



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

Grant agreement no: 604521

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Date of issue: 10/08/ 2016

Project co-funded by the European Commission under the Seventh Euratom Framework Programme for Nuclear Research & Training Activities

Dissemination Level: PU - Public

Start date of project: 12/08/2013

Duration: 36 months



DISTRIBUTION LIST

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Project in short

<http://eagle.sckcen.be>

Education, training and information to the general public are key factors in the governance of ionizing radiation risks. Communication about ionizing radiation with the general public has to be further improved, as highlighted also by the 2011 nuclear accident in Japan. An effort is needed to analyze the state of the art and the existing needs in education, training and information, and to coordinate the information and communication about ionizing radiation at European level. This was the objective sought by the EURATOM call Fission-2013-6.0.2: Education / training / information towards the public. The selected project was entitled **EAGLE (Enhancing educAtion, traininG and communication processes for informed behaviors and decision-making reLatEd to ionizing radiation risks)**, and it was active 2013-2016.

The project set out to identify and disseminate good practices in information and communication processes related to ionizing radiation. For this purpose, the consortium reviewed 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 European level. The lessons learned from the nuclear accident in Fukushima also provided valuable input. The main goal of the project was to enhance public understanding of ionizing radiation and to facilitate a coordinated communication approach.

Moreover, EAGLE fostered a move towards the ideal of citizen-centered communication, including a participative component. The project brought together representatives of nuclear actors, users of ionizing radiation, authorities, mass and social media, and informed civil society. The project website contains the scientific reports and records of many rich interactions: <http://eagle.sckcen.be/en/Deliverables>

More information can be obtained from the coordinator of the project Mrs. Tanja Perko, tperko@SCKCEN.be, SCK•CEN.

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About deliverable:

Deliverable D1.3. Guide for improvements of solutions for good practices and coordination for ionizing radiation information sources



Guide for improvements of solutions for good practices and coordination for ionizing radiation information sources

Summary

WP1 of the project EAGLE is dealing with the education, training and information (ETI) materials and activities provided by the representatives of public and private institutions that communicate about the ionizing radiation, its risks, and radiological protection issues in EU member states. An overview of communication practices regarding ionizing radiation, the risks of its application and nuclear accidents (Fukushima case), was carried out by EAGLE Work package 1 (WP1) with the help of many information sources from nuclear power plants, governmental institutions, regulatory bodies, technical support organizations, universities etc. in EU member states.

Information sources were divided into two basic groups that can be collectively called “nuclear industry, regulators and policy makers” and “medical institutions”. Citizens generally accept the exposure to ionizing radiation due to medical procedures and reject it when it is linked with nuclear energy production. The examples of ETI materials from “medical” and “nuclear” institutions revealed a great difference in objectives of ETI materials from respective information sources. While the medical information sources clearly speak about the effects of radiation on human body and compare positive and negative impacts of ionizing radiation for a defined patient, the nuclear industry, regulatory and policy-maker information sources provide either scientific explanation of ionizing radiation, or try to convince citizens that there are strict safety measures, that everything dealing with nuclear technology is under control and that exploitation of nuclear energy is economically and even environmentally beneficial.

An analysis of relevant aspects of ETI materials and activities was performed by on-line survey and supplemented by the interviews with top management of information sources to evaluate the communication culture in the organizations. Examples of ETI materials provided by information sources or found on websites were evaluated; general, good and bad practices were noted. Results were presented in the project delivery D 1.1 (***Analysis of education and training materials and activities regarding the ionizing radiation***). Eventual specific aspects of communication strategies and ETI materials and activities during and after the Fukushima accident were also analyzed and presented in the project delivery D 1.2 (***Analyses of ETI materials in EU related to Fukushima accident***).

It was confirmed that the information sources are fully aware of the need for good communication with stakeholders, with the general public or civil society in particular. However, a lot needs still to be done to reach a mutual understanding, respect, acceptance and confidence on the side of information sources and information recipients. New communication channels provided by social media are appreciated by the citizens and are very useful in crisis situations. Results of the analysis of the impact of Fukushima accident on general communication approaches in EU member states indicated that this nuclear accident did not have a long lasting impact on communication practices of information sources. This fact indicates that communication sources have a rather rigid approach to communication activities. It can be one of the reasons that the communication gap between the public and the information sources is maintained for decades despite obvious efforts of information sources. As the objective of the project EAGLE was to analyze the status quo in ETI materials and activities and to propose the improvements, the conclusion about rigidity remains only a hypothesis.

