 20 mSv per year. It would be useful to understand why people have this different approach and translate this in recommendations on what type of targeted information should be used in future communications.

Discussions continued on the reasons determining the positive attitude of population for medical use of IR.

Daniela Diaconu (RATEN ICN) who participated in the interviewing process for mental model analysis said that it appeared that people try to find a balance between the risk to be ill or benefit to recover your health and the risk to be irradiated.

Veronica Andrei suggested finding a type of risk communication for members of the general public starting from the positive attitude they have regarding the CT scans that may help them decide to take or not a medical investigation.

Stela Diaconu (AN&DR) believes that people feel the exposure is under control when they go to the doctor. Trust is an important factor. When people believe there is someone that has control, they do not fear so much.

Veronica Andrei: People working in hospitals also need to hear about their protection against radiation.

Florin Gheba (Director of Nuclear Fuel Plant) proposed to organise in the next edition of the SIEN a workshop on how to increase the awareness of people on radiation, how it might be possible to increase the trust of people regarding the management of nuclear energy, how

to act as a nuclear company regarding public communication, how to develop and have a structured point of view.

Carmen Varlam (National Research Institute on Cryogeny and Isotopes Separation Rm. Valcea) thinks it is important to show the public that nuclear activities are subjected to rigorous control, especially people that live very close to the nuclear facilities.

Daniela Diaconu noticed the consensus on the fact that the first step is to build trust. She raised the question on how to really reach the audience in the communication programs of the institutional sources by using mental models or other concepts in defining their strategy. More knowledge about the common used representation of IR is needed.

Felicia Drăgan (CNCAN–Public Relations) mentioned that the national nuclear authority has a strategy of communication but it is not based on something like these mental models. Almost every day CNCAN receives requests from people asking information, most of them not on ionizing radiation, but for example about installations.

George Banciulea (journalist, AGERPRES, National Press Agency) expressed the interest of mass media to include IR in their communications but in a larger context. In his opinion, discussion has to be not limited to ionizing radiation. He recalled that several years ago there was a big issue on phone antennas, so people are worried about any kind of radiation, but they know they should protect somehow. For example, currently there is a great interest on microwave subject. And he expects WiFi should also be a subject to discuss. Therefore he suggested including IR in wider scope when it comes to discuss about them.

The meeting was adjourned after identifying conclusions and some recommendations.

4.5 Conclusions

1. The Romanian sources mandated to inform the public on ionising radiations issues (CNCAN - the regulatory body and ANDR - the waste management organisation) do not presently use a mental model approach or other grounded method in the elaboration of their information and communication programs. Actually according to CNCAN practices, the only information for the public consists in the legal framework, regulations, etc. and the only communication with the public is based on questions and answers to particular problems.
2. Some of those questions from the public typically focus on the safety of installations. It is important to show the public that nuclear activities are subject to rigorous control, especially people that live very close to the nuclear facilities.
3. There is a need for a more active participation of the institutional sources (CNCAN, ANDR) in the informing population, stressing the safety culture existing not only in the medical sector but also in nuclear energy.
4. Nuclear industry is interested to identify the reasons for which the population is so easily permissive to the use of the IR in medical investigations. It was suggested the nuclear sources should make necessary changes in their communication policies. The main questions to be investigated are: Is it a general trust in medical doctors? Is it about a fundamentally

different perception of risks and benefits associated with medical treatment and nuclear activities?

5. Mass media finds more interesting (from journalists point of view) to embed the IR topic in larger contexts, notably those corresponding to risks that concern the public (the entire spectrum of radiations, including non-ionizing electromagnetic radiation, etc.).

5. Report from the Slovenian workshop

The national workshop with representatives of informed civil society from Slovenia was the first one organized on the topic of the EAGLE research on mental models of ionizing radiation. Held in June 2015, its aim was to present findings to the Slovene national institutions which are providing information to the public on ionizing radiation and to discuss the possibilities of improving communication with citizens. The workshop was entitled: "Public understanding of ionizing radiation, challenges and solutions".

Invited were all representatives of institutions which were involved in the analyses of communication culture in Slovenia (10 organizations from regulators, ministries, industry, implementer, medical applications and TSO), representatives of media and representatives of civil society organizations (ex-local partnerships, NGOs ...), for a total of over 40 Slovenian participants. The workshop was an opportunity to share the thoughts, experiences and approaches that each institution has already developed in relation to their communications on ionizing radiation. Discussion was facilitated on the following topics: What are the consequences of the findings from mental models research, what changes can institutions make in their communication practices based on the results and what are the needs of media to improve the current situation.

