

## **Lessons Learned from the Korean Nuclear Waste Disposal Issues in terms of Risk Communication Processes- 11171**

**Chang-Ju Lee**

*Korea Institute of Nuclear Safety*

*34, Gwahak-ro, Yuseong, Daejeon, Korea, 305-338*

*cjlee@kins.re.kr*

### **ABSTRACT**

Communication to the public or stakeholders against appearing risk of any facilities or events has an important role in the policy making, but depends on societal environment or conditions – sometimes it may be distorted or overstated, even though its contents are similar. Therefore, “risk communication” activity is important for any cases, since it becomes an interactive process among individuals, groups, and institutions, used in exchanging information about topics concern with health, safety, security, or the environment.

If we want to make succeeding the risk communication in any societies, we have to prepare its explicit guideline. In the case of nuclear society, specific guideline for each case would be applied. In order to deal with this concern, therefore, it is necessary to establish a concrete risk communication model, if possible, based on actual nuclear issues. This study performs an environmental analysis for nuclear risk communication (hereafter, calls N-RiCom), prepares an optimal N-RiCom model based on fundamental processes for the communication, and shows case studies for diagnosing domestic hot nuclear issues. The N-RiCom model is developed utilizing traditional S-M-C-R-E (sender-message-channel-receiver-effect) process scheme, which consists of diverse primary factors affecting these processes, respectively.

Also wide-scale survey was performed in order to get practical factors for determining perception of the public on the N-RiCom, and to evaluate relationships between affecting factors. The other objectives of the survey are to identify the level of public awareness concerning nuclear risk, and to check the nuclear policy where more risk communication is necessary, depending on survey regions.

The actual domestic nuclear events regarding low and intermediate level waste disposal were chosen as cases for in-depth assessment. The details of three cases were identified and adopted to the N-RiCom model. For each case, specific information on background of the issues and progression of the conflict was identified. Based on the above information, in-depth analyses depending on primary factors of S-M-C-R processes were performed, so we can find practical insights and get lessons learnt for each case. From the analysis, ultimately, why some cases are failed and the other cases are succeeded, in terms of risk communication processes, were clarified.

## **1. Introduction**

When government or regulatory agencies must decide whether to license nuclear power plants despite extremely low probability of pipe rupture in a future accident, democratic societies are faced with difficult choices. The usual decision-making processes of consensus or social acceptability are insufficient to resolve such issues of modern technology, as denoted by CRPC [1].

In the past, only a few experts possessed the best information available to accurately estimate the extent of the possible harm or the likelihood of its occurrence. However, while great weight needs to be given to these experts' decisions, democratic principles require that the decisions be controlled by non-specialists, including NGO, who are answerable to the public. It is also necessary to identify various promoting and/or limiting factors in the communication process which primarily occurs among the receivers related with the process.

Many communities have defined the underlying problem in terms of "public understanding of risk," "risk perception," and "risk communication." We believe that what is needed is for people to better understand or more substantially perceive the potential costs and benefits of specific technological options. The nuclear technology also needs understanding about its risk and communicating with the general public, as well as the informed public.

Communication is a broad social-science and an imperfect art. This is why the nuclear society is getting more involved in identifying the public's nuclear perception and in coping with the communication challenges in a well-planned, effective and integrated manner. Undoubtedly, the starting point of risk communication should identify what the public wants.

In order to deal with these matters, since 2001, the Korea Institute of Nuclear Safety (KINS) has conducted public opinion polls on a yearly basis in order to gain knowledge about the public's awareness toward nuclear safety and to identify their needs. The main purpose of these past surveys is to provide the regulatory authority with basic information concerning the public's opinion on nuclear safety and regulations. Acting on objective assessment of the public's opinion findings, KINS can formulate long-term nuclear safety policies and public relations strategies to enhance the public in understanding nuclear safety better. In addition, since early 2007, KINS started a new project to achieve the research objective of its plan to establish a N-RiCom model based on the public survey.

## **2. Environmental Analysis for the N-RiCom**

In general, the term, "risk communication" can be defined as an (two-way) interactive process among individuals, groups, and institutions, used in exchanging information about topics concern with health, safety, security, or the environment [2].

