Summary report on the lessons about the technical standards for prevention of radiation hazards in emergency exposure situations and existing exposure situations after the TEPCO Fukushima Daiichi Nuclear Power Plant accident

Radiation Council
Advisory board of implementing ministries/agencies

1. Background

Technical standards for prevention of radiation hazards in Japan (hereinafter referred to as "technical standards") have been historically established with respecting and incorporating the ideas internationally agreed such as the International Commission on Radiological Protection (hereinafter referred to as "ICRP"), the International Atomic Energy Agency and so on. In adopting the policy, the Radiation Council has confirmed validity and consistency of technical standards by playing a role in ensuring uniformity among them.

With regard to the adoption of ICRP Publication 103 "The 2007 Recommendations of the International Commission on Radiological Protection", the Radiation Council had just started the discussion in Japan before the TEPCO Fukushima Daiichi Nuclear Power Plant (hereinafter referred to as "TEPCO FDNPP") accident occurred. Relevant Ministries and Agencies were forced to respond to the accident, and they prioritized the formulation of various technical standards regarding both emergency exposure situations and existing exposure situations.

Coping with the TEPCO FDNPP accident, the response by the government needed unprecedented decision to select various protective actions. However, if there is a change in the situation over the course of time, the technical standards need to be reconsidered to appropriately respond to the changed status.

The Radiation Council did not have the function of voluntary investigation and recommendation. Act on Technical Standards for Prevention of Radiation Hazard (Act No.162 of 1958) was revised in April 2017, and then the Radiation Council came to have authority to investigate and make recommendations voluntarily. Taking it as a trigger, the Radiation Council decided to scientifically investigate and review the present situation after the

TEPCO FDNPP accident to summarize relevant reports.

The first proposal report from the Radiation Council has been made out to summarize the latest fundamental framework of radiological protection mainly based on ICRP. This report (hereinafter referred to as "Report on the fundamental RP (radiological protection) policy") contains the concepts and the principles to be referred to when relevant Ministries and Agencies will develop technical standards. It was published on January, 2018.

As for the next step, the Radiation Council decided to review the standards formulated after the TEPCO FDNPP accident following the Report on the fundamental RP policy. In particular, it focused on the criteria of radioactive concentration in foods and ambient radiation dose-rates, since more consideration will be required concerning the relationships between food contamination/ambient dose rates and individual exposure doses such as effective dose. After the accident, the change in the situation over the course of time has been well characterized to review the effectiveness of these standards and the actual conditions of their operation. Clarification of the lessons learned from the review will complement the Report on the fundamental RP policy, and will also be able to use discussion in the Radiation Council for future development of technical standards in emergency exposure situations and existing exposure situations.

2. Lessons learned

(1) Importance of correct understanding of assumptions and scenarios behind numerical standards

Point 1.1: There were cases where the numerical values were used beyond the originally intended use of them.

The provisional regulation values for food were adopted, which were numerical values originally developed by the Nuclear Safety Commission as an indicator that it is appropriate for the Nuclear Emergency Response Headquarters to start considering whether to take the food and drink intake restriction measures. The same numerical values were used as a cancellation requirement of the measures.

In this way, when using numerical values beyond the originally intended

use of them, it is necessary to explain to the society after fully understanding the positioning and derivation process of such standard values (for example, it was formulated as a measure of whether the Nuclear Safety Commission would introduce food intake restriction referring to the Chernobyl accident, or it took into account the physical half-life due to natural decay of nuclides under the scenario of exposure by a single large release, etc.) at the operation stage.

Point 1.2: It has been pointed out that a situation has occurred as "Use of the criteria can go around independently out of context", that is, only the numerical values are spread widely without proper understanding of their backgrounds and meanings.

With regard to the current reference values for food (e.g.100 Bq/kg for general foods), the requirements for designation of the contamination status survey area and the requirements for the area for establishing the decontamination implementation plans under Act on Special Measures Concerning the Handling of Environmental Pollution by Radioactive Materials (areas exceeding 0.23 μSv/h), which are derived from 1 mSv/year as additional effective dose, it has been pointed out that a situation as "Use of the criteria can go around independently out of context" such as "This food is dangerous because it exceeds 100 Bq/kg", "It may be dangerous because it may exceed 50 Bq/kg (which is the standard for infant food) when a food for adults is given to infants", or "If at least one site in the sites after decontamination has more than 0.23 μSv/h, decontamination is insufficient and it is dangerous, so it must be re-decontaminated" has occurred.

Point 1.3: In some cases, the meaning or the position of the numerical standards has not been properly conveyed.