The National Workshop was implemented on Tuesday, 16 June 2015 from 13:30 till 15:15 as a session of the three-day conference "RICOMET 2015 - Risk perception, communication and ethics of exposures to ionizing radiation", Brdo Castle, Slovenia. It was held in Slovenian language, with simultaneous translation between Slovenian and English to accommodate the Work Package leader (who made an introductory speech in English) as well as the RICOMET participants from many European countries who chose to attend this session.

5.1 Agenda

The workshop program was moderated by *Ms. Milena Marega, REC*. An introductory speech on main activities under EAGLE WP3 and on the aim of the workshop was made by *Dr. Daniela Diaconu, RATEN ICN*, including presentation of a report on public views across EU on education and information in the post-Fukushima context. This was followed by the presentation of mental model research results with members of the Slovenian lay public by *Dr. Nadja Železnik, REC*.

An expert panel was organized to include *Prof.dr. Marko Polič* from University of Ljubljana, the representative of Slovenian National Nuclear Safety Authority *Mr. Marjan Tkavc*, the representative of the NGO FOCUS Slovenia *Ms. Lidija Živčič*, and the representative of the National RTV Slovenia *Ms. Renata Dacinger*. The speakers shared their views as an introduction to the open discussion on the research findings, the consequences of actual mental models and the recommendations for better communication. At the end of the workshop the main conclusions were summarized by moderator *Ms. Milena Marega*.

5.2 Summary of the expert panel and discussion

Prof.dr. Polič, professor of psychology, pointed out that it is very important to take into consideration the public level of knowledge; that is why the mental models research is necessary. In some cases scientific personnel consider the public as simply not knowledgeable and that sharing basic information with them would overcome this obstacle. Unfortunately, the people's perception and mental models are far more complicated and complex; in general people rather accept information which is in accordance with their beliefs. Similar misleading conclusions are also seen among technical scientists who consider their topic in too narrow a context. As *Ms Železnik* concluded in the mental model research that in Slovenia there is negative perception of nuclear energy, also a majority of other studies have confirmed that due to its catastrophic potential nuclear energy is generally very negatively perceived. He emphasized that there is constant changing of situation and social context, and that communication has to be also led in accordance with the developments (in previous century the nuclear energy was considered advanced, nowadays there are many open issues regarding nuclear, especially nuclear energy and related accidents). He pointed out that communication is managed mostly as a one way promotion campaign without proper dialogue and interactions, or the latter is used only partially on some subtopics (for instance, local partnerships were set up in the context of siting radioactive waste disposal, but when the goal was reached and the site was confirmed, the public participation was terminated). He concluded that as this is part of the one big topic – electricity production, it should be managed very democratically and inclusively; if this it is not so, then we can ask ourselves how democratic are the countries we live in.

Mr. Tkavc, the representative of the Slovenian National Nuclear Safety Authority confirmed that mental models are already in use and known, but he supported the improvement actions. He stressed that in Slovenia the system is similar to other countries with nuclear and other facilities applying ionizing radiation. Nuclear safety is controlled by national authorities - National Nuclear Safety Authority and Slovenian Radiation Protection Administration, with involvement also of other responsible bodies like the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief in case of emergencies. He pointed out that all listed authorities have a lot of experience with communication on a regular basis and at special occasions (like this event), but less experience with emergency communication as there has been no nuclear emergency in Slovenia. Authorities try to follow IAEA guidelines. The main issue is that regular non-crisis communication is less interesting than crisis news so it does not get much attention from the public. However, while older people are not so interested in regular communication, the youth is more curious and open to that kind of basic information and therefore the information sources should direct their communication process to this audience with the aim of improving their knowledge (e.g. the difference between irradiation and contamination).

Ms. Živčič, NGO representative, started her talk with statement that there is a lack of trust in the information generated by national authorities, based on the survey finding that the public have more trust in the information received from the NGOs side, especially in time of disasters. Communication should not be led as a one-way persuasive campaign of positive information. This approach diminishes the perception of credibility of the information and puts the public in a lower, not inclusive, position. She recommended using open dialogue as

the right way to provide information; especially she addressed the importance of hearing public opinion and acceptance of different views. Most important is to provide reliable and realistic information in a timely manner. Especially misleading is the first information at time of emergency when the authorities try to calm down the public reaction with such typical statements as "everything is under control, there is no safety risk", etc. Such messages lead to deep public suspicion and lack of trust. Additionally, public information should be easily understandable and clear. It is not rational to expect that the lay public will automatically understand the phenomena of IR, whence the role of the scientists, education system and media to provide information that is clear and easy understandable.

Ms. Živčič gave an example of bad communication from Slovenia (concerning the construction of thermal power plants Šoštanj) and judged that in such a context trust can easily be lost. She added that the similar loss of trust can be expected in the case of a new NPP at Krško for which many investments are already under way although no formal decision to build a new NPP was taken on the national level. She also raised the issue of limited access to the information from certain nuclear organizations (in particular the owner of NPP, but also some public bodies, which according to her employ all legal means to withhold information).

