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A Contribution to the Journal of the Physical Society of Japan (JPSJ)

Participating in the Symposium "Nuclear Power Utilization and Energy Issues: from Physicists' Viewpoint"

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1. Preface

On June 10, the Physical Society of Japan held a symposium on the above theme, in which I was among the participants. None of the speakers touched the responsibility of Japanese physicists for the disastrous accident at the Fukushima nuclear power plant. This fact made me suspect that the purpose of the symposium was not only to promote atomic nucleus research but also to demonstrate the organizers' committed stance on its application, nuclear power generation. Furthermore, the symposium seemed like a podium for announcing that physicists need not shoulder any responsibility for this earthquake-induced nuclear disaster. Hosting such a one-sided event exclusively for pro-nuclear-power opinions, the Physical Society of Japan will inevitably meet with severe criticisms both in Japan and in the world as a whole. The Japanese public will naturally denounce "the Physical Society" as degrading itself to an agent for the N-power interest group dubbed "Nuclear Power Village"; the international community will certainly voice its concern that "the Physical Society of Japan" is only too blind to, or irresponsible for, risks that nuclear power entails.

2. Effects induced by radiation exposure

In my previous paper in this journal, I already mentioned the linkage between physicists' responsibility and issues concerning radiation exposure.¹⁾ Here, therefore, I would like to take up a speech on radioactive radiation exposure in the symposium, because this topic is one of the most important and urgent challenges now facing people not only in Fukushima but also in the whole world. One of the speakers, Mr. Tokushi Shibata, tried to evaluate the radiation exposure in the Fukushima accident based on the Recommendations of the International Commission on Radiological Protection (ICRP) 2007. Thereby, he argues that the risk from Fukushima's radiation exposure is not so large compared with the risk from workplace accidents in primary industries or the risk from the carcinogenicity induced by cigarette smoking.

Mr. Shibata also insists that “the induction of deterministic effects (harmful tissue reactions) of the ICRP2007 will scarcely occur where radiation doses are less than 100mSv.” His assertion is incompatible with the conclusion drawn by the US National Academy of Science’s Committee on the Biological Effects of Ionizing Radiation. Its report BEIR-VII emphasizes that “the current scientific evidence is consistent with the hypothesis that there is a linear, no-threshold dose-response relationship between exposure to ionizing radiation and the development of cancer in humans.”

As to the stochastic effect of low radiation doses, Mr. Shibata affirms: “In cases where 20mSv/year lasts 50 years, the cumulative dose of radioactivity will become 1Sv. This means that the carcinogenic risk will be equal to 5.5%, that is, 0.11% per year, calculated from 5.5% for a period of 50 years. This is almost equal to occupational risks such as in primary industries. Thus, government’s measure to evacuate all the residents is not appropriate. (...)”

As to internal radiation exposure, he addresses, “given cesium 137 remains in muscle tissues and exposes the whole human body to radiation, its intake limit is set at 5mSv for the first year. The risk from taking the food or drink containing a radiation level equivalent to this upper intake limit for a period of one year will, calculated from 5.5×10^{-5} /year for 1mSv/year, amount to 2.8×10^{-4} /year. This is almost equal to the risk from accidental incidents, 3.2×10^{-4} /year. Although the radiation limit for food and drink intake is now set at 5mSv, even if a person takes in 10 times this amount for a period of one year, the cumulative dose will be 50mSv/year and the risk of cancer 0.25%. The effect should not be viewed as so significant, considering that the cancer risk excluding radiation is as high as about 30%.” These are quoted from Mr. Shibata’s Power Point forms.

3. Problems in the Shibata report

(1) He rehearses the ICRP ‘s underestimation of radiation risks.

Mr. Shibata completely ignores the following important findings. Dr. Thomas F. Mancuso’s study at the Hanford nuclear weapon plant, among others, has already shown that the cancer death risk among these workers is approximately two times higher than the ICRP’s recommendations. In 2001, the then US president Bill Clinton

and vice-president Al Gore officially adopted this value and granted compensation for radiation-exposed workers at nuclear plants. Dr. John William Gofman, taking internal radiation exposure into consideration, has called for the risk to be eight times higher than the ICRP recommendations. These facts make it reasonable to conclude that the ICRP recommendations underestimate the risk.

