Commentary

Reconsidering of Risk Communication
–Reconstruction of Nuclear Risk Communication–

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This commentary looks at issues and challenges that were encountered in relation to nuclear risk communication in the aftermath of the Fukushima Daiichi Nuclear Accident. Conventional practices are critically examined to consider how risk communication in the nuclear sector should be reconstructed, and what governments and experts should do to regain the lost public trust.

I. Introduction

The Fukushima Daiichi Nuclear Accident (hereinafter referred to as the "Fukushima Accident") led to the emergence of radiation and radioactivity risks associated with nuclear power. These risks are causing social problems related to the health effects of exposure to low-dose radiation as well as the management and isolation of radioactive waste. They have also given rise to the need for nuclear safety with regard to earthquakes, tsunamis, and other external events as well as the fundamental roles of nuclear itself. Together with the government's Investigation Committee on the Accident at the Fukushima Nuclear Power Plant of Tokyo Electric Power Company, many experts stressed the importance of risk communication. Accordingly, members of Atomic Energy Society of Japan and many other stakeholders began to engage in nuclear risk communication. However, during the three and half years since the Fukushima Accident, nuclear risk communication has not proven effective in practice. This commentary clarifies the issues and challenges encountered in relation to conventional nuclear risk communication. In this discussion, recommendations are also made on how risk communication in the nuclear sector should be reshaped going forward.

II. Characteristics of Nuclear Risk Communication

Nuclear risks are posed by radioactivity and radiation, neither of which can be sensed by humans in any way. For this characteristics, they are regarded as something completely different from the risks posed by other technologies. For example, genetically modified

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organisms, space development, artifacts carry potential risks. The Fukushima Accident has now alerted many Japanese people to the apparent risks that radiation poses to the environment and human life [1].

The conventional method of nuclear risk communication was developed with the aim of promoting public understanding of nuclear and gaining public acceptance in ordinary times based on the fundamental assumption that nuclear safe was assured, without postulating a major disaster. This risk communication method encouraged the adoption of a paternalistic approach in which experts would provide explanations to convince people according to their own agenda.

Furthermore, the series of nuclear accidents and scandals that have occurred since 1995 has caused the public to develop a sense of distrust toward such risk communication on the basis that it is driven by the collective interests of the pro-nuclear lobby, which is sometimes referred to as the "nuclear village."

According to popular perception, politicians cannot be trusted. They often say things like, "A clear explanation should be provided to the public to gain their understanding" all for the sake of "their safety and peace of mind." However, the phrase "gain their understanding" tends to be regarded as an attempt to convince people. It is common knowledge in the field of risk communication that the use of this phrase in this type of context actually arouses mistrust, contrary to the intention of gaining trust.

Another characteristic of nuclear risk communication is its focus on external communication with the public. For this reason, no strategic measures have been taken by organizations through any process, including their governance and internal communication, with due consideration given to risk governance and social responsibilities. These organizational issues and challenges are discussed in Chapter IV.

III. Issues and Challenges Related to Nuclear Risk Communication

1. Concept of Risk

Before discussing issues and challenges associated with nuclear risk communication, let us look at the concept of risk.

Scientists and engineers commonly define the term "risk" as being the product of an event's probability and its impact (i.e., the magnitude of an event's consequence).

Similarly, the Nuclear Regulatory Commission (NRC) in the United States defines "risk" as the product of an event's probability and its consequences [2]. However, ISO 31000:2009, an international standard for risk management, defines "risk" as the "effect of uncertainty on objectives" [3]. Rather than it being defined by probability, such a risk clearly takes into consideration both desirable effects and undesirable effects. In economics, risk can represent both losses and gains. If this approach is adopted with respect to radiation, risk involves a trade-off between hazards and benefits as shown in **Figure 1**. Meanwhile, Peter Sandman, a sociologist who specializes in risk, has developed the following formula: "Risk = Hazard + Outrage" [4]. Various definitions and concepts of risk are applied in different fields. This means that, before using the term "risk," people from different backgrounds must first agree on a definition.