Our recommendations to improve ETI materials and activities about ionizing radiation and its risks are the following:

R1: It is not advisable to prepare the ETI materials and activities on a common template in all EU member states.

R2: ETI materials and activities should be prepared for specific target publics (e.g. students, local population, politicians, journalists, teachers ...) and should respond to their interests and needs.

R3: ETI materials and activities should be regularly reviewed and adapted according to feedback from the target public. Preparation of the materials together with the public is very beneficial.

R4: ETI materials like leaflets, video-clips, annual reports, webpages, blogs, TV and radio broadcasts etc. are valuable but not sufficient communication tools; science-to-citizens approach and open discussions about facts and fears should be promoted as an efficient tool for communication about ionizing radiation.

R5: Employ internet-mediated encounters (e.g. webinar, online forum, platforms...) in order to enhance interaction with different groups of the population. Actively participate on a social media landscape.

R6: ETI materials and activities should communicate facts, not opinions, in order to empower the citizens to take informed decisions but not to dictate their decision.

R7: Information sources should consider and implement role division, and define the responsibility of information sources, educational system, media, policy makers etc.

R8: ETI materials and activities should support teachers' work but duplicating their work should be avoided.

R9: Information sources should show and explain what they are doing and what are the health and environmental risks from their activities. Justification of radiation activities must be presented to the public.

R10: Before starting to prepare ETI material or activity, think of innovative and effective ways to attract the public's attention.

R11: Risks of using ionizing radiation in defined situations should be clearly described and the distinction between the risk and the actual danger in emergency situations should be explained. The impacts of using the ionizing radiation should be put in the context of exposure to natural background radiation

R12: ETI materials and activities should address radiological protection aspects in parallel with nuclear safety issues.

R13: Radiation risks and radiation safety issues should be balanced and preferably presented together.

R14: Institutional communication culture should be constantly adapting to the actual communication landscape in order to support and facilitate all routine and emergency communication activities.

R15: Engagement in the ongoing dialogue among the professionals and public should be a routine procedure.

R16: Contribute to citizens' science projects by organizing or promoting projects about ionizing radiation, sharing information and verifying collected information.

R17: Support science correspondents by offering education and training related to IR topics including emergencies. In addition, some funds for scholars could be established in order to encourage knowledge gathering in a journalistic population.

R18: Establish "Science Media Centers" as a centralized scientific data service for journalists. Sources can foster this type of resource by becoming dues-paying members and by contributing information and expertise. Similar "Science Education Centers" can be established for teachers.

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0. Introduction

The need for regular and fair communication about ionizing radiation in our environment is already a generally accepted standard for those who are professionally involved in using ionizing radiation sources or nuclear energy, and for stakeholders as well. General public, and civil society in particular, require transparent and inclusive governance regarding all nuclear activities. The nuclear sector accepts its accountability for safe and environmentally acceptable nuclear activities and its obligation to give all relevant information about the impacts of its activities on citizens' health and the environment.

Many information materials and activities were produced and disseminated by users of radiation sources and nuclear energy in the last decades. However, the communication gap and lack of trust are still present. The objective of WP1 of project EAGLE was to collect and evaluate the information practices and materials, to evaluate them and to propose improvements on the basis of good practices.

A broad overview of communication practices regarding ionizing radiation, the risks of its application and nuclear accidents (Fukushima case), was carried out by EAGLE Work package 1 (WP1) with the help of 47 information sources from nuclear power plants, governmental institutions, regulatory bodies, technical support organizations, universities etc. in 18 EU member states¹.

Data about information sources and their own evaluation of their ETI materials and activities were collected by computer assisted online questionnaire. Representatives of information sources we also personally contacted and interviewed to evaluate their communication culture. They were also asked to provide samples of their materials and information activities and to evaluate them by means of our questionnaire. Examples of ETI materials and activities were collected also by internet searching. Specific issues of communicating about a nuclear accident (Fukushima) were analysed by a separate questionnaire.

Information sources from the nuclear power industry, radioactive waste management organizations, governmental institutions, or regulatory bodies invest in developing communication approaches and are using diverse communication channels. For some, the main objective is to involve the public and to increase public tolerance towards ionizing radiation by convincing it that living with the nuclear installation is not harmful to individuals, and can even be beneficial for the community. Regulatory and policy actors are communicating about the safety measures and eventual radiological incidents. They also provide data about the radiation measurements in the natural environment and near nuclear installations. Education, training, and information (ETI) materials follow these objectives, mainly by providing a scientific explanation of ionizing radiation, by asserting that nuclear facility operates safely and that it is strictly controlled by competent regulatory

¹ Austria, Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Greece, Hungary, Latvia, Lithuania, Poland, Rumania, Slovakia, Slovenia, Spain, Sweden, United Kingdom

institutions, that the risk for an accident is negligible and that the operator knows how to handle emergency situations. On the other hand, ETI materials describe the economic advantages of nuclear energy and technical features of its production. Such ETI materials have an important disadvantage that they are very general, don't address specific citizens' concerns and interests, and don't stimulate personal engagement.

