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Improved means for the interaction of technical experts with authorities in charge, communication from and to the public and the training of key players – *Conditions and means for information and participation of the public in a nuclear emergency and post-emergency situations*



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ARTICLE

Communication with media in nuclear or radiological emergencies: general and practical recommendations for improvement

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Abstract – Communication with mass media during and after a nuclear emergency presents both a challenge and an opportunity for emergency management. The challenge lies with the different motivations and types of process applied by mass media and emergency management; the opportunity arises from the power of mass media to reach out to an audience with information important for compliance with protective actions. This article summarises recommendations for improved media communication by nuclear emergency management professionals. Recommendations address both the traditional and new media, and are the result of empirical and qualitative research conducted in the context of the FP7 PREPARE project, including: (i) a media content analysis of newspapers articles reporting about Fukushima ($N=1340$); (ii) a content analysis of tweets about Fukushima ($N=914$); and (iii) a qualitative approach – round table discussions with stakeholders ($N > 100$) involved in communication about nuclear emergencies. Results show that although challenging, nuclear emergency communication can be improved by using mass media and developing skills, training and resources during the preparedness phase of a nuclear emergency cycle. Some general recommendations and practical advice for communication with media is given.

Keywords: nuclear emergency / communication / mass media / media communication / media content analysis

1 Introduction

Public communication is a vital part of radiological emergency management and a key to its success. Mass media, new and traditional, take an important role in public communication during a nuclear event and the post-event phase.

On one hand, the mass media communication offer great opportunities for emergency management since it is by definition capable of reaching a large number of people simultaneously (Wimmer and Dominick, 2006). In the early phase of an emergency, mass media can increase awareness and understanding of protective actions and improve the response of affected populations. In the medium and long term, media can facilitate the remediation process and the return to normal life. Effective media communication can support implementation of protective measures, reduce public fears, thus minimize the chance of negative psychological effects and help sustain public confidence in the organizations that are responsible for emergency management (Perko, 2012). Moreover, emerging and evolving communication technologies, such as social media, offer the possibility of improved nuclear emergency communication, as these technologies have the potential for increased information capacity, dependability, and interactivity (Jaeger *et al.*, 2007; Perko, 2016).

On the other hand, the mass media communication is a challenge for the emergency management since communication has evolved into a multiple-way process where information is disseminated at an, often, uncoordinated incredibly rapid pace, and is able to easily reach all kinds of audiences: affected, indirectly affected and not affected by radiological risks (Perko, 2016). Social media have given to all users a virtual platform to express themselves and to share information. An overload of (miss)information coming from all kinds of sources (*e.g.*, government, expert organisations, traditional media, individuals, inhabitants, NGOs, etc.) can make it difficult for people to differentiate which information is correct. Moreover, the rise of social media has enabled users to demand more transparent, high-speed communication and accountability from governments, public institutions and emergency managers. It is therefore of importance that nuclear emergency communicators keep track of all the parties that might be interested in the nuclear emergency and to correct any incorrect information or add information that is incomplete. Besides their obvious advantages, social media can potentially become a tool for misinformation and manipulation, as well as spread anxiety. These actions cause a high time pressure and an additional personnel burden for an emergency management (Perko *et al.*, 2015a, 2015b, 2015c) as well as requiring skills, training and resources.

The importance of media communication has been highlighted during all the historical nuclear emergencies (Perko, 2011) and the recent disaster at the Fukushima nuclear power plant has shown that there are still gaps to be filled in nuclear and radiological preparedness communication (Utz *et al.*, 2013). All people, even those who are not directly affected, have the right to receive accurate information so they can make informed decisions. There has been an increase in efforts to identify and formulate emergency management protocols for improving media communication (*e.g.*, IAEA, 2012) and integrating social media into existing emergency response systems (*e.g.*, Wendling *et al.*, 2013) in addition to scientific attempts to understand the effects of emergency social media use (*e.g.*, Bunce *et al.*, 2012). Since the utility of social media relative to nuclear emergencies is intuitively appealing, different reports show that in general many social media ‘applications remain speculative, while others remain in their infancy’ (Lindsay, 2011).

