Risk Assessment of Severe Nuclear Power Plant Accidents and Ethics in Science and Technology

Roles of Scientists in the Study on the Effect of Low-dose Radiation

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ABSTRACT

The information provided by specialists as to the level of risk by radioactive substances scattered by the accident of the Fukushima Daiichi Nuclear Power Plant did not gain public trust, and caused great public confusion. People in Fukushima and other districts with higher dose contamination are suffering radiation contamination itself, and have to take various measures in their daily living. They are further burdened with sufferings due to insufficient measures taken by the central and local governments and municipalities. Being possessed by the profits for the developing entities, people involved in scientific technology with possible enormous risk tend to pay only slight consideration to people to whom serious life-threatening health injury may be caused. This tendency is found not only among specialists in health hazards from low-dose radiation exposure, but also among specialists in many other fields including medicine and life science. The risk assessment of the nuclear power plant disaster is greatly related to various problems of life ethics of today.

The accident that occurred at the Fukushima Daiichi nuclear power plant as a result of the Great East Japan Earthquake on 11th March, 2011 scattered a large amount

of radioactive substances throughout the area. The information provided by specialists in terms of the level of risk posed by these substances did not gain public trust and caused great confusion.

One Japanese leader of scientific opinion, Hiroyuki Yoshikawa, former president of Tokyo University and former chairman of the Science Council of Japan wrote an article, published in the April 2012 issue of Chuo Koron, titled 'What did scientists learn from Fukushima ? In order to regain fallen trust'. In this article, he takes up the issue of the downfall of the public's trust in nuclear power and radiation 'specialists' after the nuclear power plant accident. He also candidly admits that these so-called specialists have caused confusion about the 'influences of radioactive materials on the human body'.

> *'People have had a certain level of trust that scientists are neutral. However, the nuclear power plant accident revealed the presence of nuclear cronyism in which a group of scientists who were working as an interest group was widely exposed'. (2012: 23)*

In reference to the public confusion, Yoshikawa writes,

> *'As to radioactivity, the world has not accumulated sufficient data on the level of harm to the human body. ... Even so, the available data have not been used effectively'. (2012: 23)*

What negative effects and difficulties have been imposed on the people most likely to be affected by this failure? On 19th April, 2011, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Ministry of Health, Labour and Welfare (MHLW) issued an official notice, 'Provisional attitude on determining the use of school buildings and grounds outside the evacuation areas'. This notice instructs that, 'in the regions where preschool children and elementary and secondary school children can go to their schools, the reference level of between 1 mSv/y and 20 mSv/y should be considered as a provisional level to determine the use of school buildings, grounds, etc., once high alert conditions are over'. In addition, in order not to exceed 20 mSv/y exposure, outdoor activities on the school grounds and in other areas should be limited to when outdoor radioactive contamination is 3.8 μSv per hour and below. It means that when outdoor contamination is less than

3.8 μSv per hour, by calculation, the indoor contamination level is equivalent to 1.52 μSv per hour or less. This means that if children spend 8 hours outdoors and 16 hours indoors, their accumulated exposure can be controlled below 20 mSv per year.

The notice brought an enraged outcry as the public questioned whether the highest level of allowable dose was too high. Professor Toshiso Kosako of Tokyo University, who resigned as an advisor to the Cabinet Secretariat on 30th April, 2011, expressed his concern in his resignation address.

Kosako stated that the standards outlined in the notice issued by MEXT and MHLW for the allowable use of the school grounds in the Fukushima Prefecture were incorrect. Since these schools would be conducting ordinary school activities, the level of radioactive contamination should be close to the ordinary radioactive protection level—1 mSv per year, with the exceptional limit of 5 mSv per year for special cases. The level suggested in the notice can only be adopted in a high alert situation for a few days or one to two weeks at most. It would be utterly wrong to adopt these in the current situation. By informing the people in the region that this was an alert period and providing them with special measures, 10 mSv per year could be applied; yet this high level should be avoided. Even among the 84,000 people concerned with radiation-related work in nuclear power plants, there are only limited people who are exposed to nearly 20 mSv per year. To adopt the said figures for infants, young children and elementary school children is not acceptable not only from a scientific standpoint but also from a humanist viewpoint. A level of 10 mSv per year is rarely observed in the cover soil at uranium mine disposal sites, which typically have levels of only several mSv per year at most. Adopting the figures in the notice should be done only with great caution.

It is inferred that the 19th April notice was prepared mainly by experts on the health influences of radiation and protection from it, such as the Nuclear Disaster Experts Group in the Prime Minister's Office (Keigo Endo, Kenji Kamiya, Kazunori Kodama, Kazuo Sakai, Yasuhito Sasaki, Shigenobu Nagataki, Kazuhiko Maekawa and Shun-ichi Yamashita) and Fukushima Prefecture Radioactive Health Risk Management Advisors (Shun-ichi Yamashita, Noboru Takamura and Kenji Kamiya). As a specialist in radiation protection, Professor Toshiso Kosako squarely opposed the contents of the notice.