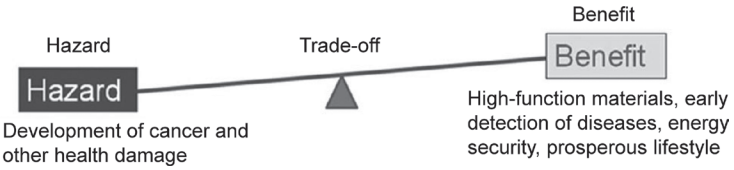


Figure 1 Trade-off of risks associated with radiation

2. Issues Associated with Nuclear Risk Communication

After the Fukushima Accident, the government of Japan developed a policy package for radiation risk communication to enable those affected by the accident to return home in accordance with the action plan for addressing health concerns among such people (decision issued on May 31, 2012, by the coordination committee tasked with addressing health concerns among people affected by the nuclear accident) [5]. Such efforts are to be undertaken jointly by the Reconstruction Agency, the Ministry of the Environment, the Cabinet Office, the Food Safety Commission, the Consumer Affairs Agency, the Ministry of Foreign Affairs, the Ministry of Education, Culture, Sports, Science and Technology (MEXT), the Ministry of Health, Labour and Welfare, the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Economy, Trade and Industry, and the Secretariat of the Nuclear Regulation Authority. This package also encourages risk communication by, for example, preparing national documents on the health effects of exposure to radiation, conducting training for professionals involved in the healthcare, welfare, and education sectors, and developing participatory programs.

In Fukushima Prefecture, radiological education is conducted in elementary and junior high schools using instructional materials [6] on radiation prepared by the prefectural board of education and a supplementary reader [7] on radiation prepared by MEXT for elementary and junior high school education. Risk communication is also carried out independently by the Japan Health Physics Society [8], the Japanese Radiation Research Society [9], and many other learned societies and associations as well as educational and research institutes. These numerous efforts to carry out risk communication in practice deserve praise, but are the public actually aware of the outcomes of these efforts?

The overall issues associated with nuclear risk communication are examined by analyzing some of these risk communication practices concerning the health effects of exposure to radiation.

(1) Attention to context

After the Fukushima Accident, the media shared a message from experts calling for "a suitable degree of fear based on a proper understanding of radiation." This message was intended to raise awareness among the public and encourage them to gain an accurate understanding of the health effects of exposure to radiation. Essentially, the message implied that it is important to gain an accurate understanding of radiation risks. However, people with little interest or understanding of radiation tended to skip over the actual implications and interpret the message out of context to mean, "Let's fear radiation." Despite its coincidentally similar wording, the message was probably not inspired by *Two Minor Eruptions* [10], an essay written by Torahiko Terada on the eruptions of Mount Asama. In his essay, Terada refers to "a suitable fear" to point out that "it is easy for people to fear something too little or too much, but it is difficult for them to develop an appropriate amount of fear." This message was misinterpreted in contradiction to this line.

The same problem was experienced with a press release issued following the Fukushima

Accident when the chief cabinet secretary announced that there would be “no immediate health damage.” Mindful of public concerns, the secretary was trying to reassure the public that there would be no health damage. Instead, public anxiety was fueled by the misinterpretation that “the health damage would manifest itself later.”

These examples demonstrate that choosing the right expressions in risk communication can be tricky. Depending on the context, especially if only a limited amount of information is available, the expressions used can even be interpreted in ways that are completely opposite to their intended meaning. Risk communication should not be guided by the logic of an information provider. All expressions must be carefully examined to consider how they might be perceived by the intended recipients.

(2) Attention to the amount of information

The national document entitled *Basic Information on Radiation Risks* [11] contains a vast amount of information that is divided into 15 sections over 36 pages. In the introduction, the document defines itself as a document that is intended to provide a clear and accurate explanation of the basics of radiation risk, including the use of terms. Admittedly, the document is accurate thanks to the oversight provided by experts, but it is hardly clear for readers.

For instance, although the term “risk” appears 16 times in the body text and figures, it is only explained in a footnote written in a small font on p. 15 that states, “A risk is the scale of probability of the manifestation of a harmful effect. It is not simply an antonym of ‘safety’ or a synonym of ‘danger.’” The document also states that, “Risk communication in practice requires the creation of documents that conscientiously address matters of interest to the intended targets.” However, that leaves us with the question of who is supposed to convert this difficult, hard-to-understand information into fine-tuned explanations.

