

Critical Analysis of the WHO's health risk assessment of the Fukushima nuclear catastrophe

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On February 28th, 2013, the World Health Organization (WHO) published its „Health risk assessment from the nuclear accident after the 2011 Great East Japan earthquake and tsunami“. This report concluded that “for the general population inside and outside of Japan, the predicted risks are low and no observable increases in cancer rates above baseline rates are anticipated.”¹ The assessment is based on preliminary dose estimations, published by the WHO in May 2012², which were severely criticized by the German Section of IPPNW, independent researchers and Japanese civil organizations.³ This analysis discusses the eight main objections to the current WHO report and shows why it should not be considered a neutral scientific assessment of the actual health risks of the affected population, nor a valid basis for future decisions and recommendations.

1. The report is based on faulty assumptions

Scientifically speaking, the main point of criticism to this report has to be the fact that the health risk assessment is based on dose assessments which are dubious, if not to say plain wrong. The source term estimates (the total emission of radioactive particles) used in the WHO report were significantly lower than those of independent research institutions and in some cases also lower than TEPCO's own measurements. The exposure of the population living in the 20-km zone around the nuclear plant was omitted, even though this population may have been exposed to high levels of iodine-131 before and during the chaotic evacuations. The quantity and selection of food samples used in the calculations of the internal radiation dose were shown to be inadequate and in stark contrast to samples published by the Japanese authorities. Finally, and perhaps most crucially, the report was mainly composed by scientists working for organizations with stakes in the continued and profitable utilization of nuclear energy, casting doubts on the neutrality of the report's findings. All of these detailed points of criticism can be found in the report by IPPNW Germany entitled “Analysis of WHO report on Fukushima catastrophe“, which is freely available online.⁴ No matter how expertly undertaken, a calculation of health risks can only be as exact as the assumptions that it is based on. An assessment that relies on data, whose validity has to be questioned on the grounds of lacking neutrality, selective sampling, distortion and omission of relevant facts, cannot be accepted by the scientific community as a basis on which to make health recommendations.

2. The report ignores the health risks for people outside of Fukushima

While radiation was spread to a large area of northeastern Japan, including metropolitan Tokyo, and contaminated foodstuff, soil and waste were distributed beyond the borders of Fukushima prefecture, only the fourteen most affected residential areas (Group 1 and 2 of the WHO report) were considered for the total health risk assessment⁵, thereby negating any measurable health effects for the population of the rest of Fukushima province, Japan and the world. In fact, the report makes the claim that “outside the geographical areas most affected by radiation, even in locations within Fukushima

¹ WHO. „Health risk assessment from the nuclear accident after the 2011 Great East Japan earthquake and tsunami, based on a preliminary dose estimation“, 28.02.2013. www.who.int/ionizing_radiation/pub_meet/fukushima_report/en/index.html

² WHO. „Preliminary dose estimation from the nuclear accident after the 2011 Great East Japan Earthquake and Tsunami“, 23.5.2012. whqlibdoc.who.int/publications/2012/9789241503662_eng.pdf

³ Rosen, A. „Analysis of WHO report on Fukushima catastrophe“, 3.8.2012.

www.fukushima-disaster.de/fileadmin/user_upload/pdf/english/ippnw_analysis_WHO-report_fukushima.pdf

⁴ Rosen 2012.

⁵ WHO 2013. p. 52.

prefecture, the predicted risks remain low and no observable increases in cancer above natural variation in baseline rates are anticipated.”

We know from the Chernobyl catastrophe, however, that while the most affected populations were the ones living in the highly contaminated fallout zones, a great number of people living in the less contaminated areas in the former Soviet Union, Europe and Asia Minor, were also affected, leading to increased incidences of morbidity and mortality⁶. As the health effects of low-dose radiation are stochastic in nature and as the generally accepted tool for calculating cancer risk is the linear non-threshold (LNT) model, the exposure of a small population with a high amount of radioactivity can have the similar results in absolute numbers of cancer cases, as the exposure of a large population with a relatively small amount of radioactivity. While the effects by small amounts of low-dose radiation on large populations are generally more difficult to detect in epidemiologic studies, discounting them altogether disregards a large amount of cases in absolute numbers and can only be seen as an attempt to downplay the expected health effects of the nuclear catastrophe.

In the case of Fukushima, the high amount of marine contamination through leaks, deliberate discharge of highly radioactive waste and fallout has to be taken into consideration, especially due to the large role that sea-food like fish or algae play in the Japanese diet. Levels of radioactive caesium measured in North Pacific sea bass rose continually from March until September of 2011, with a maximum contamination of 670 Bq/kg found on September 15th, 2011.⁷ With total radioactive marine contamination of about 15-27 PBq, the Fukushima fallout constitutes the single highest radioactive discharge into the oceans ever recorded.^{8 9 10} As many of the critical food samples and findings were not included in the original dose assessment, the importance of contaminated sea-food for the general public outside of Fukushima prefecture has not been properly accounted for in the current WHO report.