The ultimate goal of our ongoing project is to establish a practical implementation system for N-RiCom. First of all, fundamental processes for this system, including sender, message, channel, and receiver, were diagnosed through in-depth searches on domestic example cases. The search results are summarized as follows;

- a) There is an insufficient manpower and organization available for preparing N-RiCom in many companies.
- b) It seems that the strategies for N-RiCom in a company are somewhat diverse and non-unified.
- c) Short-term strategy to meet stakeholder needs exists, without long-term planning for N-RiCom.
- d) There are few category differences in the target (receiver) groups.

Next, vulnerabilities and advanced features of previous N-RiCom systems were identified through the environmental impact analysis given by PEST technique.

- (1) **Political environment.** In actual, the government takes care of regulatory policies considering mindset on the public movement and feedback; there is a changing trend from the DAD (decide-announcement-defense) policy to the public opinion-focused policy; also there is a newly-emerging trend about mutual networking and cooperation-based policy.
- (2) **Economical environment.** It seems that the public thinks the value for the current nuclear power generation is steadily increasing; however, if the nuclear safety cannot be totally assured, the other regenerative energies may be superior to the nuclear power. Also, if an adequate communication system for the public is achieved, it can help to solve the problems or conflict of opinions related with the nuclear power generation.
- (3) **Society-cultural environment.** In terms of social perception for the safety, the concerns of the public for preparing a compound solution such as risk communication have been increased; public consciousness on the involvement to the nuclear policies and related systems has been gradually increased; new movements on the science-culture regarding a special public culture are emerged.
- (4) **Technological environment.** Since the commitment to high quality, excellence and professionalism in nuclear power operation can be found throughout the diverse PR tools of media and experts' statement, acting as a positive mechanism for the reduction of public distrust; The IT for two way information transfer such as high speed communication network has been highly developed; with the ground demand of techniques for achieving safe and pleasant environment, the transparency for such management on nuclear power and waste treatment is also required.

After the summary on the results of PEST analysis, we can conclude that the global environmental factors surrounding N-RiCom have become more affirmative, and that might allow more active and positive strategies on domestic N-RiCom.

### 3. Overview of N-RiCom Model Development

For preparing a kind of N-RiCom model, benchmarking on the current other similar models were performed as follows [3];

- the model for general risk perception pattern process,
- the model for social amplification of risk,
- the model based on lay public communication,
- general hazard risk communication model,
- the model for crisis and emergency risk communication model,
- the mental model approach,
- the enhanced cooperative model (ENCOM).

After benchmarking of the above models, a simplified but practical model on N-RiCom is suggested. The model is based on the traditional S-M-C-R-E (sender-message-channel-receiver-effect) scheme (“Who says what in which channel to whom with what effect?”) and tentative primary factors as shown in Figure 1 [3].

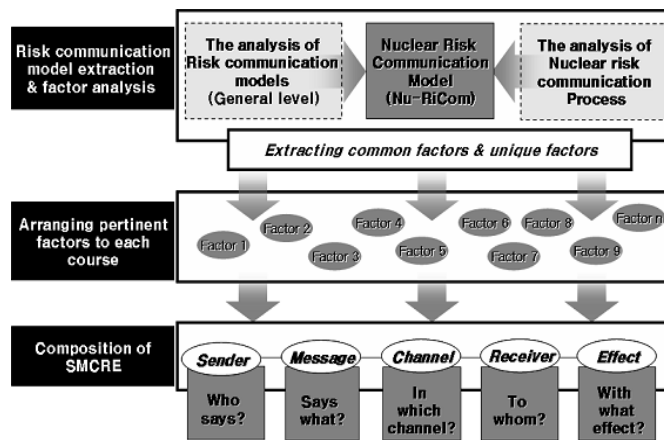


Figure 1. The overall process of N-RiCom model development

In general, the communication issues can be classified with 3 cases; “general case,” “local case,” and “crisis case,” in terms of the impacts on public perception. For achieving effective public consensus regarding a national policy such as the case of nuclear waste disposal, i.e., a policy for general case, we have to utilize the survey process based on a factor analysis in the risk communication model.

#### 4. The Preliminary Survey for Optimizing the Model

Typical primary factors of each S-M-C-R-E process have been surveyed in 2007 by way of preliminary and small-scale (about 200 samples) public questioning, and then screened out for optimizing the model configuration. The major objective of the survey is to extract a lot of preliminary primary factors for the determining perception of the public on N-RiCom. The numbers of items of the survey for each process, as well as explanation of the process, are denoted in Table 1. The survey is evaluated by the 7-points “Likert scale.” In the scale, point 1 means “I absolutely disagree,” point 4 means “Normal or I don’t know,” and point 7 denotes “I absolutely agree.” Finally we can extract the primary factors (P.F.) for each process, as shown in Table 1.