Today mass media can intensify or downplay a nuclear risk (Kasperson and Kasperson, 2005), they allow rapid dialogue among users (Utz *et al.*, 2013) and public engagement (Ng and Lean, 2012). Therefore, implementation of media communication in the emergency management plan requires clear recommendations, practical advice as well as an experienced and dedicated team to be successful.

To facilitate the development of improved nuclear emergency communication by using mass media, the empirical study of traditional and new media reporting about a nuclear emergency, use of mass media for public communication and comprehensive qualitative discussions about how mass media is employed during nuclear emergency are needed. This study fills this gap by a systematic review of traditional and new media reporting about the Fukushima nuclear accident. It uses a qualitative approach to discuss results of the empirical study as well as practical use of mass media with communicators, stakeholders and final recipients of the information. Results of the empirical and qualitative research published elsewhere (Perko and Turcanu, 2013; Tomkiv *et al.*, 2014a, 2014b; Perko *et al.*, 2015a, 2015b, 2015c, 2015d) were used to formulate recommendations for improvement of communication with media for nuclear/radiological emergency management. These recommendations refer to the crisis communication during an emergency (event) phase and post-event phase rather than to the long-term communication that has to be applied in a recovery or preparedness phase.

2 Method

The recommendations are formulated by the consolidation of quantitative and qualitative research and several years of work within the EU PREPARE project. The empirical results were obtained from the content analysis of newspaper articles and Twitter messages (tweets) about the Fukushima nuclear accident, which were published within the period from 11th of March 2011 to 11th of May 2011. The content analysis of newspapers articles was conducted in the following six countries: Belgium, Italy, Norway, Russia, Slovenia and Spain. A total of 1340 articles, directly or indirectly related to Fukushima, were selected for coding. These articles were sampled from twelve leading newspapers: “Le Soir” and “De Standaard” in Belgium ($N=260$); “Corriere della Sera” and “La

Repubblica” in Italy ($N=270$); “Aftenposten” and “Dagsavisen” in Norway ($N=133$); “Komsomolskaya Pravda” and “Izvestiya” in Russia ($N=172$); “Večer” and “Delo” in Slovenia ($N=158$) and “El País” and “El Mundo” in Spain ($N=315$). The coding was done using standard methods for content analysis (Neuendorff, 2002) and detailed in a specific code book developed for the research (Perko *et al.*, 2015a, 2015b, 2015c). The content analysis of messages posted on Twitter containing the word “Fukushima” was conducted in Norway ($N=414$) and Belgium ($N=500$) (Brussels time zone in the Dutch language). The quantitative content analysis was performed in accordance with the codebook developed for this particular study (Tomkiv *et al.*, 2014a, 2014b). Additional qualitative analysis of the text of tweets was carried out to get an overview of prevailing public opinions and interests (Tomkiv *et al.*, 2014a, 2014b).

The recommendations based on qualitative research are results of round table discussions, focus groups and workshops conducted in the context of the International Conference on Risk Perception, Communication and Ethics of Exposure to Ionizing Radiation (RICOMET) (Perko *et al.*, 2015a, 2015b, 2015c). The conference was held in Brdo, Slovenia 15–17 of June 2015. The conference gathered more than 130 participants from European countries as well as from Japan, Canada, USA, Turkey and Israel. Their background varied from experts in public communication, media representatives –journalists and editors, researchers from social sciences, human and natural science, radiation protection officers, practitioners from nuclear medicine, nuclear power plant operators, to other nuclear industry professionals, nuclear safety authorities, and also to NGOs and representatives from civil society. The leading discussion points were the following:

- Traditional media in the context of the Fukushima nuclear accident;
- Social media in the context of the Fukushima nuclear accident: Challenges and opportunities;
- Dialogue with the journalists reporting about ionising radiation issues (emergency and non-emergency); and
- Quality of public information in nuclear emergency, in daily life and public understanding of ionizing radiation (Table 1).