Prior to his resignation, a situation was mounting which amplified the public's sceptical view of the precautionary measures taken to mitigate health concerns over radiation, presented by the Japanese government and the Fukushima Prefectural gov-

ernment. An increasing number of citizens doubted what Shun-ichi Yamashita had said in his article 'Influence by radioactive substances' (Yamashita 2011). Yamashita plays an important role for the Prime Minister's Office as well as the Fukushima Prefectural government as a specialist on the thyroid gland. He is also a professor at Nagasaki University School of Medicine and Vice President of Fukushima Medical University at the same time.

His statement in the article was as follows:

> *The likelihood of getting cancer increases a little if a person is exposed to 100 mSv and more radiation at one time, and it is said that when the amount is controlled under 50 mSv per year, people are not affected. The total amount of exposure for workers at nuclear power plants is designated to be 50 mSv per year because greater safety is considered.*
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> *The greatest concern over people about being exposed to radiation is that they may get cancer later in their lives. In a case where 100 people are simultaneously exposed to 100 mSv radiation, one or two more persons than usual will get cancer at some point in their lives. Currently, one out of three Japanese dies of cancer. As such, in the above-mentioned situation, there would be no significant increase in the number of cancer patients. (Yamashita 2011)*

Yamashita repeatedly stated that the influence of low-dose-radioactive substances was negligible. He said, 'You will not be affected by radioactivity if you keep on smiling. But you will be affected by it, if you are worried about it'. And, 'Even in difficult times, you will not have any harm to your health if you are not worried about it'. Also, 'In any case, if you are exposed to less than 100 mSv per hour, your health will not be affected' (through Internet retrieval). Because of these statements, he faced criticism from many people, and the force of criticism increased after the resignation of Professor Kosako as an advisor to the Cabinet Secretariat.

Since Yamashita's speeches, an intense conflict has continued between those who agree with the Japanese and Fukushima Prefectural governments that the health damage resulting from radioactive fallout is so negligible that preventive measures should only be taken in limited districts, and those who believe that preventive measures should be taken because health damage due to radioactive fallout, particularly in children, is unknown. The national and Fukushima governments have not taken suf-

ficient preventive measures against radioactive substances on the grounds that their findings show that health effects from radioactive substances is small. This stance can be confirmed by the Report of the Working Group (22 December, 2011) on Low Dose Exposure, organised under the government's Advisory Committee on Measures Against Radioactive Contamination:

According to international agreements, the significant increase in the risk of cancerogenesis by radiation exposure under 100 mSv is difficult to prove as it is so negligible that it may be hidden by other cancer-promoting factors. Although attempts are being made to clarify the cancer-promoting risk of low-dose-radiation exposure by scientific procedures other than epidemiologic research, at the moment, the risk to the human body has not yet been revealed (19).

People in Fukushima and other districts with higher doses of contamination are suffering radiation contamination, and have to take various measures in their daily living. They are further burdened with suffering due to insufficient measures taken by the central and local governments and municipalities. The anger, sorrow and stress among the local residents, including those who have taken refuge elsewhere, is mounting a search of public support. Their complaints include measures being too few; geographically biased radioactive surveys; poor assistance for relocation or evacuation; lack of food safety measures and indefinite safety standards for produce, animal products, and marine products; poor support for decontamination work; too little compensation, overly complicated application procedures for compensation and difficulty initiating the application; and dissention and conflict caused by differences in radioactive risk assessment among specialists.

Why have specialists made safety-inclined assessments about 'radioactive influence on the human body'? The author has collected speeches repeatedly delivered by specialists after the nuclear power plant accident in order to consider what research studies and ideologies they had based their safety-inclined speeches on (Ichinose et.al. 2012) and the blog article 'The process through which Japanese specialists on radiation effects and their prevention have become inclined to have less severe safety standards than the ICRP level' (Shimazono 2012). Since the late 1980s, it was observed that Japanese specialists on radiation effects and health physics had been studying with a view to emphasise that health risks from low-dose-radiation exposure are small, and that in fact, such exposure has a favourable effect on health.