The author has been carrying out risk communication regarding low-dose radiation for the citizens of Tsuruga. This experience has taught him that an excessive amount of information makes it difficult for the recipients to get a clear view of the overall picture and pick out answers to important questions such as “Are we safe?” and “How will our children and future generations be affected?”

In nuclear risk communication, the amount of information to be provided to stakeholders must be adjusted according to their levels of understanding to make sure that the information they require is clarified.

(3) Intercomparison of risks

People often compare radiological risks with other risks, such as the risks of cancer development as published by the National Cancer Center [12].

It is easy to compare the risks of cancer development associated with smoking, drinking, lack of exercise, insufficient intake of vegetables, and low-dose radiation. However, the implications of such a simple comparison need to be carefully examined. Many smokers and drinkers are aware of the health risks that their choices entail. Many other people take care to avoid smoking, drinking, lack of exercise, and insufficient intake of vegetables. These people were not exposed to low-dose radiation by choice, though. In this sense, a comparison with other risks is meaningless. In fact, such a comparison could even come across as an attempt to trivialize the risks of radiation-induced cancer development.

Western practitioners of risk communication have learned from their own experience that a simplistic comparison of radiological risks and other risks can undermine public trust in them [2]. Consequently, they refrain from conducting thoughtless comparisons of risks. Instead, they make careful comparisons only for people who care about the health of others. Despite this, why are thoughtless comparisons of risks still being conducted in Japan?

One underlying cause is the false assumption made by experts that they can expect the public to make rational judgements after comparing the levels of risks for them. Unfortunately, it must be kept firmly in mind that people do not make rational judgements when it comes to risks. People may cease to trust anything a person says if they have previously resorted to thoughtless comparisons of risks.

3. Challenges Associated with Nuclear Risk Communication

Risk communication requires a methodology with theoretical foundation in liberal arts and social sciences. The methodology cannot be discussed in isolation from the practice. There are certainly tried and true procedures. Nonetheless, in practice, careful preparation and flexible response must be made in accordance with intended counterparts.

Risk communication on the health effects of exposure to low-dose radiation must also take into account psychological and mental factors. In some cases, risk communication may require counseling skills comparable to those possessed by clinical psychotherapists. In other words, risk communicators—or practitioners of risk communication—are highly specialized professionals whose jobs cannot be handled by part-time volunteers. The national government conducts training in risk communication for professionals engaged in healthcare, welfare, and education as well as municipal personnel. However, these stakeholders cannot engage in risk communication on a full-time basis.

Going forward, long-term engagement in nuclear risk communication will be of growing importance to address global challenges related to the management and isolation of radioactive waste, nuclear safety with regard to earthquakes, tsunamis, and other external events, and the fundamental roles of nuclear. Appropriate risk communication materials should certainly be prepared to live up to these tasks. On top of this, a new method needs to be adopted in research and development, and risk communicators will need to be trained on its effective application.

Universities are also expected to offer relevant courses and produce nuclear risk communicators who can overcome global challenges. They should also expand human resource development systems for working professionals in partnership with nuclear regulatory bodies, power utilities, municipalities, and non-profit organizations.

IV. Nuclear Risk Governance

So far, this commentary has discussed radiation risk communication methodology that targets the public as external stakeholders. However, another methodology of risk communication targets members of organizations as internal stakeholders. The NRC in the United States has developed guidebooks [2, 13] on engaging in strategic risk communication with both external and internal stakeholders. These guidebooks are used in the training of NRC personnel.

External risk communication and internal risk communication might seem mutually independent. However, they are integrated as interrelated elements from the perspective of the risk governance discussed in this section, which proposes a new model for nuclear risk governance.

1. Concept of Nuclear Risk Governance

Nuclear risk communication is not a stand-alone practice that exclusively targets external stakeholders. It brings together the domains of risk assessment, risk management, and the public. A strategic approach must be taken for the processes involved in these domains. Moreover, the risk-informed assessment and the decision-making process to deal with the risk should be clarified. Optimal organizational governance should also be explored to ensure transparency for the public.

Many people think that the national government and experts should clarify the risk criteria. However, the public holds a diverse range of values. Some people will accept the presented risk criteria with little objection, but others will remain unconvinced and not accept them.

