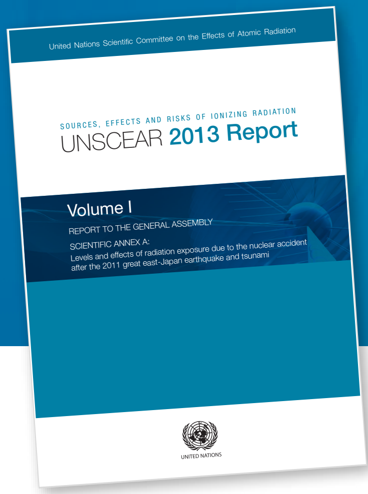
UNSCEAR:
The Fukushima accident



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.

UNSCEAR is a scientific committee of the United Nations. 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 approved 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. They provide the scientific basis for recommendations and standards for the protection of people and the environment.

What is the report about?

In the report "Levels and effects of radiation exposure due to the nuclear accident after the 2011 great east-Japan earthquake and tsunami", the main focus is 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 include 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 addresses marine, freshwater and terrestrial ecosystems.

Eighteen United Nations Member States provided more than 80 experts to conduct the analytical work cost-free. As of mid-2014, the UNSCEAR report is the most comprehensive, international scientific analysis of the levels and effects of exposure to radiation following the accident at the Fukushima-Daiichi Nuclear Power Station.

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, Slovakia, Singapore, Spain, Sweden, United Kingdom and United States of America.

Along with that, 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.

Measurements were not 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. These and a host of other factors impeded the data-collection process in Japan. As a result, 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, a significant amount of measurement data became available with time, which were used directly in the assessment. For the longer-term dose assessment of long-lived radioactive substances, the assessments were guided by numerous data on 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?

For the population affected by the accident, cancer rates are expected to remain stable.

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

Science makes it possible to reasonably quantify the health risks for the population of the Fukushima Prefecture of doses due to the accident that are considerably larger than those estimated. After an exposure corresponding to an acute dose of 100 mSv, the lifetime risk of cancer would be estimated as 1.3 per cent, in addition to the pre-existing, usual 35 per cent chance of developing cancer in a Japanese population that is unexposed.

What were the dose levels?

The two most significant radionuclides, iodine and caesium, delivered different dose levels.

In simple terms, iodine-131, when ingested or inhaled, is taken up preferentially by the thyroid. However, it dissipates very quickly, as it has a short half-life (eight days). Two isotopes of caesium (caesium-134 and caesium-137) have longer half-lives (2 years and 30 years respectively) and irradiate the body fairly uniformly.

Doses to the thyroid mainly from iodine-131 ranged up to several tens of milligrays (mGy) and were received within a few weeks after the accident. Maximum rates of exposure occurred shortly after the accident, however, any threat from exposure to iodine-131 had passed within a month or so after the accident because it dissipated. The radionuclide can no longer be detected.

The whole-body effective doses,[1] mainly from caesium-134 and caesium-137, ranged up to ten or so millisieverts (mSv) and

[1] 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.

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 are less than the doses received from natural background radiation (which in Japan is about 2.1 mSv annually). This is 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 their normal risk is very low.

It is possible to speculate that a small number of pregnant women in the Fukushima Prefecture might have received absorbed doses to the uterus of about 20 mGy, although district-average exposures were considerably lower. However, because of the small numbers involved, no discernible increase in the incidence of childhood cancers, including leukaemia, among this group is 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 and a statistically discernible increase in radiation-related health effects among workers or their descendants that could be attributed to radiation exposure is 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 is expected, because its magnitude would be small in comparison with normal statistical fluctuations in cancer incidence for such a small group.

For the thirteen 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 can be inferred. However, no discernible increase[2] of the incidence of cancer in this group is expected because of the difficulty 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 for 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 is low, it should be recognized that certain individuals and groups (especially workers) have received doses of radiation that warrant 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 (freshwater 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 confined to areas close to where highly radioactive water was released into the ocean. Potential exceptions were water plants, especially those located in the area where radioactive water was discharged into the ocean.

Continued changes in biomarkers for certain terrestrial organisms, in particular mammals, could not be ruled out, but their

[2] For the purpose of this study, the Committee has used the phrase "no discernible increase" where a health risk can 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.

significance for population integrity is unclear. Any radiation effects would have been constrained to a limited area where deposition of radioactive material was greatest; beyond this area, the potential for effects on biota was insignificant.

How does this study fit in with other available reports?

UNSCEAR found that the exposure of the Japanese population was low, leading to correspondingly low risks of health effects due to radiation later in life. This finding is consistent with the conclusions of the WHO Health Risk Assessment Report.[3] A larger quantity of data became available to UNSCEAR after the period considered by WHO; this resulted in more precise estimates of dose and associated risks, which were a little lower. Even though the estimated doses and risks reported by UNSCEAR are lower, they are scientifically consistent with the early WHO findings. Simply put, UNSCEAR had more data (beyond 2011, into 2012, and even some information in 2013) and therefore less uncertainty. WHO, on the other hand, had data up to September 2011, and therefore, greater uncertainty.

Previous experience shows that, as time passes, more information becomes available to refine findings and analyses. This process will continue over the coming years.

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 accident progression and the resulting exposures to the public, workers and the environment will continue to come forth.

UNSCEAR will follow developments in the situation and the results of research as they are published, and will consider them in developing its future programme of work.

While more information will present itself in the future, and some details may change, the overall picture is not likely to change dramatically.

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[3] http://www.who.int/ionizing_radiation/pub_meet/fukushima_risk_assessment_2013/en/

The primary purpose of the WHO health risk assessment of the Fukushima Daiichi nuclear accident was to estimate its potential public health impact so that future health needs could be anticipated and public health actions could be taken. The assessment thus was based on a preliminary estimate of radiation doses, as described in the report published in May 2012.

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