Another factor that Mr. Shibata underestimates is internal radiation exposure. He claims that if internal radiation exposure limit is to be raised from the present 5mSv to, say, 10 times that level, i.e., 50mSv, the effect would not be “so significant.” But this current upper limit 5mSv on public radiation exposure is a result of the recent drastic relaxation as an emergency measure from the previous 1mSv, and is in itself a dangerously high level. Furthermore, with all radioactive elements other than cesium taken into consideration, actual exposure doses should be far higher. This fact requires the internal exposure to be evaluated for every organ and for every nuclide. Little is known about the internal exposure by low doses of radioactivity, much less its mechanisms. For example, 20 years of research has elucidated that there exists what is called “bystander effect” in which cells exposed by radiation can affect their neighboring cells not exposed at all. Considering this effect, exposure by low doses of radioactivity is more hazardous than it seems. In comparison with food radiation standards enforced in foreign countries including the United States and Belarus, Japan’s are outstandingly lax, which Mr. Shibata tries to justify in vain.

By assuming that carcinogenicity is the only form of health damage induced by radiation, Mr. Shibata ignores these already well-known facts: nuclear power plant workers are susceptible to symptoms like “A-bomb bura-bura disease” (an unexplained chronic fatigue syndrome that has been observed in Hiroshima and Nagasaki A-bomb survivors); children exposed in the Chernobyl accident are often fatigable and easy to suffer from common diseases. Surveys of British nuclear plant workers and Nagasaki-Hiroshima A-bomb survivors have also revealed that radiation can induce a series of circulatory conditions such as hypertension.

(2) Mr. Shibata overlooks the real picture of damage using the concept of relative risk.

Dealing with a disaster or a nuclear accident requires researchers to focus on the absolute number of the deceased. Needless to say, it makes no sense to compare the industry-related risk occurring every year with one 50th of the

nuclear-accident-induced cancer death toll for a 50 year period. As the May 11 N-plant accident happened at one time, its future cancer death toll should be evaluated as a whole. For example, even if based on the ICRP risk estimation which Mr. Shibata adopts, provided that two million population of Fukushima Prefecture receive radiation exposure 20mSv for a period of one year, the collective dose amounts to 40,000 manSv, and this means that 2,200 people will die from cancer. Suppose that Fukushima population continue to be exposed at this level for ten years, more than 20,000 people would die of radiation-induced cancers. Children are especially vulnerable to radiation; those aged one to nine have approximately three times higher sensitivity than adults. Contamination by Cesium 137 with 30 year half-life lasts long, therefore, people, if not evacuate, are destined to be tormented by fears of radiation exposure in many decades to come.

An unforgivable mistake for an expert like him is to identify the risk of residents including children from everyday radiation exposure with the risk of workers in workplace. While occupationally exposed workers have been affected by leukemia, the Japan's government has certified some cases as work-related. Over the past ten years, the minimum radiation dose in these cases has been at 5.2mSv. In other words, the government has officially confirmed that 5.2mSv radiation dose is the cause of leukemia, thus this radiation exposure dose 5mSv has the serious meaning.

(3) Risk-benefit analysis is aimed to force people to be exposed

Mr. Shibata's above-mentioned errors are rooted to the so-called risk(cost)-benefit analysis or what the ICRP calls "the optimization": "The number of people exposed and the magnitude of individual doses shall be kept as low as reasonably achievable, with economic and social factors being taken into account." Following this proposition, Mr. Shibata, as also mentioned above, discards the previous radiation dose limit, 1mSv/year, although this level is essential to protect human life. And he approves of higher radiation exposure doses such as 5mSv/year or even 50mSv/year, under the pretext of a state of emergency. But his sticking to emergency standards, which necessarily force population to be exposed by higher doses of radiation, unveils his real intention: giving benefit to the perpetrators by shifting radiation risk onto the victims; and coercing people to tolerate the exposure. The fact was that the ICRP-centered radiation exposure control regime was in itself built for this very purpose, and this truth is never to be forgotten.²⁾

In my opinion, no nuclear power plant can be safe. As long as nuclear power plants continue operating, dangerous radioactive wastes continue piling. Now is the time to stop nuclear power generation immediately and shift to the safe and sustainable social development promptly.

I would like to hear our members' opinions on this matter.

- 1) Kosaku Yamada: The Journal of the Physical Society of Japan, vol.66 (2011) p.459.
- 2) Yasuo Nakagawa: "A History of Radiation Exposure" Gijutu-to-ningen-sha 1991

(July 3, 2011)