Most issues associated with nuclear risks are heavily influenced by uncertainties because they fall within the realm of trans-science, which cannot be resolved by science alone. The influence of uncertainties should essentially be considered through interactive dialogue by encouraging people to exercise self-determination through the sharing of unbiased risk-related information, going beyond the conventional approach to risk communication to encourage people to exercise their right to know.

This commentary advances the conventional method of nuclear risk communication, which involves interactive dialogue among stakeholders. It adopts the concept of "co-evolutionary governance" that encourages self-determination to propose a strategic model for participatory risk governance with due consideration given to risk management and social responsibilities, as typified respectively by ISO 31000: 2009 and ISO 26000: 2010. This model is conceptualized in **Figure 2**. To provide an idea of the type of "co-evolutionary governance" involved in the participatory risk governance model, the author will briefly explain how he is conducting community-based nuclear risk communication regarding the health effects of exposure to low-dose radiation with stakeholders in Tsuruga.

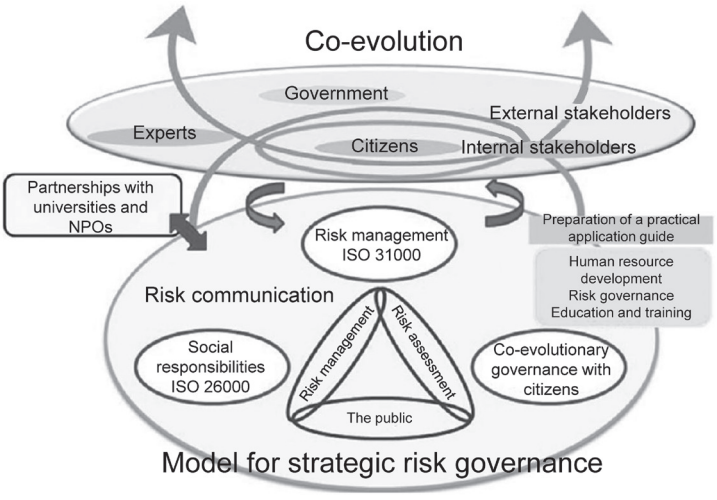


Figure 2 Concept of the model for participatory nuclear risk governance

2. Model for Community-Based Nuclear Risk Communication [14)]

The model employed in community-based nuclear risk communication concerning the health effects of exposure to low-dose radiation identifies the obstacles and challenges faced by the public in recognizing the risks posed by low-dose radiation. In doing this, the model addresses the questions of how information on radiological risks should be provided in a scientifically sound way, how uncertainties that cannot be exclusively addressed by science alone should be handled, and how the psychosocial impact should be taken into account.

To address these obstacles and challenges, study sessions were organized for small groups of local community members to coproduce a guidebook on the health effects of exposure to low-dose radiation.

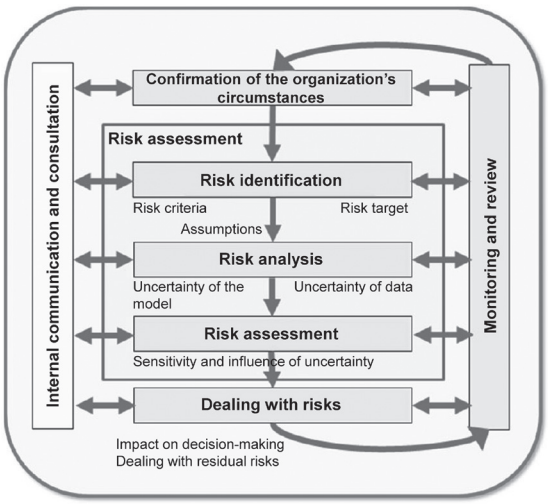
First, a working draft of the guidebook was prepared by researchers involved in radiobiology, sociopsychology, risk communication, public participation, and social responsibilities. The draft was then discussed at the following study sessions involving three groups of several to a dozen citizens from Tsuruga. Group 1 consisted of residents of Tsuruga, Group 2 consisted of public health nurses, registered dieticians, and midwives from the health care center in Tsuruga, while Group 3 consisted of media journalists from the Tsuruga press club. These study sessions were repeated to assess how well local citizens recognized and understood the risks and to discuss the content and wording of the draft guidebook. In fiscal 2013, eight study sessions were held. Citizens and relevant researchers were also invited to participate in discussions at a public symposium in Tsuruga and another one in Greater Tokyo. In fiscal 2014, the draft was jointly revised based on these discussions to compile the introductory part of the guidebook on the health effects of exposure to low-dose radiation. This process was aimed at coproducing a convincing guidebook for participating citizens that would allow them to provide explanations to their fellow citizens.