3 Recommendations

3.1 Recommendations related to the traditional media

Communication about ionizing radiation is too often seen as a one-directional transfer of information from a source to a receiver, inspired by the idea that the general public needs to be educated by explaining facts to them. Nuclear emergency management should conceive and define the communication process as bi-directional or multi-directional, where citizens or public play a more active role. Citizens miss the recognition by stakeholders, industry and research of being a competent stakeholder and this creates a gap between the intentions of communicators and public perceptions. The communication process, and the education and empowerment of citizens, needs to be expanded from a simple honest provision of facts to recognize that:

- A mutual learning and transparency among all stakeholders should be encouraged.

Table 1. Practical advice for mass media communication.

Challenge	Practical advice for mass media communication
Coordination of public information	<p>Only limited coordination of public information can be achieved in the early stages of a nuclear accident: be prepared.</p> <p>Information source dispersion needs to be taken into consideration in nuclear emergency planning at all levels.</p> <p>Communicators have to respond to requests for information not only related to emergency but simultaneously also other non-emergency topics (such as energy shortage and supply, nuclear technologies, nuclear waste).</p>
Balanced and socio-technical communication	<p>Personalized information will have a greater chance of being published in the media than objective, technical information.</p> <p>Present complete information: media need two sided information (risks-benefits, pro-contra...)</p>
Media attention	<p>The newsworthiness of public information (publish-ability) will change through time.</p> <p>The nuclear –emergency information is the most newsworthy for the media at the beginning of the accident. At a later stage, media re-orientate the attention to other topics.</p> <p>Recovery and evaluation is more newsworthy in countries without nuclear energy installations than in countries with NPP.</p> <p>Communicate about water consumption issues, followed by farming products already during an early event although not contaminated. Food predicts and food chain are of great media interest..</p> <p>Public communication is one of the most followed aspects of a nuclear emergency management.</p> <p>Evacuation has to be communicated intensively not only to evacuees but also to a global public worldwide. Media are interested in evacuation since it can be presented as an event.</p> <p>Long-duration sheltering of the population, measurement of people's contamination, especially of iodine in thyroid of children, and the use of iodine tablets as a prophylactic measure, are also topics in a media interest.</p>
Communicating radioactivity	<p>Use comparisons with different exposures to radiation and not only the measurement units itself.</p> <p>Where possible, put units into context with legal limits, these provide journalists with a benchmark to frame their story with.</p> <p>Be consistent with units (<i>e.g.</i>, mSv or roentgen) and understand that numeracy related to risk and safety is meaningful only to a limited number of journalists and people.</p> <p>Be very clear about the reference points used for comparison of the doses and exposure, one can't expect journalists to know which limits doses were compared to.</p> <p>Do not communicate exposure rates only; include an explanation of the possible health risks associates with exposures.</p> <p>Develop and make available visual material in advance; this should cover an explanation of radiation doses and effects, and in perspective of other exposures and risks.</p> <p>When appropriate, compare radiological risks of of the present accident with radiological risks of previous nuclear accidents. Take specifics of the country where you communicate in to account.</p>
Communicating country specifics	<p>Each country has its own communication and interest specifics during an emergency. Communicators have to be aware of them.</p> <p>Communicate contextual information such as evacuation plans, stress tests results, similar NPP, basic knowledge (<i>e.g.</i>, difference between contamination and irradiation) not only radiological risks.</p> <p>Know your public: attitudes, risk perceptions, historical memory and address these characteristics in your communication.</p>

- Knowledge-based society requires citizens' involvement at a large scale: also local communities, teachers, students, health professionals, mothers, volunteers, etc.
- Risk communicators should support citizen engagement and create opportunities for people to monitor radioactivity with the help of scientists.

Nuclear emergency management should promote a trans-disciplinary approach in research on communication in nuclear and radiological emergencies. This refers especially to improvement of collaboration between the technical sciences and social sciences and humanities. This collaboration should address the following:

- Research topics for the social sciences need to be defined within the following areas: communication, risk perception, ethics/humanities and safety culture.
- Life scientists need to know more about the methodologies and theoretical frameworks applied by the social science research and humanities.
- Ethical and societal values need to be incorporated in the research and practice of communicating about the nuclear and radiological emergencies.
- A strategic research agenda (SRA) on social sciences needs to be created and then incorporated into existing EU research platforms and agendas within radiation protection (*e.g.*, MELODI, ALLIANCE, NERIS, EURADOS).

