

Nuclear catastrophe in Japan

Health consequences resulting from Fukushima

By Henrik Paulitz, Winfrid Eisenberg, and Reinhold Thiel, 6 March 2013



Since 2011, the food chain in Japan has been severely contaminated by radionuclides from Fukushima
Photo: IPPNW

Summary

On 11 March 2011, a nuclear catastrophe occurred at the Fukushima Dai-ichi nuclear power plant in Japan in the wake of an earthquake and due to serious safety deficiencies. This resulted in a massive and prolonged release of radioactive fission and decay products. Approximately 20% of the radioactive substances released into the atmosphere have led to the contamination of the landmass of Japan with 17,000 becquerels per square metre of cesium-137 and a comparable quantity of cesium-134.

The initial health consequences of the nuclear catastrophe are now, two years after the incident, scientifically verifiable. Similar to the case of Chernobyl, a decline in the birth rate was documented in the nine months following the nuclear catastrophe. Throughout the whole of Japan, the total drop in number of births in December 2011 was 4362, with the Fukushima Prefecture registering a decline of 209 births. Japan also experienced a rise in infant mortality, with 75 more children dying in their first year of life than what would be expected statistically.

In the Fukushima Prefecture alone, some 55,592 children were diagnosed with thyroid gland nodules or cysts. In contrast to cysts and nodules found in adults, these findings in children must be classified as precancerous. There were also the first documented cases in Fukushima of thyroid cancer in children.

Table 1: Overview of the existing and expected consequences for health from the Fukushima nuclear catastrophe

	Number	Source
Decline in live births for 2011	4362	Körblein 2013
Rise in infant mortality for 2011	75	Körblein 2013
Children with thyroid gland cysts and/or nodules in the Fukushima Prefecture alone	55,592	Fukushima Prefecture 2013
Expected incidence of cancer cases resulting from external exposure to radiation	18,950 - 41,303	IPPNW 2013
Expected incidence of cancer cases due to food intake	18,633	IPPNW 2013
Expected cases of severe illnesses among workers employed by Tepco in the nuclear facility in 2011	17,715	IPPNW 2013

The present document undertakes three assessments of the expected incidence of cancer resulting from external exposure to radiation. These are based on publications in scientific journals on soil contamination in 47 prefectures in Japan, the average total soil contamination, and, in the third case, on local radiation dose measurements made in the fall of 2012. Taking into consideration the shielding effect of buildings, the medical organization IPPNW has calculated the collective lifetime doses for individuals at 94,749 person-Sieverts (PSv), 206,516 PSv, and 118,171 PSv, respectively.

In accordance with the risk factors set by the European Committee on Radiation Risk (ECRR) for death caused by cancer (0.1/Sv) and the incidence of cancer

(0.2/Sv), these figures translate into 18,950, 41,303, and 28,418 expected cases of cancer due to external radiation exposure in Japan.

133,832 measurement results published by the Japanese Ministry of Health were used to make an estimate of the number of expected cases of cancer due to the consumption of contaminated food. However, a large part of the data could not be used, because only figures less than maximum allotted levels and not those of actual measurements were published.

The some 17,000 measurement readings were sorted according to Japanese prefectures, with the Fukushima region (the Fukushima, Miyagi, Tsuchi, and Ibaraki prefectures) showing an average total cesium contamination of foodstuffs at 180.8 Bq/kg. Calculations indicated total cesium levels of 108.1 Bq/kg for the rest of eastern Japan and 71.8 Bq/kg for western Japan. Due to the nature of the database, it remains unclear to what extent these underlying values are representative. As such, it has here been conservatively assumed that, in the following year, food was on average contaminated by only half this amount of cesium.

The annual consumption level of Japanese produced foodstuffs was estimated at 30,753,745 tons, and the corresponding levels for the three defined Japanese regions was determined on the basis of their relative share of the total population. In addition, an ecological half-life period of 5 years was assumed.

According to the calculations made by the medical organization IPPNW, the resultant collective lifetime dose amounted to 93,166 person-Sieverts. Correspondingly, some 18,633 cases of cancer can be expected due to contaminated food intake.

The applied risk factor of 0.1/Sv, which has also been recently accepted by the World Health Organization (WHO), indicates a probable underestimation of the true risk. Recent studies point to a risk factor that is approximately twice as great, thereby resulting in a doubling of the calculated illness figures. If one assumes a risk factor of 0.2/Sv, then the expected incidence of cancer due to increased external radiation exposure would amount to between 37,899 and 82,606 cases, while 37,266 cancer cases would result from the intake of contaminated food.

Table 1.2: Expected incidence of cancer due to external and internal radiation exposure assuming a risk factor supported by recent findings

	Number	Source
Expected incidence of cancer cases resulting from external exposure to radiation	37,899 – 82,606	IPPNW 2013
Expected incidence of cancer cases due to food intake	37,266	IPPNW 2013

With respect to those workers, who, according to Tepco, the operating company of the damaged nuclear facility, were on duty in the plant in 2011, the IPPNW estimates on the basis of experiences in Chernobyl that there will be more than 17,000 cases of serious illnesses.

Some of the quantitative results of this work are subject to uncertainty, as much of the original data has only been published in an imprecise form and certain calculations involved making further assumptions. Nevertheless, the IPPNW has deemed it necessary to present this quantitative estimate in order to make clear the true dimension of the nuclear catastrophe at Fukushima.

At present, there are numerous nuclear power plants operating at sites facing the potential risk of an earthquake. Most are much less able to withstand the force of an earthquake than nuclear reactors in Japan. Even a relatively weak earthquake could, at any time, thereby trigger another nuclear catastrophe almost anywhere, whether in Asia, America, or even in Europe.