The process was also aimed at providing a means for diverse actors to coproduce and deliver effective messages on risks as well as to develop a viable model for community-based risk communication.

3. Participatory Model for Risk Governance [15)]

Nuclear risk communication related to earthquakes, tsunamis, and other external events as well as the management and isolation of radioactive waste requires advice from risk assessments and risk management experts, and information from power utilities. This is because the formulation of effective risk messages requires information from each of the processes involved in the performance of risk assessments by power utilities (e.g., risk criteria definition, risk identification, risk analysis, risk assessment, and risk/residual risk resolution) and from internal communications, as shown in **Figure 3**. Power utilities that carry out risk management activities tend to be cautious and defensive in their external communications with the public as they seek to protect themselves from risks. Rather than building mutual trust, this type of nuclear risk communication often leads to confrontation between the two sides.

The proposed participatory model for risk governance seeks to overcome this malady and expand co-evolution with the involvement of local community members, as mentioned in the previous section, even further to develop co-evolutionary governance of the whole community. A third-party organization that is independent of any power utilities, which include social responsibilities, serves as the basic framework for the model. Stakeholders with constructive intentions are fairly represented as members that manage the organization. Power utilities that manage risks are invited to provide relevant risk-related information from their internal



ISO 31000:2009 Risk Management – Principles and guidelines, 2009.

Figure 3 Practical process of risk management

communications in order to prepare and deliver proper and effective risk messages. The management process is clearly communicated to the public to ensure its credibility and transparency. Experts to be consulted on matters related to risk assessments and risk management are chosen through consultation among the members of the organization.

The framework is also aimed at human resource development for the requisite personnel to ensure that they can carry out nuclear risk communication effectively. The development of a new model for nuclear risk governance will be pursued by clarifying the details of its framework and processes as well as how these processes will be interlinked. Examples of this include how the organization will be structured, how neutral management will be ensured, how stakeholders can be involved in an equitable manner, how the power utilities will cooperate, and how accountability and transparency will be ensured. If we take the local information committees found in France as an analogy, the idea is to encourage the participation of local assembly members as stakeholders.

In this respect, a similar effort should probably be made by the nuclear regulatory bodies with a mandate to protect people's lives, health, and the environment. The author is curious to know whether readers share his belief that nuclear regulatory bodies must live up to their missions and fulfill their social responsibilities to clearly explain their regulatory standards and the outcomes of conformance reviews by going beyond the simple publication of information.

V. Conclusions

The issues and challenges associated with conventional nuclear risk communication were discussed based on the experience of risk communication concerning explicit radiation in the aftermath of the Fukushima Accident. This commentary also proposed a participatory model for nuclear risk governance over the long-term to manage and isolate radioactive waste, ensure nuclear safety with regard to earthquakes, tsunamis, and other external events, and continue nuclear risk communication concerning the fundamental roles of nuclear.

As typified by the debate over the possible resumption of nuclear power in Japan, the use of nuclear power tends to invite confrontation between two camps that seem unable to reach a constructive solution. Nuclear risk communication is a social technique that is used to share unbiased risk-related information among stakeholders, build up mutual trust through mutual understanding of their different values, and lead them in a constructive direction. It is not intended to convince others or reach a rough-and-ready consensus. Although it may seem a roundabout way of doing things, it is actually the most reliable and fastest way to reach consensus while avoiding conflict and the associated social costs. The essence of this approach is mutual respect for differing opinions among stakeholders and acknowledgement of the fact that their values can change through interaction.

Everyone would agree that we share a common goal of wanting to build a society in which people can feel safe, thrive, and pursue happiness. The author hopes that constructive nuclear risk communication will prove conducive to achieving this goal.

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