For example, Kazuo Sakai conducted a biological experimental study of low-dose radiation at the Central Institute of Electric Power Industry (CIEPI) and devised

the 'dose and dose rate map'. Hence, he is highly regarded for his contribution to the development of the theory on the safety of low-dose radiation. Sakai stated the following in his article in the 'CIEPI News' No. 401 (2004):

> *A mistaken idea that even a micro amount of radiation is harmful is the cause of people's fear about radiation and radioactivity. I have considered the need to uniformly integrate reports on micro amounts of radiation, which have previously only been fragmentarily disclosed, and have therefore devised the 'dose and dose rate map'. I expect that this map will alleviate public fears over radiation and simultaneously incite discussions leading to the effective use of low-dose/low-dose-rate radiation. (Sakai 2004, 3)*

Studies including the above are geared towards those who consider the standards laid by the International Commission on Radiological Protection (ICRP) 'too strict', and who aim to lower the standards. ICRP, the leading agency that the world relies on to present universal standards for radiology protection, advocates the linear no-threshold hypothesis for the estimation of cancer risk (i.e. LNT hypothesis), considering that even low-dose radiation under 100 mSv will continue to adversely affect human health, causing illnesses such as terminal cancer, although the level of harm will decline over a period of years if there is no further exposure. However, some specialists consider that the ICRP standards based on the LNT hypothesis are too strict and insist that they should be relaxed in order to promote nuclear power plants.

CIEPI has been taking the lead in asserting that the ICRP standards are too rigid both in Japan and the world and has been promoting studies in favour of the safety of low-dose radiation in partnership with universities across Japan. The National Institute of Radiological Sciences, where Kazuo Sakai moved to from the CIEPI, has also been energetically engaged in research studies to review the LNT hypothesis from the standpoint of studying the cancerogenesis mechanism. The National Institute of Radiological Sciences is the core Japanese agency for scientific studies of radiological influence and protection. Toshihiko Sado, who has been leading the research study, makes the following statement:

> *As long as we take this stance, it would mean that there is no 'safe amount' of effects of these sources acting on the human body. This view makes the public excessively nervous, thinking that even micro amounts of radioactive substances and environ-*

> *mental chemicals will have health risk. This nervousness may cause them to have higher levels of stress, which may cause new health issues. In this sense, it seems that the LNT hypothesis is exerting an impact on the public beyond the function of simply setting the safety guidelines to prevent harm from radioactive substances and environmental chemicals (Sado et al. 2005: 4–5).*

The above discussion proves that many Japanese experts in radiological health hazards have conducted their studies based on this concept, considering health effects of low-dose-radiation exposure to be minimal.

The preventive measures taken after the 11th March earthquake to protect the local people against low-dose-radiation exposure at the suggestion of the specialists were so precarious that they resulted in provoking resentment among the public. While saying that they were committed to observing the ICRP standards, specialists were strongly influenced by the notion that the ICRP standards were too rigid. In formulating measures, they consequently paid little consideration to the local people.

The Japanese government (i.e. the cabinet and related ministries) and local governments had delegated the formulation of important policies to specific groups of specialists for many years. After the 11th March earthquake, the authorities again had to entrust a limited range of specialists to formulate policy measures. In the process of developing nuclear power plants, the government has pushed forward the establishment of nuclear power plants at different locations, depending on the help of specialists while being faced with opposition by local people in respective locations. This was true with the question of health hazards caused by low-dose-radiation exposure.

Specific groups of politicians, government officers, business circles, academicians and the media, who are deeply involved in the development of nuclear power plants, have formed a special interest group, commonly called 'Nuclear Cronies'. They spent enormous amounts of money on advertising the advantages of nuclear power plants and embracing interested people. On the other hand, they have hidden unfavourable information on nuclear power plants from the public. These points have been criticised by the public. Many specialists in radioactive health hazards have also been integrated into that community with the communal principle of nuclear cronyism.

This kind of situation has arisen because of the special features of nuclear power development and the studies of the health hazards of radioactive substances. Since the beginning of research on atomic bomb development (under the direction of the military during World War II), these fields have been veiled in secrecy. One reason

may be that nuclear power development was initiated in the military arena, where means that were hardly considered to be humane or ethical were justified for the sake of the purpose. Even under the name of 'peaceful use of nuclear power', nuclear power plant development was still associated with a military purpose. The closed nature and information cover-up also continued because nuclear power plant development involved enormous risk. Being conscious of uneasy feelings among local people opposing nuclear power plants, the people on the development side have been beset by the temptation to select or embody risk information in favour of the promoters, and a mechanism to justify this has been developed.

Given their interest in the profits for the goods they develop, people involved in scientific technology that possibly poses an enormous risk tend to pay only slight consideration to those people who may suffer serious life-threatening health injuries as a result of risky technologies. This tendency is observed not only among specialists in health hazards from low-dose-radiation exposure but also among specialists in many other fields including medicine and the life sciences. In this sense, the issue of risk assessment arising through the nuclear power plant accident in Fukushima is considered to be relevant to bioethics and medical ethics, and further to the ethics of contemporary scientific technologies. The risk assessment of the nuclear power plant disaster is highly relevant to various problems in applied ethics today.

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