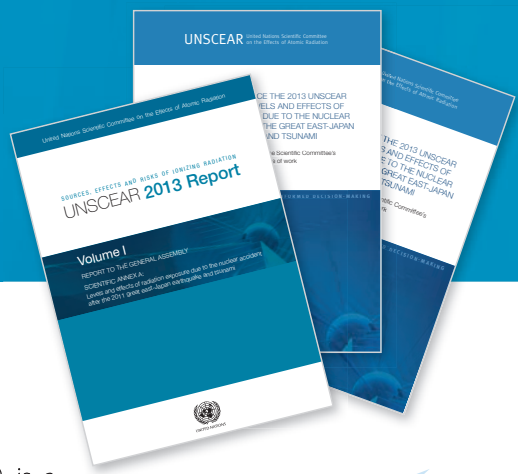
UNSCEAR 2013 Report

"Levels and effects of radiation exposure due to the nuclear accident after the 2011 great east-Japan earthquake and tsunami"



What is UNSCEAR?

The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) is a committee of the United Nations established by the General Assembly in 1955. It is composed of scientific experts nominated by Member States.

Its mandate is to assess and report on the levels and effects of exposure to ionizing radiation. Governments and organizations throughout the world use the Committee's estimates as the scientific basis for evaluating radiation risk and for deciding on protective measures. The Committee's mandate is based on science. Its reviews are relevant to policymakers, but it does not establish policy. UNSCEAR does not owe allegiance to any country, organization, commercial enterprise or lobby. The Committee's programme of work is supported by the General Assembly; it typically covers a four- to five-year period.

The organizational responsibility for servicing the Committee lies with the United Nations Environment Programme, which provides the UNSCEAR secretariat in Vienna. The secretariat organizes the annual sessions of the Committee and manages the preparation of documents for the Committee's scrutiny. It compiles relevant data submitted by United Nations Member States, international organizations and non-governmental organizations, as well as peer-reviewed scientific literature, and engages specialists to analyse those data, to study relevant scientific topics and to produce scientific evaluations. After approval by the Committee, these authoritative reviews are published as reports. They provide the scientific basis for recommendations and standards for the protection of people and the environment.

What was the report about?

In the 2013 report "Levels and effects of radiation exposure due to the nuclear accident after the 2011 great east-Japan earthquake and tsunami", the main focus was on the exposure to radiation of various groups of the population, and the effects in terms of radiation-induced risks for human health and the environment. The population groups considered included residents of the Fukushima Prefecture and other prefectures in Japan; and workers, contractors and others who were engaged in the emergency work at or around the accident site. The environmental assessment addressed marine, freshwater and terrestrial ecosystems.

Eighteen United Nations Member States provided more than 80 experts to conduct the analytical work cost-free. The UNSCEAR report was among the most comprehensive international scientific analyses of the levels and effects of exposure to radiation following the accident at the Fukushima-Daiichi Nuclear Power Station.

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Where did the Committee get its data from?

Member States of the United Nations submitted data to assist the process, including Argentina, Australia, Belarus, Belgium, Canada, China, Finland, France, Germany, India, Indonesia, Japan, Malaysia, Mexico, Pakistan, Philippines, Poland, Republic of Korea, Russian Federation, Singapore, Slovakia, Spain, Sweden, United Kingdom and United States of America.

Additionally, several international organizations, such as the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), the Food and Agriculture Organization of the United Nations (FAO), the International Atomic Energy Agency (IAEA), the World Health Organization (WHO) and the World Meteorological Organization (WMO) contributed to the work by providing expertise and sharing data.

All datasets had to be deemed "fit for purpose" before being used in the analysis. Some datasets were not used directly in the assessment, but were valuable for comparison and relevance checks.

Few measurements were available in the first few days because of the disruption caused by the tsunami and the accident. Existing infrastructure had been wiped out and power was not available. The immediate focus was on the important task of saving lives. Therefore, the Committee had to use models extensively to support its assessments. This means that there were uncertainties in the estimation of doses from short-lived radioactive substances. However, large amounts of measurement data became available with time, which were used directly in the assessment. Apart from evacuees, the dose assessments were guided by measurements of deposition of radioactive substances on the ground. The Committee also used models based on past experience to make projections for future exposure.

What is the outlook?

In general, cancer rates are expected to remain stable for the population affected by the accident. A discernible difference from pre-existing levels due to radiation exposure is unlikely.

The Committee does not expect significant changes in future cancer statistics that could be attributed to radiation exposure from the accident.

- Cancer rates to remain stable
- Theoretical increased risk of thyroid cancer among most exposed children
- No impact on birth defects/hereditary effects
- No discernible increase in cancer rates for workers
- Temporary impact on wildlife

Health risks

In general terms, because the doses following the accident were low, the risks were correspondingly low. After an exposure corresponding to an acute dose of 100 mSv to the whole body, the lifetime risk of cancer could be estimated at about 1.3 per cent, in addition to the usual pre-existing 35 per cent chance of developing cancer in a Japanese population that had not been exposed.[1]

What were the dose levels?

Radionuclides of iodine and caesium made the largest contributions to the estimated doses.