The situation is different in the medical use of radiation sources. Here ionizing radiation is associated with health improvement instead of health harm, although the radiation exposure to individuals due to the medical use of ionizing radiation is generally much higher than the exposure resulting from nuclear energy production. Medical use of ionizing radiation is generally acceptable and even recommendable. Medical doctors who propose using of ionizing radiation for treatments or diagnostics enjoy trust and their work is considered ethical. The problem of radioactive waste is not highlighted. The decision about taking the risks associated with additional medical exposure to ionizing radiation usually concerns an individual person who decides about his/her own health benefit or risk, the decision having no influence on the community or welfare of other persons. Communication materials about ionizing radiation aspects in medical use are adjusted to these specific aspects and provide another type of information than communication materials produced by information sources in the nuclear industry or governmental bodies responsible for nuclear energy and nuclear safety. They provide information about beneficial and harmful impacts of ionizing radiation on the human body. More attention is paid to radiological protection measures, direct radiation effects during medical treatment, and recovery from radiation impacts.

Each of the surveyed communication approaches in the nuclear industry and medical use of ionizing radiation is functional in its own context. We consider that the medical approach is more adapted to public needs and is also more efficient, although many medical information materials are much less attractive and sophisticated than ETI materials produced by information sources from the nuclear power industry, radioactive waste management organizations, governmental institutions, or regulatory bodies.

There are several challenges for information sources to improve their ETI materials and activities, for example to distinguish and balance the public, policy-makers', company's, and personal interests, to promote awareness of natural background radiation (e.g. radon, NORM), to communicate risks and danger properly, to engage citizens in policy and decision making process, to establish a sustainable relationship with the citizens and/or local community. Comparison of information about ETI materials and activities from different information sources from EU member states provided a useful source of ideas and good practices. This deliverable presents some guidelines for improving the information and education materials about ionizing radiation and its risks.

I. Aspects of education, training and information (ETI) materials and activities

A quick survey of web pages of any institution dealing with ionizing radiation sources shows that producing ETI materials relating to ionizing radiation and the risks has become a standard activity and that these institutions took the responsibility to inform, educate and discuss the ionizing radiation and its risks. Today the question is not whether to communicate about ionizing radiation or not, but how to do it. Our online survey showed that most of the institutions do it by themselves and consider themselves as being the basic and most appropriate information source in diverse communication activities available to the public (see D 1.1 Analysis of education and training materials and activities regarding ionizing radiation). Although this assumption is not always valid, because other information channels like mass and social media, civil society initiatives and curriculum of compulsory education are also important, it has a significant influence on ETI materials and activities.

The guidelines presented in D 1.3 refer only to ETI materials and activities provided by primary information sources (nuclear power plants, radioactive waste management organizations, governmental institutions, regulatory bodies, medical institutions). ETI materials and activities from the nuclear power industry, radioactive waste management organizations, governmental institutions, or regulatory bodies are in the focus of the guidelines and materials from medical applications are used for comparison.

I.1 Needs of information sources and the citizens

Based on our review of publicly available ETI materials and observed activities, three aspects stand out reflecting that information sources take for granted:

- citizens would like to participate in decision-making about nuclear energy and nuclear installations,
- citizens are ignorant about ionizing radiation,
- citizens worry about ionizing radiation because they don't know enough about it.

Though, the information sources in our online survey stated that according to their experience, the basic interest of the public is to be informed about the actual risks that they are convinced are necessarily associated with the ionizing radiation. The public wants the information about the activities of the information source, requires accurate facts, and is not satisfied with promises or assertions. They are very sensitive to the willingness of information sources to respond to any of their questions and provide all data that they

would like to have, irrespective of their real importance for safety or radiological protection. They want to be treated as an equal partner in communication.

One of the possible explanations for the citizens' needs to be informed and involved in decision-making is that they have little confidence in the decision makers. By taking part in the decision-making process they try to control the situation and the decision makers. Less secure they feel, more they reject any nuclear facility or radiation activity and more they want to be involved in the decision-making. By increasing their trust in decision makers and in safe operation of radiation facilities the citizens' motivation to oppose the nuclear facility may decrease. The trust building is one of the central points of ETI materials and activities.