Ms. Dacinger, representative of the national RTV, referring to the statement that it is hard to get media to focus on ionizing radiation topics, pointed out blame on both sides. Publishers lack trust in the journalists' work. As media is the first line to the public, they are obliged to provide interesting news, therefore the authorities and scientists have to motivate the journalist with interesting topics/ stories. She pointed out that besides the findings from the mental model results there is another big issue to address and this is the interests expressed by the public. There is a flood of news and information when the topic is interesting, but the question remains - how to address those topics at other times. She mentioned a possible solution: a storytelling concept (e.g. article title: Marie Curie's notebooks are still radioactive).

Discussion was provoked with the intriguing question: What do you think if people would be more involved in the development process of energy supply in Slovenia and that some general consensus would be reached, would then new solution such as new NPP construction be more acceptable? First feedback is that technical documents are not generally readable, but also the lack of public interest is a problem. Additionally, there are possibilities for engagement in the energy decision-making process, but maybe there is no real interest in this topic. Engagement of the general public into the highly technical parts of the process could be problematic due to lack of detailed knowledge; sometimes even scientists from other fields do not know about specific topics. Media should give a real picture and not provide information generated by interest groups (industry, policies, etc.). Exposed was how important is the role of primary education about IR at school and this should be used as one solution. A Slovak example of engagement was presented, how they start to engage public at the early stage of the new plant. The discussion was concluded with YES to a real engagement process, taking into consideration public ideas and opinions, which might obtain or increase trust.

6. Recommendations

6.1 From the French context

At the end of the French workshop, participants reviewed the conclusions and recommendations that had emerged from EAGLE WP2 media seminars held in France in 2015. Most of those recommendations were found to correspond closely to remarks and suggestions heard from the CLI during the preceding discussion. For this reason, **the CLI board members decided to "ratify" the EAGLEWP2 recommendations.** Additional or adjusted text suggested by the participants is underlined.

- **Developing 'risk culture' is a worthwhile objective for public communication about ionizing radiation risks**
 - *Risk culture means that people are aware of the existence of risks but also, of preventive and protective actions that are taken by the authorities or that people themselves can take in some cases.*
- **Advice for official sources**
 - i. Adapt public information to the everyday life and observed needs of citizens.
 - ii. Create highly accessible and attractive data presentations (like infographics) through multiple channels for the public and for use by the media.
 - iii. Create open discussions during crisis and non-crisis periods, where members of the public can ask their questions.
 - iv. Foster and facilitate the activity of civil society organizations which are responding to citizen needs "on the ground".
 - v. Develop institutional independence and transparency, clarity, dialogue, credibility and balance in communications.
 - vi. Partner with community structures like science museums.

Furthermore the workshop participants delivered specific advice for civil society information organizations like their own.

- **Additional advice for civil society organizations like the CLI**
 - Find out about the resources that can be offered by national sources and build cooperative, joint information events, like school presentations.

- Embed information activities in existing community activities (especially festive ones, including the local Science Festival).
- Go to the public on their own ground, instead of making them come to you.
- Take the time needed to listen and learn what questions people have.
- Combine discussion of ionizing radiation risks with active education and communication about other technological risks that may exist in the same community.
- Let residents get to know the people who are tasked with risk management, and learn firsthand about the prevention plans that are in place.

6.2 From the Polish context

The following pragmatic suggestions emerged from the Polish workshop discussion:

- In order to communicate information about ionizing radiation, one could start by discussion of topics related to nuclear medicine which is accepted by most of the public;
- The education about the ionizing radiation must be provided, above all, at primary level;
- Education of teachers and journalists is very important;
- Even the best educational curricula cannot replace good will and knowledge of teachers who pursue them; the need of increasing the attractiveness of communication, especially at school level by use of appropriate educational aids, is very important.
- In relation to the program of Polish nuclear energy, the participation of the public in decision-making process should be ensured at the earliest possible stage of nuclear projects execution. In order to make informed decisions, knowledge about the subject of the decision and appropriate information are required.
- Concerning the discussion of advisability of building a nuclear power plant in Poland, one must ponder on the method of communicating information so that it reaches the target recipients, often exposed to demagogic messages from opponents of nuclear power plants.
- As a good practice one should give an example of activity of FORUM ATOMOWE (atomic forum) and creation of a mobile lab initiative - atomic

bus. The bus reaches the remotest corners of Poland, presents knowledge about IR and nuclear energy in a form adapted to the knowledge and abilities of a simple recipient. Another way is to create educational television and radio broadcasts addressed to different audiences.