With regard to the requirements for designation of the contamination status survey areas and the requirements for the areas for establishing the decontamination implementation plans, in "the interim report of the study meeting held by the Ministry of the Environment, Reconstruction Agency and 4 cities in Fukushima prefecture", it is mentioned that their intention such as "The purpose of radiological protection is to reduce the exposure dose of individual as low as reasonably achievable. Decontamination is one of the means to accomplish it but it is not only.",

"The value 0.23 μSv/h is not a target for decontamination. It is the numerical value to use in designating the contamination status survey areas." and "A calculating formula to convert the annual additional dose 1 mSv to 0.23 μSv/h is an estimated value in a specific daily life style." has not been conveyed correctly to the residents.

Lessons based on the above issues

Although it is natural for technical standards to be formulated with a certain assumption and scenario in the absence of sufficient data immediate after an accident, it is necessary for policy makers to define the position of the viewpoint of radiological protection, to clarify the target and the period to which the standards should be applied, to properly understand and operate them, and at the same time to explain them to the society including the possible advantages and disadvantages which may be brought about. Then, it is also necessary to explain what extent the technical standards have the degree of safety margin or uncertainty depending on the exposure situation, in consideration of the change of the situation etc.

It is necessary to understand that there were some cases where the relationship between the assumptions/scenarios and operation of the standards was unclear in the response to this accident, that safety cannot be ensured only by lowering the standard values, that at the time of an accident, it is important to take various protective measures in consideration of optimization and reduction of the additional individual doses and to promote the recovery and reconstruction of the society while considering the effects other than radiation, and that measures by numerical standards are mere one means for that.

(2) Difference of implications between numerical standard based on reference levels and dose limits in planned exposure situations

Point 2.1: Some technical standards developed after the accident required "bellow 1 mSv as an additional annual dose" by means of regulatory compliance.

As it is judged as a violation of the law if the food is distributed beyond

the numerical standard, the current standards for food are considerably strict as the technical standards in existing exposures situations and differ from the concept of reference levels.

Point 2.2: In Japan's legal system, it seems that adopting the concept of reference levels contains legislative issues, and regulatory methods by means of punitive or obligatory actions should not be ruled out uniformly. On the other hand, when trying to set the numerical standard for an individual dose in the general public in emergency exposure situations or existing exposure situations, it is necessary to understand the difference between the meaning of dose limits and reference levels.

(3) Importance of a process of verifying the validity of the standards comparing with the original purpose when there is a change in radiological situation over the course of time or accumulation of data

Point 3.1: It is said that the revisions of technical standards developed mainly in response to existing exposure situations are difficult because of concern about the social impact, especially reputational damages.

As for current standard values for food, radioactive concentration in actual food is much lower than assumed and the estimated internal dose from food intake is extremely lower than 1 mSv per year. Therefore, it may be hard to explain the need of continuously using the current standard value for monitoring from the perspective of radiological protection.

Point 3.2: From the viewpoint of optimization, it is important to establish a process of verifying the validity of the numerical standards comparing with the original purpose when the radiological situation has changed over the course of time or characterized data have accumulated. In addition, it is necessary to develop the decision making policy of transitioning the exposure situation from the emergency exposure situation to the existing exposure situation.

3. Viewpoint of deliberation in the Radiation Council based on the lessons

Based on the lessons written in 2., it will be fundamental to deliberate the

development of technical standards in emergency exposure situations and existing exposure situations in the following way. In this regard, however, when the Radiation Council is actually consulted regarding technical standards, it will discuss them on a case-by-case basis depending on the actual circumstances at that time.

(1) When formulating a numerical standard, it is necessary to confirm the validity of the underlying assumptions and scenarios and the concept of the margin assumed in the assumptions and scenarios. In order to avoid social misunderstandings and confusions such that two simple categories as 'safety' and 'danger' were observed by "Use of the criteria can go around independently out of context" diverted away from the original aim of the standard, appropriate measures should be taken such as adding notes to the report on matters to be kept in mind when handling the numerical standard.

(2) When trying to set the numerical standard for an individual dose for the general public, it is necessary to differentiate the meaning of the dose limit and the reference level. In particular, if the numerical standard is implemented by the regulatory method with penalties etc., it should be checked whether it cannot be secured by other methods.

(3) It is necessary to check whether the process of verifying the validity can be beforehand incorporated in the system in term of the original purpose, when there is a change in situation over the course of time or accumulation of characterized data.

Supplement

This Report is to be primarily used by the Radiation Council for its own deliberations, and it's also to be used by relevant Ministries and Agencies for reference when they formulate technical standards. In addition, it is expected that it helps the people and experts outside the field of radiological protection and will serve as a reference for the ongoing efforts to recover from existing exposure situations.

From now on, when formulating technical standards in emergency exposure situations or existing exposure situations, it is necessary to pay particular

attention to this Report in addition to the Report on the fundamental RP policy.

The Report does not intend to disapprove the approach or specific values regarding the technical standards already formulated based on the TEPCO FDNPP accident, since the validity cannot be judged only by the uniformity of technical standards. Basically, the Radiation Council will continue to compile the documents for preserving the uniformity of technical standards in the regulatory guide.