The interest of information sources is to establish a productive relationship with the local community and to achieve the acceptance of their activities in the community. They want to do it efficiently and reliably, and as simple as possible. By ETI materials and activities, they want to increase the knowledge but they feel that they are not very successful in increasing social acceptance of radiation activities in decision-making procedures. The explanation may be that the knowledge about ionizing radiation and the acceptance of radiation activities on the community level are not correlated, although knowledge and acceptance on a personal level are correlated. Understanding the risks from ionizing radiation indeed increases trust in individuals but may also decrease the individual motivation to participate in decision making because a person has no need to control the decision makers. In this way, ETI materials and activities do not change the characteristics of the group involved in decision making.

I.2 Objectives of ETI materials and activities

The main purpose of ETI materials and activities is providing information in one direction. There are two main groups of ETI materials and activities: those that can be used in schools, and those that are designed for local community. According to our survey, reported in D 1.1, information sources usually don't systematically create opportunities to get the feedback from the public. They provide answers to specific questions from the public but a comprehensive development of ETI materials and activities based on the feedback of the public is rare.

ETI materials and activities mainly provide a scientific explanation of ionizing radiation and information about the benefits from radiation or nuclear activities. Answering to questions coming from the public is also stated by sources to be an important objective. In the actual ETI materials, our review suggests that information sources stress low incidence rate of emergency situations and safety measures being undertaken. They provide data about radiation emission from the facilities and additional dose exposures because of radiation activities. Communicating about risks and uncertainties is not common although the information sources are aware that this issue is very important for the public. Communication in an emergency situation is considered important as a part of the

emergency plan which is not included in standard ETI materials and activities with the main objective to increase trust.

In general, the materials reviewed are intended to support the idea that the information sources are competent in their field and that they can be trusted. There is no need for citizens to bother with a critical evaluation of available information and potential uncertainties. This, more traditional, approach is already being criticized by some information sources, especially those working in the radiological protection field.

I.3 Types of ETI materials and activities

The most common type of ETI material is a website of the information source. It can have specific sections dedicated to education and information for teachers. Traditional printed media (magazines, books, posters) are still popular and more than 1/3 of information sources don't use social media. Those who use social media use them for the dissemination of their materials and for interactive contacts and discussion with the public.

Propaganda approach in preparation ETI materials and activities is very common because information sources aim at quick and consistent effects. Such ETI materials and activities promote the use of ionizing radiation, sometimes they can be biased or uncritical in order to influence the public. The other common approach is teaching/instructing approach that might be useful for informing pupils and students but is less popular with the adult population.

ETI activities (hands-on experiments and measurements, simulations ...) and direct interactions with public (round tables, open-door days) are becoming increasingly important recently. They are more demanding for the organizer and it is more difficult for the information source to control the information that is transmitted. Nevertheless, the sources reported that this type of activities has a very positive influence on confidence building between both actors – information source and the public.

II. Success criteria for ETI materials and activities

II.1 Important factors for the information sources

For the information sources surveyed by EAGLE, the most important motive for communication with the public is the establishment of and acceptance of their activity and achievement of cooperation of the stakeholders, when needed. Some of them communicate to fulfill the legal requirements or accepted standards which demand transparency and public involvement. It is important that the information source can control the information which is transferred to the public. One of the reasons is that they consider nuclear activities to be very complex and that the information is easily misunderstood or abused. This is not in the interest of the information source and it is common that it tries to have a monopoly over education and information activities.

Institutions use communication for the promotion of their activities and convincing the citizens that their activity is justified and even good for the community. They try to communicate about the issues that they think are important for the public, but at the same time, they communicate about the issues that are important for their own organization. Because the values and goals of information sources and the citizens are usually not the same, this approach could produce mistrust on both sides.

II.2 Important factors for the users of information

There are two main groups of users of information provided by information sources: general public as direct users and secondary information sources, such as journalists and teachers.

In the course of project EAGLE the stakeholders expressed their view that the public requires ETI materials and activities that are easily available, presented in an understandable language, and refer to their local situation. Opportunities to discuss open, uncertain and more complicated issues are highly valued. That's why activities, where the public can directly participate, are preferred over study materials or lecturing. It is very important that they feel that their points of view are respected and that their questions, ideas or other contributions are appreciated. In cases of social media, mail or other similar contacts and requests, it is important that information sources respond without delay.