Iodine-131, when consumed or inhaled, is taken up preferentially by the thyroid. However, it dissipated very quickly, because it has a short half-life (eight days), and ceased being a source of exposure to radiation a few months after the accident. The radionuclide can no longer be detected. Doses to the thyroid mainly from iodine-131 were estimated to be up to several tens of milligrays (mGy).

Two isotopes of caesium (caesium-134 and caesium-137) have longer half-lives (2 years and 30 years respectively) and irradiate the whole body fairly uniformly.

The whole-body effective doses,[2] mainly from caesium-134 and caesium-137, were estimated to be up to ten or so millisieverts

[1] Health risk assessment from the nuclear accident after the 2011 Great East Japan earthquake and tsunami, based on a preliminary dose estimation. World Health Organization, Geneva, 2013.

[2] The effective dose adjusts physical measures of radiation dose, expressed in grays and milligrays, for biological effectiveness of the radiation and is an indicator of potential for development of radiation-induced cancer. Effective dose is expressed in the unit sievert (Sv) or fractions according to the metric system: a millisievert (mSv) is one-thousandth of a sievert; a microsievert (μSv) is one-millionth of a sievert.

(mSv) and will be received over the lifetime of those exposed. While at its most intense at the time of the accident, the additional rate of exposure gradually falls with time.

The additional exposures received by most Japanese people in the first year and subsequent years due to the radioactive releases from the accident were estimated to be less than the doses received from natural background radiation (which in Japan is about 2.1 mSv annually). This was particularly the case for Japanese people living away from the accident site.

Impact on the general population and children

The Committee estimated doses to the thyroids of adults to be up to about 35 mGy in the most affected districts, albeit with considerable variation (from about two to three times lower or higher) between individuals.

For one-year-old infants, the district-average thyroid dose in the most affected areas was estimated to be up to about 80 mGy. UNSCEAR noted a theoretical possibility that the risk of thyroid cancer among the group of children most exposed to radiation could increase and concluded that the situation needed to be followed closely and further assessed in the future. However, thyroid cancer is a rare disease among young children, and the normal rates are very low.

Largely because small numbers were involved, no discernible increase[3] in the incidence of other childhood cancers, including leukaemia, was expected.

Impact on workers

For almost all workers (99.3 per cent as of 31 October 2012), the effective doses reported were low (less than 100 mSv) with the average at about 10 mSv. Any radiation-induced risks would be correspondingly low. A statistically discernible increase in radiation-related health effects among workers or their descendants that could be attributed to radiation exposure was not expected on the basis of current knowledge and the information on doses.

As of 31 October 2012, about 0.7 per cent (i.e. about 170) of the workers were estimated to have received effective doses in excess of 100 mSv, predominantly by external exposure, with an average dose of about 140 mSv. No discernible increase in cancer in this group was expected, because its magnitude would be small in comparison with normal statistical fluctuations in cancer incidence for such a small group.

For the 13 workers who were estimated to have received absorbed doses to the thyroid in the range of 2 to 12 Gy, an increased risk of developing thyroid cancer and other thyroid disorders could be inferred. However, no discernible increase of the incidence of cancer in this group was expected because of the difficulty in confirming such a small increase in incidence against the normal statistical fluctuations in cancer incidence for such a small group.

Long-term measures

It is important to maintain a long-term medical follow-up of the exposed population, and in relation to certain diseases, to provide a clear picture of their health status development. While the overall impact in terms of population statistics was low, certain individuals and groups (especially workers) received doses of radiation that warranted medical follow-up.

Radiation exposures and effects on terrestrial and aquatic ecosystems

The doses and associated effects of radiation exposure on plants and animals following the accident were evaluated against the Committee's previous evaluations of such effects.

In general, the exposures of both terrestrial and aquatic (fresh-water and marine) ecosystems were too low for observable acute effects. Any effects were expected to be transient in nature, given their short duration.

Effects on non-human biota in the marine environment would have been localized—i.e. confined to areas close to where highly radioactive water was released into the ocean.

Continued changes in biomarkers for certain terrestrial organ-isms, in particular mammals, could not be ruled out, but their significance for population integrity was unclear. Any radiation effects would have been limited to the area where deposition of radioactive material was greatest; beyond this area, the potential for effects on biota was insignificant.

[3] For the purpose of this study, the Committee has used the phrase "no discernible increase" where a health risk could be inferred on the basis of existing risk models, but an increased incidence is unlikely to be observed in the future using currently available methods, because of the combined effects of the size of population exposed and low exposures.

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Future research

Past experience from the accidents at the Chernobyl and Three Mile Island nuclear power plants shows that more information about the factors contributing to the progression of the accident and the resulting exposures to the public, workers and the environment will continue to come forth.

To keep abreast of new scientific information that has emerged since the launch of its 2013 Report, UNSCEAR conducted reviews of relevant scientific literature published in 2014 and 2015 to guide the Committee's future programme of work. The findings were published as White Papers in both English and Japanese.

While more information will become available in the future, and some details may change, the Committee does not expect the overall picture to change dramatically.

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