In addition, risk communicators need to find the converging values and differences among the emergency stakeholders that must be respected (such as knowledge, roles, practices, needs, objectives, etc.).

The interest of journalists in playing an active role in communication planning and preparations before the outbreak of nuclear and radiological emergencies should be encouraged and opportunities created. In this respect, the common ground between journalists and other stakeholders in nuclear emergencies should be improved.

As a result of workshop discussions recommendations on interactions with journalists include the following:

- International communication networks need to be operational.
- Coordination among supranational authorities to produce reliable data is important.
- More transparency and honesty from governments would be welcomed.
- Journalists need to be helped by their science colleagues or external experts (somebody needs to translate specific data to ordinary journalists) because most do not have sufficient knowledge on nuclear issues.
- Even under uncertainty, society demands information after an accident or during an emergency and journalists need to prepare for that.
- Try to understand that press cannot wait—it has short deadlines. They need to meet the deadline even if they may make a mistake.
- Coordination of official information is important, but journalists cannot always trust the official information.

As a consequence of the above recommendations it is clear that research on communication in nuclear and radiological emergencies needs to be more action-oriented. Simply

generating new knowledge is not enough; this should be complemented by transferring new knowledge into practice. Results of projects need to contribute more to achieving positive changes in real life.

In communication research and practice, nuclear emergency management needs to consider a broad spectrum of risks, such as: disease risks, ethical risks, risks from radiation protection countermeasures, psychological risks, etc. If risks are related to uncertainty, then nuclear emergency communicators need to learn how to communicate uncertainty to the people.

Communication in time during and before nuclear or radiological emergencies is also related to trust and availability. The former relates to taking into account the feelings of people, empathy, competence and trustworthiness while availability relates to the relation between experts and journalists.

Assessment of the evacuation cases in time of nuclear and radiological emergencies shows that evacuation creates confusion regardless how it is planned. Nuclear emergency actors need more research on the evacuation in case of nuclear emergencies and complex exercises, where communication aspects are trained as well (Perry and Lindell, 2003; Swain and Tait, 2007; Malesic *et al.*, 2015).

Nuclear emergencies are low frequency—potential high consequences event. Therefore, nuclear emergency management needs to learn based on the rare existing cases, this learning including communication.

In the triangle among the governmental stakeholders (especially public relations representatives), scientists/experts and journalists a partnership is of paramount importance. This partnership should be based on the mutual benefits, trust and availability. These actors need to create mutual expectations, minimal joint goals and build or manage mutual trust. This is important because they have to some extent different interests. Scientists should be educated about the value of communicating their knowledge, uncertainty and scientific limits to the public in time of an emergency and before. They should be stimulated to share information with journalists and public openly. Governmental stakeholders need to support responsible research related to emergency management, which implies giving due attention to social and ethical issues, as well as stakeholder and public participation.

Involvement of communication aspects in nuclear emergency exercises, for instance students of journalism are highly recommended. Journalists themselves have limitations to participate in such exercises because of their ethical code, while students of journalism can.

3.2 Recommendations related to the social media

Social media allow people to exchange information in virtual communities and networks (*e.g.*, Twitter, Facebook, YouTube, etc.). They offer many opportunities and can be used in a variety of ways in relation to nuclear and radiological emergencies:

- General communication about radiation to increase public familiarity and knowledge of the topic.
- Crisis communication—instant spreading of the relevant information.

- Crowd sourcing – engaging large number of individuals for performing a common task (*e.g.*, using dosimeters for measurements of background radiation as in case of SAFECAST).
- Discussion forums – engage in a two-way communication with community in order to address their questions and concerns and build trust between people and organizations.
- Research – follow trends and topics that people are interested in, analyse perceptions of public, the way they use media, in order to learn, adapt communication to be relevant.
- Open data – creating platforms where data can be collected and made open to everyone to increase transparency.
- Empowering public – strengthening community values and relationships, supporting citizen watchdog initiatives.