For journalists and teachers, the important characteristics of ETI materials and activities are different. For a journalist, the most important thing is responsiveness and willingness to adapt to their time constraints. This is especially important when they report incidents. They

also prefer direct contact with technical or scientific staff than the contact with public relation department. For information sources this means that they have to prepare specific ETI materials for journalists, dealing with the most common issues covered by the media (basic data, good infographics that can be directly reproduced). Information sources have to recognize that a credible journalist has to keep his/her reputation of being independent and trustful and being committed to providing information for the good of the citizens. Journalists need concise information. They also need some additional background information in order to become more familiar with the subject, but only in the case that they can afford the time to study the matter.

Teachers need useful teaching material that can be directly used in the classrooms. The best are teaching completes with text and graphic explanations, instructions for experiments or observations, a list of additional education materials, video clips, interesting web pages, and tests. Adaptation of the same theme for different levels is very useful. Teaching materials have to be in simple and exact language and with many illustrations. Teachers also need special training about ionizing radiation where they can test the available teaching materials. They also need support and advice for situations when pupils or students, their parents or other teachers in principle oppose teaching about ionizing radiation.

II.3 Other factors

Points II.1 and II.2 focused on factors regarding the performance and approach to ETI materials and activities. There is another group of factors that are equally important for the information sources and for the users of information. They are dealing with the quality of information, data and concepts being provided by ETI materials and activities.

During the course of the project, some issues were continuously proposed. For example: include also natural radiation sources in our environment (radon, NORM materials), explain that the technology for cleaning contaminated sites and managing radioactive waste and spent fuel is known, speak more about exposure to ionizing radiation, doses, and the means to reduce the exposure, explain dose-effect relationship, discuss scientific uncertainties related to the effects of ionizing radiation, support teaching about ionizing radiation in schools ...

All these topics have one feature in common – they are interesting and relevant from the point of view of understanding nature but they may not serve any specific utilitarian interest of information sources or stakeholders.

III. Guidelines for improving ETI materials and activities

The work of all work packages of the project EAGLE was considered for preparing guidelines for improved ETI materials and activities. WP1 provided input data about the existing materials and the evaluation of these materials by the information sources. Evaluation and expectations regarding ETI materials and activities from the point of view of media, educational system and public were provided by the work of WP2 and WP3. Inputs from discussions at RICOMET conferences, stakeholder dialogue groups, and workshops were also incorporated into the final recommendations for information sources. Details of inputs will not be repeated in this report because they can be found in the documents cited at the end of this delivery (**V. Inputs for Deliverable 1.3**).

The results of work in the frame of project EAGLE gave the following recommendations for information sources to improve ETI materials and activities:

R1: It is not advisable to prepare the ETI materials and activities on a common template in all EU member states.

R2: ETI materials and activities should be prepared for specific target publics (e.g. students, local population, politicians, journalists, teachers ...) and should respond to their interests and needs.

R3: ETI materials and activities should be regularly reviewed and adapted according to feedback from the target public. Preparation of the materials together with the public is very beneficial.

Producing ETI materials and preparing ETI activities is in principle an interesting and creative job. Diverse approaches to communication-related also to the cultural and national characteristics of the target public and information sources were noted in our research. According to information sources, they served their purpose, but could be improved. Additionally, the local or national public is not homogenous but represents diverse groups with diverse interests, social relationships, background information, values etc. It is almost impossible to prepare a uniform material or activity that would satisfy the needs of every subgroup. Information sources often solve the problem by using the approach of school books or citizen-science materials but this approach would not satisfy everybody.

No universal template can be proposed and ETI materials and activities demand a **custom-made approach**. Asking the **public to propose the improvements** of ETI materials and activities is also a good practice.

It is understandable that ETI materials and activities are designed according to the objectives of information source but the acceptance of the materials and activities is better when they primarily respond to social or psychological needs of the public. This is emphasized in ETI

materials and activities referring to medical applications of ionizing radiation which is strictly in the interest of the patient (information user) and not in the interest of the medical institution (information provider).

R4: ETI materials like leaflets, video-clips, annual reports, web pages, blogs, TV and radio broadcasts etc. are valuable but not sufficient communication tools; science-to-citizens approach and open discussions about facts and fears should be promoted as an efficient tool for communication about ionizing radiation.

R5: Employ internet-mediated encounters (e.g. webinar, online forum, platforms...) in order to enhance interaction with different groups of the population. Actively participate on the social media landscape.