Table 1. The numbers of items of the survey

<b>Process</b>	<b>Description</b>	<b>Survey Items</b>	<b># of P. F.</b>
S	Sources for providing nuclear-related information	75	8
M	Messages for nuclear-related information	66	7
C	Channels for transferring nuclear-related information	60	6
R	Receivers on nuclear-related information	60	6
E	Effects resulting from the communication	61	6

#### 5. The Final Survey

##### 5.1 Overview of the Survey

In this section, key features of the final public survey are described. Typical primary factors of each S-M-C-R-E process have already been surveyed by way of preliminary public questioning, and then screened out for optimizing the model configuration. For further intrinsic delicacy of primary factors of S-M-C-R-E processes, specific recommendations by experts were gathered.

The main objective of the wide-scale survey (1,000 samples) performed in 2008 [4] is to get practical factors for determining perception of the public on the N-RiCom, and to evaluate relationships between affecting factors, followed by the study on the causal influence between primary factors (i.e., causal loop diagram). Other objectives of the survey are to identify the level of public awareness concerning nuclear risk, and to check the nuclear policy where more risk communication is necessary, depending on survey regions.

About 500 citizens from the capital city and 500 site residents from each plant site participated in the survey. The questioning items were prepared for each N-RiCom process, for risk perception and for policy preference, respectively, as shown in Table 2. For the objective of survey, we outsourced the work to an

external consultant who had carried out the respondent sampling, interviewee selection and training, face-to-face interview, data collection, and processing. The survey was also evaluated by a 7-point “Likert scale.” To identify the internal consistency of the survey items, we used Cronbach’s alpha ( $\alpha$ ) as a reliability measure, and it should be noted that the analyzed values of all items by this measure were acceptable.

Table 2. Overall structure of the final survey

Class	Description	Survey Items	Primary Factors
Factors for SMCRE Process	S	28	5
	M	28	5
	C	31	5
	R	30	5
	E	27	6
Other Concerns	Nuclear risk perception	16	n/a
	Nuclear policy preference	11	n/a

## 5.2 Analysis of the Survey Results

### 5.2.1 Relationship of Process Factors

The survey results indicate that there is a difference between urban region and local site inhabitants’ region in terms of the factor structure. To get a better deep understanding, we performed multi-variable stepwise regression analysis, providing a former factor as an independent variable and a latter factor as a dependent variable. In terms of anticipation level of receivers, we can find highly affecting independent factors to the dependent factor for whole regions, site region, and non-site region, respectively, as shown in Table 3.

Table 3. Highly affecting primary factors in terms of expectation level

Process	Whole regions	Site region	Non-site region
S	Moral recognition, Social duty	Specialty	Moral recognition
M	Diversity info.	In-depth info.	Trust info.
C	Consideration on attribute/distinction	Media diversity	Media diversity
R	Demands and concerns	Objective judgment	Request for info. improvement
E	Enhancement of Policy support	Consensus of public opinion	Enhancement of magnanimity

### 5.2.2 Comparison Assessment on Nuclear Perception

There exists a so-called “region gap” in nuclear perception including risk perception, because each region has a different perception in terms of subjective safety. For example, in case of the question on “Nuclear is an important source of energy” or “Nuclear energy is risky,” subjective perception of site region is higher than those of non-site (i.e. urban) region.

It is noted that a previous our study identify local residents near nuclear power plants have their own perception toward nuclear safety mostly based on the following four sub-factors: communication, trust, emergency response capability, and personal emergency coping skills. It seems that the survey results confirm that identification.

### 5.2.3 Comparison Assessment on Nuclear Policy

Also, there exists a “region gap” in terms of nuclear policy. Table 4 presents some cases of assessment items. In case of the question on “Site inhabitants’ should be provided by any compensation due to the residual risk of nuclear energy” and “Nuclear facility gives bad image to the people of site region,” subjective perception of urban region is higher than those of site region. However, we cannot identify exact reasons why these unexpected results come out.