Social media are excellent tools to get a snapshot of public opinions and perceptions, to understand and address questions and worries of the public. They offer a rapid flow of the information and the opportunity to create a multi-way public communication. Therefore, it is recommended that any official institution should use social media in the event of a nuclear or radiological emergency.

Social media have enabled an explosion of citizen watchdog initiatives in the nuclear and radiological field. This can be used for putting more pressure on governments and responsible authorities to improve their transparency in accountability in this field.

Social media have also created new active social communities that are based on the principles of bottom-up approach and open data standards. Using these new possibilities would support the transparency of the decision-making process and the accountability of public opinion within that process. It should also help in building trust on the information provided by official bodies.

Opening stakeholders' institutions for social media channels does not come without risk. It brings inevitably partial loss of control over the message you are trying to get through and the impact this message will have. Some negative feedback, hate and trolling should be expected. Social media have a great potential to spread rumours, propaganda and manipulation, so the issue of media accountability needs to be addressed. However, there is also room for regulation and for correction of incorrect information.

Avoiding the use of social media is not an option – if you are not there to pick up agenda, to share information, to answer the questions and disprove rumours – someone else will be which could result in a loss of control.

Learning to use social media for communicating before and during nuclear and radiological emergencies will be a long-term process, there are no shortcuts. One needs first to observe, collect information, and learn how to use it. Key to effective public social media communication is in constant presence – in crisis and non-crisis times.

Social media is just another tool and it is up to people to decide its role and value. Communication is always about people and not technology and any good social media strategy and online popularity should be turned into real world appearance and application

In the field of nuclear and radiological emergency communication, one should of course avoid exclusive focus

only on the part of population that uses social media. But even if the public is not present on the social media – journalists are. Traditional media actors have been actively using social media (*e.g.*, Twitter) as a source of information due to the newly established concept of citizen journalism, which enables ordinary people to become first informers, and the increasing use of social media by official bodies. In addition, newspapers and TV-channels are using social media for promotion and popularization of their news articles. At the same time, Due to its rapid development social media stresses the need for quality journalism to disprove rumours and provide correct information.

Despite the increased popularity and importance of social media, recent studies have shown that traditional media are still the primary source of information to the population in case of nuclear or radiological emergency (ref). New reality is not a substitution of traditional communication channels by new ones. New reality is convergence of new and old media their co-existence and co-dependence.

The key to effective communication in nuclear or radiological emergencies is in leveraging all potential tools and channels for reaching various audiences and providing a mix of specific communication to the specific audiences.

To conclude, the following elements of good practice should apply to the use of social media in communication as an important information source for the traditional media:

- Talk directly to the stakeholders and ensure that stakeholders can respond, forward and discuss the messages with each other.
- Inform stakeholders quickly, directly and take into account that one might lose control over the communication process.
- Distribute the messages via on-line newspapers and via social media. This can result in a high re-tweeting of the message published by on-line newspapers and in a higher reputation and less secondary crisis reactions such as boycotting by using social media.
- Conduct focus groups from three age categories (*i.e.* youth, adult, senior) to determine the sort of information, layout, and other features that they would like to see in the social media.
- Engage website designers to create an interactive website with hypertext features that are linked to social utility tools.
- Make test runs of the website and social utility tools, and improvise where necessary.
- Publish the social media sites to the public.
- Monitor social media to follow and understand public opinions and concerns.
- Keep in mind the opportunities created by social media like crowd sourcing and open data and use them if needed (Table 2).

4 Conclusions

Nuclear emergency communication has been a very challenging and complex process. Based on an empirical and qualitative research conducted in the context of the FP7 PREPARE project, this paper identifies ways in which communication can be improved along several dimensions.

Table 2. Practical advice for communication using new media.