Active involvement of public has long-lasting effects because it provides people an opportunity to **reconstruct their mental models**, beliefs, opinions and understanding. Open space of free discussion and presenting different opinions not only stimulates **critical reasoning** but fulfills also personal **emotional needs**. If a communication only demonstrates that a certain idea is right or wrong, it is somehow assumed that the partners in communication are not **equal**. Such circumstances don't support tolerance and respect and can't be a favorable situation for **trust building**.

Social media tools and on-line interactive materials are excellent media for stimulating interactions between information sources and the public. Using online tools, sources can display how they work, giving insight into the processes of expertise and the way these impact society. The young generation is used to these communication channels and it is much easier to reach them by the internet than by traditional ETI materials. A possible disadvantage from the point of view of information sources is that internet-mediated communication requires that the administrator be continuously on-line, but this **constant communication** involves also public and promotes participation.

R6: ETI materials and activities should communicate facts, not opinions, in order to empower the citizens to take informed decisions but not to dictate their decision.

For the needs of project EAGLE, the users of ionizing radiation technology were defined as primary information sources. It can be expected that these information sources are biased in favor of a positive attitude to ionizing radiation applications.

Good practice for informing and education public about the risks and consequences of the medical application of ionizing radiation shows that when **examples of possible adverse effects are described and explained in the context of the benefits** people accept the information rationally and make an informed decision about their exposure. Explaining the risks on the basis of safety analyses, modeling and considering the probability of the worst combination of events is much more demanding.

Information sources should be aware that the information that they understand as a fact because they know additional facts, can be understood as an opinion on the side of the public which has no additional information. Consequently, such information is rejected. In order to **avoid conflicts**, it is better to use only the information which can be proven by additional information. This approach is also increasing trust.

By communication proven facts, the information sources **set the standards of knowledge and communication** also for the citizens and foster critical evaluation of the information that is needed for informed decision making.

R7: Information sources should consider and implement role division, and define the responsibility of information sources, educational system, media, policy makers etc.

R8: ETI materials and activities should support teachers' work but duplicating their work should be avoided.

Nuclear industry, governmental institutions responsible for nuclear and radiation issues and also radiological protection institutions still consider that they are more or less the only reliable information source about ionizing radiation and its risks. This was maybe true in the past but has changed a lot. Interested citizens can get good **information about ionizing radiation also from other specialized sources**. Information sources as were defined in the project EAGLE are accountable and competent to give information about their work. They are most convincing when they **speak about their profession and discuss as experts**.

It is a good practice to **cooperate with school teachers and science journalists** who are specialized to explain science concepts and skilled in adapting to different knowledge background of the public. More specific ETI materials and activities are needed for teachers and journalists. It is advisable to establish a stable relation with these particular stakeholders and to cooperate with them as **allies**, not simply as a target public.

R9: Information sources should show and explain what they are doing and what are the health and environmental risks from their activities. Justification of radiation activities must be presented to the public.

R10: Before starting to prepare ETI material or activity, think of innovative and effective ways to attract the public's attention.

Most of the citizens faced with the fact that there is a source of ionizing radiation in their environment are worried. Their worries don't come from the experience of real danger but from the feelings that they don't have all the information about the utility. **Practical information and, if possible, also demonstrations** of work procedures are interesting for local residents and allow them to gain a pragmatic vision of safety measures, or to **evaluate the social benefits from the nuclear utility**. When the utility that uses ionizing radiation performs well and there are no incidents it is more difficult to attract the interest from the public for any, even excellent ETI material or activity. The first step in communication should

always be evoking interest in the way that is most suitable for the community. In order to do that, the information source needs to know the community very well.

Very strict measures to exclude the public from approaching nuclear installations can contribute to suspicion, uncertainty, and mistrust. Information about the reasons for such safety measures and comparison with other industrial facilities can be helpful. It is not a good practice to describe other examples of similar facilities without giving transparent information about the local facility.

R11: Risks of using ionizing radiation in defined situations should be clearly described and the distinction between the risk and the actual danger in emergency situations should be explained. The impacts of using the ionizing radiation should be put in the context of exposure to natural background radiation.

R12: ETI materials and activities should address radiological protection aspects in parallel with nuclear safety issues.

R13: Radiation risks and radiation safety issues should be balanced and preferably presented together.

An important leitmotiv during all project activities was the observation that risks are addressed as a topic of communication mainly in cases of crisis or incident situations. Because ETI materials and activities emphasize safety and avoid discussing risks, a false impression can emerge that radiation is necessarily linked to crisis situations. Analysis of educational materials indicated that students get the basic knowledge about radiation in secondary schools. This knowledge can be applied later to evaluate impacts and risks related to radiation. It is difficult to determine why this knowledge is seldom used in practice but one of the reasons is certainly the fact that radiation incidents and risks are addressed separately from physical foundations of ionizing radiation.