Table 4. Some comparison results (4 out of 11) of the survey on nuclear policy

Assessment Items by Questionnaire	Non-site region (*)	Site region	t
I agree on the government policy for nuclear energy.	4.53	4.69	-1.77
I believe the press (media) regarding nuclear news.	4.57	4.44	1.50
Site inhabitants’ should be provided by any fund or compensation.	5.70	5.48	2.98
Nuclear facility can give bad image to the people of site region.	5.0	4.06	10.0

(\*) It is given by mean values from 7-points Likert scale assessment.

## 6. Case Studies for Diagnosing the Issues

Actual domestic nuclear issues were chosen for diagnosing problems and touching insights. The details of following three cases were surveyed and adopted to the N-RiCom model:

- 1) Anmyondo case on the first attempting waste disposal facility
- 2) Iwido case on the second attempting waste disposal facility
- 3) Gyeongju case on the final accepted waste disposal facility

For each case, specific information on background of the issues and progression of the conflict was identified. Based on the above information, in-depth analyses depending on primary factors of S-M-C-R

processes were performed, so we can find practical insights and lessons learnt for each case. From the analysis, ultimately, why some cases are failed and the other cases are succeeded in terms of risk communication was identified. The overall insights coming from the summarized assessment are shown in Table 5.

Table 5. Summary of the assessment on actual domestic issues

Process	Details of assessment	Remark(*)
S	· Many problems identified continuously in respect of accommodation effort of communication with the residents, cultivation of thorough-going safety consciousness, institutional morals for transparency, etc.	2L 1H
M	· Inadequacy in terms of more focus on the necessity for facility construction and the economic effects through the facility operation · A lot of cases regarding lack of consideration on the receiver's needs	2L 1H
C	· Trend on positive enhancement in case of diversity and familiarity of media channel · Inadequacy in terms of channel selection by the receivers, considering their characteristics and features	2L 1H
R	· Usual trend of focusing on short-term persuasion strategy · Inadequacy in terms of communication strategy for public confidence retrieval	1L 1M 1H

(\*) It is given by assessment results for each case: L means "low", M "medium", H "high" class category, respectively, in terms of risk communication process. For example, 2L means 2 cases of low category, among 3 cases.

## 7. Summary and Conclusions

We have achieved an objective for making enhancing model for risk communication in the filed of nuclear society. We expect, therefore, that our N-RiCom model can play an important role in obtaining public consensus and enhancing public acceptability on nuclear power generation and waste facility. This expectation is primarily based on the following possibilities:

- The model can give a practical two way process for communication in case of occurrences of nuclear safety issues.
- With regard to the application of domestic nuclear issues, it can give valuable solutions or suggestions for clearly promoting the risk communication.
- It can assist to prepare an effective and efficient national regulatory framework regarding public policy communication.

The survey results present some valuable insights on policy preference and diverse affecting N-RiCom factors in terms of expectation levels, as follows:



- 1) The highly affecting independent factors to the dependent factor are sometimes different for each region;
- 2) There is a “region gap” in nuclear perception, because each region has a different perception in terms of subjective safety;
- 3) Unexpectedly, for some questions, subjective perception of urban region is higher than those of site region.

The assessment for actual three domestic nuclear issues is also summarized. That result gives valuable insights in respect of risk communication, which may be reflected upon making nuclear policies and enhancing relationship with the public in near future. We hope, by comprehensively applying these national experiences, that we can get a way to establish N-RiCom framework for supporting enhancing social acceptance, and clarifying a difference regarding public cognition and information. Based on the survey insights, however, it seems that improved strategies for more effective communication, which feature the planning, methods, details and new approaches of such communication, may be necessary.

#### **REFERENCES**

- [1] Committee on Risk Perception and Communication, *Improving Risk Communication*, National Academy Press, Washington D.C., 1989.
- [2] Effective Risk Communication, The Nuclear Regulatory Commission’s Guidelines for External Risk Communication, NUREG/BR-0308, USNRC, January 2004.
- [3] C. J. Lee, et al., Preparation of an Enhancing Model for Nuclear Risk Communication, Transactions of the Korean Nuclear Society Autumn Meeting, Pyeong-Chang, Korea, October 30-31, 2008.
- [4] C. J. Lee, et al., An Analysis of the Public Survey for Nuclear Risk Communication, Transactions of the Korean Nuclear Society Autumn Meeting, Jeju, Korea, May 22, 2009.