Challenge	Practical advice for communication using new media
Complexity	Use complementary animated graphics, multimedia and links to updates from other web and social media.
	Help readers to visualize complex topics with graphics and comparisons, <i>e.g.</i> , radiation levels with CT scan, X-rays, annual doses for all sources and for natural source. However, context is essential and maps will usually not be sufficient.
	Make extended information related to ionizing radiation from news available on internet. Expand from a one-way news provision from traditional media to open for feedback by using internet (<i>e.g.</i> , comments, twitter feed).
Uncertainty	Give media training to experts so they are able to explain events and be involved in on-line communication and explanation of ionizing radiation. (Be prepared to have expert-volunteers on line to have a dialogue with citizens and with other experts having different opinions.)
	Communicate uncertainties, <i>e.g.</i> , acknowledge scientific dispute over the effects of long-term exposure to low doses of radiation, admit when knowledge is lacking, but underline areas where there is scientific consensus.
	Make animated graphics, videos, simulations, related to ionizing radiation, available for TV newscast.
Globalisation of radiological risk	Communicate in local language but also in other world spoken languages (<i>e.g.</i> , English); take cultural and political differences into account
Anxiety	Organise radiation seminars on line for the public to help reduce anxieties in the post-disaster setting or public presentations on the technical aspects of the Fukushima nuclear accident for interested laypersons.
	Provide animated maps, which include a time series visualization of regional effects, a local site map, selected news reports, radiation by distance to show several trend lines at different dates in addition the map incorporates many of the changes requests by readers of an interactive internet page.
	Have a rumours control centre and active response on rumours disperse by new media.
Unfamiliarity	Report radiation units only in the context and with descriptive explanation. <i>E.g.</i> , comparisons with a historical nuclear accident, with legal limits and norms and with the natural radiation background. Use plain language versus scientific language in order to reach a wider audience.
	If the INES is used as a comparison criterion or reference with other radiological or nuclear emergencies, supplement with animated graphics, multimedia and links to updates from other websites.
	Organize pseudo-events to attract the media attention, for instance excursions to a contaminated site or visits to waste disposal sites, and stream them on-line and publish them on YouTube or other social media channels.
Socio-political context	Remain impartial on related political topics, such as being asked to take a side related to a nuclear energy policy.
	Be well informed about all major nuclear accidents, since media as well as public make links between any nuclear event and major nuclear accidents like Chernobyl or Three Miles Island and information about them is always available on internet.
Relationship	Establish relationships among the information sources long before the emergency also by using social networks.
	Incorporate traditional and social media in the corporate crisis communication strategy.
	Make extended information related to ionizing radiation from news available on internet. Expand from a one-way news provision from traditional media to open for feedback by using internet (<i>e.g.</i> , comments, twitter feed).

The nuclear emergency authorities need to recognize that communication in nuclear and radiological emergencies needs to be a two-directional or multi-directional process. They need to integrate the use of traditional and social media in order to improve the effectiveness of communication. More transdisciplinarity, mutual learning, transparency and mutual understanding of different yet connected roles among stakeholders before and during the emergency is needed. In today's societies, risk communication is seen as a socio-centric communication based on public participation with which the gaps between stakeholders can be bridged during a crisis communication. It is vital to think and prepare how to communicate uncertainties to the people. Uncertainties should be admitted and elaborated. Social media should be used to identify the existing public uncertainties and to engage public in creating a joint interpretation of the issues, if possible. Journalists or at least students of journalism need to be included in the nuclear emergency exercises.

A broad spectrum of recommendations provided in this paper should be seriously considered by the nuclear emergency communication planners and practitioners. A typical error in emergency planning has been to keep producing good written plan papers without actually achieving the true community emergency preparedness (Perry and Lindell, 2003). Another typical mistake has been exclusion of the population-at-risk in the emergency planning or a lack of participatory processes (Swain and Tait, 2007). We believe these recommendations represent a bottom-up input for improvement of existing communication plans. Smart integration of traditional and social media in the preparedness phase will lead to major improvements of communication at the actual emergency situation, when only smart information by a smart communicator can contribute to protect health of increasingly communication-proactive people.

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