As we don't have sense organs for ionizing radiation most of the people are not aware that it is present everywhere in the environment. It is a very good practice to provide the citizens with **measurement equipment for ionizing radiation** so that they can **check the radiation levels in their environment by themselves**. This is also useful for eventual emergency situations because people already have the experience of normal radiation levels in their environment. Although there are still uncertainties about the risks of low doses of ionizing radiation it is advisable to speak about them openly, and explain how and why the dose limits were defined. Public should be informed about the average doses for the population and for professional workers.

The **independence and integrity** of the information source which is communicating about risks and incidents are absolutely required. In principle, it is very difficult to prove to the citizens that the information source working for the nuclear industry, or any other stakeholder, is independent. In any case, communication about risks and safety requires specialized skills, and sources should ensure that spokespersons and front-line experts have training for this.

R14: Institutional communication culture should be constantly adapting to the actual communication landscape in order to support and facilitate all routine and emergency communication activities.

R15: Engagement in the ongoing dialogue among the professionals and public should be a routine procedure.

R16: Contribute to citizens' science projects by organizing promoting projects about ionizing radiation, sharing information and verifying collected information.

Well developed and differentiated communication culture indicates that the organization is not only committed to the efficient and safe operation but also to a good relationship with stakeholders. It is a message that the organization **respects stakeholders**. Conditions for realizing tasks and commitments of communication culture are provided by higher management which supports **communication activities in routine and in emergency situations**. Good communication culture is reflected in the **constant, fair and transparent dialogue** between experts and the public about all relevant issues related to the operation of the facility. Preparation and dissemination of variable ETI materials and activities, suitable for different stakeholders groups, and supporting other communication activities, is a standard in organizations with a good communication culture.

R17: Support science correspondents by offering education and training related to IR topics including emergencies. In addition, some funds for scholars could be established in order to encourage knowledge gathering in a journalistic population.

R18: Establish "Science Media Centers" as a centralized scientific data service for journalists. Sources can foster this type of resource by becoming dues-paying members and by contributing information and expertise. Similar "Science Education Centers" can be established for teachers.

Journalists and teachers are the most important persons which **transfer information** about ionizing radiation to specific target groups of information users. They are the actual **opinion-makers**, the teachers do it in long-term scale, while the influence of journalist is more transitory. Opinion polls made in the frame of project EAGLE show that citizens don't trust journalists too much because they often link them with politics. At the same time, journalists with integrity are highly valued.

In order to do their job correctly, teachers and journalists need to constantly **refresh and upgrade** their knowledge. Information sources that establish a sustainable relationship with journalists that write about science and technology have valuable co-workers. It is important to **provide them enough reliable and interesting information** and to qualify them to use this information. Short training provided by the information source every several years is a very good opportunity to **sustain the relationship** with journalists.

Similar applies also for teachers, only they require **different types of information**. Journalists need mainly information about the current situation in the nuclear installation or in the case of emergency and the general basic knowledge about ionizing radiation only helps them to evaluate the data and to prepare a better article. Teachers need very basic information about the ionizing radiation, its applications, and associated risks. Information about current events is useful to increase the interest of students for the basic information.

IV. Conclusions

Although ionizing radiation has always existed in the natural environment most of the members of the public understand the ionizing radiation as a threat to their health. Local communities usually oppose construction of nuclear facilities but the same citizens usually have no objections to the medical application of ionizing radiation. Having access to all relevant information regarding the environmental quality and impacts on human health is an established democratic norm in EU member states. Citizens, as well as the government and business, are aware of it. Institutions included in the project EAGLE studies, in particular the online surveys and interviews performed by WP1, declared that they supported information and communication activities, and considered them to be of good quality.

WP 1 of the project EAGLE attempted to find good practices in communication activities of nuclear sector and medical institutions that result in building confidence with the public, and consequently support and sustain a productive dialogue between the public and the implementers of ionizing radiation technology. This productive and sustainable dialogue is essential to empower the citizens to be able to critically search for reliable information and make an informed decision when necessary. Detailed recommendations for improving ETI materials and activities are given in the previous chapter (**III. Guidelines for improving ETI materials and activities**). General considerations regarding the outcomes of project EAGLE are presented in the following.

