Improving Radiological Protection by Reflecting the Voices of the Affected Population: Lessons of Fukushima Accident.

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After the Fukushima nuclear disaster, one Fukushima resident delivered a speech stating that "facts are hidden" and "the country does not protect its citizens (Muto 2012)." As exemplified by these words, there were severe problems with the Japanese government's response. Through literature survey, interviews with citizens, and questionnaires survey, we identified the essential problem of the radiation protection policy in Fukushima: “the lack of citizens' perspective.” Based on our findings, we propose the following must be introduced into the revised General Recommendation (GR).

In the case of Fukushima nuclear disaster, "the adverse health effect or excessive relative risk coefficient (ERR), is not significant below 100 mSv" was misunderstood by experts as "there is no risk below 100 mSv" which caused confusion and anxiety in Japanese society, and distrust of the expert held by the citizens has persisted until today. ICRP 103 also states that “the LNT model is that some finite risk, however small, must be assumed (para. 99).” However, as cited in ICRP 146, "today, much of the available data are broadly supportive of the linear-non-threshold model (NCRP 2018a; Shore 2018) (para. 22).” In the revised GR, LNT should be admitted as a scientific fact, and the reference level of 100 mSv should be lowered. In addition, reliable prolonged exposure studies, such as Techa River and INWORKS, obtained similar ERRs with acute exposure studies; thus, DDREF should be one instead of two.

Thyroid screening was conducted on 300,000 children in Chernobyl but only about 1,000 in Fukushima, making it difficult to assess the cause of thyroid cancer detected in Fukushima. The Japanese government conducted soil contamination measurements mostly in Fukushima. Later voluntary citizen measurements revealed that contamination level is high even in neighboring prefectures such as Miyagi and Tochigi, but no health examination has been conducted as in Fukushima (Shimizu 2023). These facts clearly show that the necessary measurements have not been conducted in the contaminated areas after the accident, which led to an inappropriate response by both local and national governments. Preparation for disaster that enables not only the protection of residents but also measurement must be stated in the GR.

Even more serious is the problem of the increasing damage caused by measures taken by the government after the accident that ignore the voices of citizens. For example, area decontamination was not carried out in highly contaminated cities, including Date-city in Fukushima even though the citizens requested it. As mentioned above, health examination was not conducted in the vicinity of Fukushima. Furthermore, the Japanese government plans to discharge contaminated water from the

FDNP into the ocean, despite the majority of Japanese citizens' opposition. Citizen's opinion has thus been ignored in decision-making on radiation protection after the accident. ICRP 103 states that "(decision-making) process *may* include the participation of relevant stakeholders (para. 224)," but the revised GR should state that "process *must* include the participation of relevant stakeholders."

The issue of the lack of public access to information related to thyroid examinations has also violated the public's right to know and has prevented people from expressing their opinions. Thyroid ultrasound images will not be given to a recipient of a thyroid examination, conducted by Fukushima Prefecture so that the recipients must claim FOIA to view the images. Since the third round, results of thyroid examination in Fukushima at the municipal level have been undisclosed, making it impossible for researchers to analyze the results of thyroid examination in Fukushima. In addition to data, the decision-making process of radiation protection measures is closed to the public. One of the key lessons of the Fukushima nuclear accident was the lack of proper distribution and instructions on the use of stable iodine tablets, which is not mentioned at all in the educational materials provided by the Japanese Ministry of Education（MEXT）. Furthermore, there is no explanation of how to take stable iodine tablets in the event of another severe nuclear accident. In the revised GR, the importance of transparency of the decision-making process and citizens's participation to build trust must be introduced.

While ICRP 111 lists long-term evacuations and relocation as radiation protection measures, in Fukushima, measures for returning are emphasized, free housing for voluntary evacuees has been discontinued, and even lawsuits have been filed against evacuees who have lived after the discontinuation. ICRP 138 and 146 assume that sufficient information is provided on the 'practical radiological protection culture', but not enough information has been presented by the authorities on the Fukushima nuclear accident. Attempts to develop a 'radiological protection culture' by presenting citizens with only information that is convenient for the authorities may force citizens to be exposed to radiation, thereby violating their rights. Furthermore, descriptions in educational materials by the Japanese Ministry of Education（MEXT） also emphasize the benefits of nuclear power, not its problems (Goto 2020). Fairness is also an essential part in radiation protection; thus, it should be introduced to the GR.

Based on ICRP 109 and ICRP 111, the Japanese government designated areas with projected annual exposures exceeding 20 mSv as evacuation areas, which remain unchanged even 12 years after the accident. This contradicts ICRP 109 & 111, which recommends lowering the reference level to reduce exposure. ICRP also recommends stakeholder involvement, but as mentioned above, this is rarely done. Arbitrary and partial adoption of ICRP recommendations caused confusion and distrust to the government. A systematic and nonarbitrary approach is necessary to conduct effective radiation protection.