Japan: How bad is the Fukushima fallout?

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The crisis at the Fukushima No. 1 nuclear power plant has released a large amount of radioactive substances into the air and water, raising serious concerns over possible health risks.

The government and plant operator Tokyo Electric Power Co. have repeatedly said there will be no major health impact “for the time being” and that there will be no “immediate” effects.

But what consequences will the radiation fallout actually have?

The following will examine the impact of radioactive substances on people’s daily lives, and look at how much radioactive fallout has occurred, possible health effects and how to prevent exposure.

How much radioactive material has so far been released into the atmosphere due to the Fukushima accident? Let’s compare the radioactive contamination caused by the current crisis to past nuclear accidents.

Fallout of cesium-137 has been monitored for every 24-hour period since March 18 at observation points in each prefecture, except quake-hit Fukushima and Miyagi. Cesium-137 is an international indicator for radioactive contamination.

Monitoring data has shown the total fallout of cesium-137 in Hitachinaka, Ibaraki Prefecture, for 18 days through Tuesday morning was 26,399 becquerels per square meter. In Shinjuku Ward, Tokyo, the figure was 6,615 becquerels per square meter.

Rain on March 21-22—the first since the nuclear crisis began—brought down a large amount of cesium-137, spreading the contamination to Tokyo and 13 prefectures in and around the Kanto region.

Although many people believe their lives have been free of radioactive contamination, history shows that radioactive materials were widely dispersed during the 20th century, sometimes dubbed the Atomic Age.

Domestic studies on radioactive fallout date back to 1957, three years after the exposure to radiation of the crew of the tuna boat Fukuryu Maru No. 5 after an atmospheric nuclear test by the United States. One crew member died six months after the incident.

This test took place amid the Cold War when the United States and the Soviet Union conducted a large number of nuclear tests. In 1962 alone, at least 178 nuclear tests took place, dispersing plutonium and other radioactive materials into the atmosphere. In Osaka, 688 becquerels per square meter of cesium-137 was measured in May 1963.

The worst case of radioactive contamination was the accident at the Chernobyl nuclear power plant in Ukraine, then a Soviet republic, in April 1986. About 7 tons of radioactive materials—about 400 times what was released by the atomic bomb dropped on Hiroshima—were released across the Northern Hemisphere. In Kanazawa, cesium fallout was 318 becquerels per square meter in May that year.

Areas within 30 kilometers of the Chernobyl plant were incredibly contaminated—as much as 1.48 million becquerels per square meter in some areas. Residents in these areas were evacuated. In parts of Germany and other nations, more than 70,000 becquerels per square meter were detected. In Belarus and Moldova, also Soviet republics at the time, and other nations such as Austria and Finland, the average amount of fallout exceeded 10,000 becquerels per square meter.

The level of radioactive fallout in Hitachinaka and some other areas in the wake of the Fukushima crisis is believed to be higher than that reported in the 1979 Three Mile Island accident in the United States, and about the same as that reported in Europe after the Chernobyl incident.

Fallout levels in the Kanto region have been decreasing this month. Daily readings have been about the same as the early 1960s when so many nuclear tests were conducted. Some experts have said these levels pose no threat to people's health. However, highly radioactive water leaked from the Fukushima plant into the ocean could cause severe damage to marine life.

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Upper limit changes in a crisis

There are two reference levels for the effects of radiation exposure on health—one for normal times and another for emergencies. The everyday yardstick for radiation exposure for ordinary people is set on the safe side.

According to the International Commission on Radiological Protection (ICRP), the annual intake limit for artificial radioactive substances—excluding natural radiation such as from cosmic rays and from medical devices such as X-rays—is 1 millisievert (mSv) for ordinary people.

A becquerel is a unit for measuring a substance's radioactivity, and is equal to the number of nuclear decays per second. A sievert is a unit to quantify the biological effects of radiation. Becquerels can be converted into sieverts through a formula that factors in elements including the type of nucleus and type of radiation exposure.

Research on atomic-bomb survivors suggests that the incidence of cancer increases if the radiation dose exceeds 100 mSV. The annual limit of 1 mSv was set on the grounds that if a person is exposed to this level every year until age 80, the total radiation dose will be less than 80 mSv.

But during emergencies, such as an accident at a nuclear power plant, this level is often increased. The Nuclear Safety Commission of Japan has said people should stay indoors if the annual radiation dose exceeds 10 mSV.

The ICRP in 2007 issued an advisory saying the annual radiation limit for ordinary people can be raised to 20 mSv to 100 mSv during an emergency. The ICRP's suggestion of this temporary level is based on lessons learned from the Chernobyl disaster and other incidents.

"Even if people are exposed to 20 mSv of radiation in a year, they wouldn't experience any symptoms such as nausea or burns. Raising the upper limit could increase the risk of cancer, but if there are other merits, such as avoiding the need to evacuate, it might be a feasible option," according to Yasuhito Sasaki, an executive director at the Japan Radioisotope Association.

Whether to change the annual limit on radiation intake from the normal level to an emergency level is decided by the NSC after considering the scale of the radioactive contamination and doses in different areas and reporting on this to the government.

Radiation intake limits for workers at nuclear facilities are set at 100 mSv over five years, but this limit was raised to 250 mSv following the accidents at the Fukushima No. 1 nuclear plant.

The ICRP has also issued an advisory that the emergency exposure limit for rescue and other personnel should be between 500 mSv and 1,000 mSv over five years.

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* The Yomiuri Shimbun, Apr. 11, 2011:
http://www.yomiuri.co.jp/dy/national/T110410001935.htm