Conclusions and recommendations for information sources take into account the results from all work packages of the project EAGLE. It was shown that the education, training and information materials and activities still play an important role in confidence building. The materials and activities are prepared carefully but rather conventionally. Increasing the acceptability or at least tolerance for a nuclear installation in the local community is often the main objective of the information source. Although the materials are of a good quality they don't meet the expectations of the public, mainly when the materials are prepared by the actors of nuclear sector or the government alone. Usually, the materials don't answer to specific or urgent questions of the public but instead, present general knowledge about the ionizing radiation or nuclear technology. Therefore, one of the basic requirements for improving ETI materials and activities is an inclusive and participatory approach to

communication and content selection. Information sources should be interested in the public needs and provide two-way communication possibilities. Traditional printed or audio-visual materials are less appropriate to meet this requirement.

WP3 showed that the level of public knowledge and understanding of ionizing radiation, its effects and risks is not as low as was sometimes assumed. Materials used in communication should take this fact into account, respect this knowledge and avoid teaching about the physical basis of radiation. The difference between the cognitive style of a representative of information sources (scientists, engineers) and the cognitive styles of their public should be appreciated. More information regarding the evaluation of actual risk and practical radiological protection issues should be given. Risks associated with ionizing radiation and compared to natural background radiation should be an important content of most, if not all, ETI materials and activities, in contrast to the present situation when risks are mentioned mainly with emergency situations.

The information sources often wish to take over the whole communication regarding ionizing radiation. Although this practice may seem to be reasonable it is not very effective as it doesn't provide the possibility for professional specialization in communication. Public also declares that they do not trust nuclear industry, politicians or journalists. Role division, such as information sources to communicate strictly about their activities and utility performance, education professionals to take care of building reliable knowledge, journalists or communication scientists to prepare information materials, and social scientists to define social needs and lead the activities to reach the defined social goal. If the roles in communication practices are defined and stable confidence in actors can develop through time. This is very important for emergency situations when there is no time to start to build the confidence.

The general problem of communication about risks and benefits of ionizing radiation is the lack of trust between stakeholders. No direct or causal relation between trust, knowledge, and understanding of ionizing radiation and ETI materials is defined, but there is a correlation. In order to understand better this relation, to improve the practice of providing information and improve mutual confidence, development of social and natural science interactions and joint programs and projects are proposed.

From the results of all our work we would like to especially emphasize two requirements: one is to regularly include information on radiological protection principles in ETI materials and activities, and the other is to pay more attention to ETI materials and activities specially dedicated to journalists and teachers. In the last decades, a big step forward regarding communication about ionizing radiation and its risks has occurred. The focus switched from information and education campaigns about what is ionizing radiation and how it can be used, to continuous communication using different, preferably interactive communication tools. Information can be easily found on the internet but communication with others becomes more and more valuable.

V. Inputs for Deliverable 1.3

EAGLE – (D-N°: 1.1) – Analysis of education and training materials and activities regarding the ionizing radiation, 2015

EAGLE – (D-N°: 1.2) – Analyses of ETI material in EU related to Fukushima accident, 2014

EAGLE – (D-N°: 2.1) – Overview of mass and new media treatment of ionizing radiation topics: the case of Fukushima, 2013

EAGLE – (D-N°: 2.4) – Materials for international dialogue: Output of national-level dialogues for discussion, 2013

EAGLE – (D-N°:2.5) – Outcome of dialogues: Agreed recommendations and guidelines for developing media relations for IR communication, 2016

EAGLE - (D-N°:3.3): Guide for good and bad practices in public education, training and information, 2016

EAGLE – (D-N°: 3.4) – Report from the 4 national workshops, 2015

EAGLE – (D-N°: 4.10) –Report from initial project conference, Let's communicate Ionizing Radiation, 2013,

EAGLE – (D-N°: 4.7 – 4.9) – Reports from pilot actions ((Poland, Romania, Slovenia), 2016

RICOMET 2015 – 1st International conference on Risk perception, communication and ethics of exposure to ionizing radiation, June 15-17, 2016, Brdo Castle, Slovenia

RICOMET 2016 – 2nd International conference on Risk perception, communication and ethics of exposure to ionizing radiation, June 1-3, 2016, Bucharest, Romania

6th EUTERP workshop – Legislative change in Europe: the implications for training in radiation protection (Raising to the challenge), September 30 – October 2, 2015, Athens, Greece

OECD/NEA – Working Group on Public Communication of Nuclear Regulatory Organisations (WGPC) <https://www.oecd-nea.org/nsd/cnra/wgpc-pub.html>