6.3 From the Romanian context

Romanian participants drew some pragmatic suggestions from the main workshop observations:

- While today the main communication consists in publication of regulations and ad hoc response to occasional questions, a grounded approach like Mental Models could be used by official sources in order to gain an idea of what the Romanian population wants and needs to know about ionizing radiation and risks.
- Today, questions received from the public typically focus on the safety of installations; therefore a first information effort could focus on how nuclear activities and safety are achieved and controlled.
- Nuclear industry could benefit from risk perception and communication seminars to understand the impact of trust, perceived benefits and the justification of activities using ionizing radiation. They could work with social science specialists to examine how the nuclear industry can proactively meet public expectations and develop better public knowledge of actual safety and economic contributions by the industry.
- Officials could work with journalists to help embed clarifications about IR into larger topics which clearly interest the public, such as electromagnetic pollution.

6.4 From the Slovenian context

Based on the discussions during the Slovenian national workshop several findings can be recapitulated.

A **public right** is to be informed about the ionizing radiation, so the information from the information sources should be comprehensive, transparent, available, accessible, timely and should include information about practices, benefits, potential health and environmental risks.

Trustworthy information sources

- The information sources should build confidence in their trustworthiness over long term in order to establish positive relationship with the public and to assure that their information materials, which many times are good, attractive and understandable, are used;
- The information sources should work more on credibility and comprehensiveness of information since they are perceived also by journalists to be driven by interest and are suspected too often of concealing or holding back the truth;
- Failing to provide comprehensive and timely information may seriously harm the credibility of authorities and cause large difficulties in management of the emergency situation in the longer term;
- The most important is to give information truthfully without a delay in understandable language and based on good practices;
- Responsible institutions would need to recognize the benefits of two way communication with the public and not only the disadvantages;
- The information sources should improve the transmission of information to the general public by improving the wording, delivering readable and understandable material which would be used by media;
- The communication on IR should take into account all sources of information present in different media, including those sometimes also providing unreliable, misleading data and rumours, which people choose and prefer no matter how trustworthy they objectively are;
- Clear, concise messages about different aspects should be given to the public in case of nuclear accidents and should be available also in some international language (like English). Mass media could play a key role in reassuring the public if the countermeasures are clearly explained;
- Know your public: attitudes, risk perceptions, historical memory and address these characteristics in your communication. Take specifics of the country into account (e.g. existence of nuclear installations, level of public understanding of radiological concepts).
- It is necessary that also nuclear industry change the communication strategies and rely on objective, comprehensive and complete information which should be given on time without use of legal means to restrict information;

- When sending the information, nuclear professionals must adapt to non-nuclear society. Communication must take into consideration education, age, gender, perception, attitudes, etc.;
- Even under uncertainty and recognizing their limitations, transparent, clear, understandable information must be provided to the public and the mass media from the beginning of the early phase of any nuclear emergency by the responsible authorities and government. Many different channels have to be used to reduce the misleading information and rumours.

Information channels:

- Traditional media and social media interact and are used as sources by both sides, but the principle information source about nuclear emergency (e.g. Fukushima accident) for a majority of people remains traditional media (like television, newspapers and radio) ;
- Key to effective public social media communication is a constant presence in crisis times as well as in non-crisis times; social media are just a tool – it is up to humans to define its role and value;
- There should be many different channels to reach the public and the information should be adapted to the level of understanding, but the main message should be harmonized;
- Communication of risk in mass media is generally weak and requires improvement.

The interest of people on the nuclear emergency **is high** and lasts for long time therefore information sources should assure appropriate provision of information over significant time periods;

Journalists as main public information points

- As journalists via different media still remain the main source of information for population there should be regular and continuous links between information sources and journalists in order to provide comprehensive and accurate data;
- Information sources should have a specialized knowledgeable spoke-person to communicate with journalists and access to the scientists which should be ideally learnt how to communicate with public, particularly in use of understandable language;

- Still a vast majority of Europeans feels the information the media offers about IR is not sufficient, therefore information sources should develop better strategies in order to effectively communicate with public, including the approaches to link with media.

7. Conclusions

As part of the WP3 activity planned to reach this objective a mental model investigation was performed in 4 countries (France, Poland, Romania and Slovenia). These findings were presented and discussed with representatives of national sources and journalists.

The four national workshops explored to what extent institutional sources and journalists have been used mental models in their current communication approach and their utility in the future communication programs.

Suggestions and recommendations for an improved communication proposed by participants during discussions have been collected and will be used as input in elaboration of a guide for good practices in public education and information.

The major common concerns raised during the workshops relate to education, building trust, providing adequate information, involve society in the communication process.

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