3. Continued radioactive emissions were not included in the assessment

The WHO report treats the nuclear catastrophe of Fukushima as a singular event and does not take into consideration continued emissions of radioactivity after the initial nuclear meltdowns in March 2011. In the WHO dose assessment report of May 2012, the authors wrote that “the contribution from iodine to the total exposure was considered to be zero from four months after the start of the release.” This assumes that radioactive iodine was released only at the very beginning of the nuclear catastrophe and that no further emissions occurred, allowing iodine-131 levels to fall due to radioactive decay. However, in June of 2011, Japanese government scientists still found iodine-131 concentrations of more than 200 Bq/kg in numerous municipalities of Fukushima prefecture, with maximum ranges found in Namie and Iitate of 1,300 and 1,100 Bq/kg, respectively.¹¹ As iodine-131 has a half-life of 8 days, measurements this high, 90 days after the initial fallout on March 15th, 2011, suggest additional contamination of the area with iodine-131 at a later time. Similarly, the WHO report includes vegetable samples containing 2,200 Bq/kg of iodine-131 in month three of the catastrophe – further evidence for continued emissions of radioactive iodine after the initial explosions,¹² most probably due to spontaneous fission or recriticality in one or several of the reactors. Beside iodine-131, other radioactive particles were also emitted continually for many months. As late as January of 2012,

⁶ Lengfelder, E et al. „10 Years of Chernobyl aid programmes of the Otto Hug Radiation Institute: Treatment and research projects on thyroid cancer in belarus. 3rd International Conference: Health effects of the Chernobyl accident: Results of 15-year follow up studies. June 4-8, 2001, Kiev, Ukraine“, *Internat. J. Radiat. Med.* 3, 73, 2001.

⁷ Weiss, D. „Contamination of water, sediments and biota of the Northern Pacific coastal area the vicinity of the Fukushima NPP“, *Gesellschaft für Anlagen- und Reaktorsicherheit*, Berlin. 31.10.2011.
www.eurosafe-forum.org/userfiles/2_2_%20paper_marine%20environment_Fukushima_20111031.pdf

⁸ JAIF. „Radioactive release into sea estimated triple“, *Japanese Atomic Information Forum, Earthquake Report 199*, 9.9.2012.
www.jaif.or.jp/english/news_images/pdf/ENGNEWS01_1315542569P.pdf

⁹ IRSN, “Synthèse actualisée des connaissances relatives à l'impact sur le milieu marin des rejets radioactifs du site nucléaire accidenté de Fukushima Dai-ichi“, 26.10.2011.
www.irsn.fr/FR/Actualites_presse/Actualites/Documents/IRSN-NI-Impact_accident_Fukushima_sur_milieu_marin_26102011.pdf

¹⁰ Researchers Assess Radioactivity Released to the Ocean from the Fukushima Daiichi Nuclear Power Facility“, *Woods Hole Oceanographic Institution*, 6.12.2011. www.whoi.edu/page.do?pid=7545&tid=282&cid=123049&ct=162

¹¹ Ministry of Education, Culture, Sports, Science and Technology (MEXT). „Readings of soil monitoring“, 7.8.2011.
eq.wide.ad.jp/files/110806soil_1000.pdf

¹² WHO 2012, Table A8.2, p. 106.

TEPCO admitted that atmospheric emissions of radioactive caesium were still measured with 60 MBq per hour or about 1,440 MBq each day.¹³

Adding to this are the continued dispersion of radioactive particles from ongoing work at the Fukushima Dai-ichi plant, reported leaks from radioactive cooling-water tanks and the radioactive contamination of soil and ground water due to washout. The current WHO report actually goes so far as to assume a natural “shielding effect”, as radioactive particles like Caesium-137 are washed into the ground and therefore calculates with a decrease in radioactive exposure over the years.¹⁴ While this may hold true for external radiation risk, this assumption does not take into consideration the increase in internal exposure through radioactive caesium-137 in ground water supplies and the food chain. In Southern Germany, radioactive caesium-137 contained in mushrooms and wild boar still poses a health threat, even 25 years after the Chernobyl disaster.^{15 16}

4. The report ignores the increased radiosensitivity of the unborn child

The authors of the report claim that the estimated dose levels of the population affected by the Fukushima catastrophe were too low to affect fetal development, and therefore excluded the possibility of miscarriages, increased perinatal mortality, congenital defects or cognitive impairments due to in utero exposure.¹⁷ The report also states that the radiosensitivity of a fetus was considered by the authors to be the same as for a one-year old child - an assumption that discounts most of what we know regarding biological factors for radiosensitivity. In fact, the unborn child is the most sensitive form of human life: higher tissue-metabolism and cell-division rates in a fetus increase the chance that mutations cause malignancies before they can be stopped by the body's self-regulatory mechanisms. Additionally, as the immune system and cell-repair mechanisms of a fetus are not yet fully developed, these defensive mechanisms cannot adequately prevent the development of cancer. The claim that fetuses would have the same sensitivity towards radioactivity as a child becomes even more difficult to accept, as the report itself clearly states that radioactive particles, such as iodine-131 or caesium-137, reach the fetus inside the womb through the umbilical cord, causing internal irradiation.¹⁸ Additionally, the fetus can be externally irradiated by radiation from isotopes collected in the bladder.

It has long been established fact that a fetus has to be especially protected from irradiation. The effects of low-dose radiation on the unborn child are known since the 1950's, when the Oxford Survey of Childhood Cancers showed a highly significant increased risk for leukemia in children who had been exposed to diagnostic x-rays in utero. This association has been confirmed by many case-control studies since.¹⁹ The medical profession has acted on these findings by advising against radiological procedures on pregnant women and by promoting restrictions for pregnant women working in settings that could expose them to radioactivity. Discounting the higher radiosensitivity of the fetus and the breastfed child and disregarding the specific health risks of the most vulnerable of the affected population has led to a gross underestimation of actual health risk in the WHO report.²⁰

The authors explain this procedure, by basing their assumptions on the Lifetime Span Studies (LSS), performed on the survivors of the nuclear bombings of Hiroshima and Nagasaki – studies that were only started in 1950, five years after the events occurred.²¹ How studies on the survivors of the mostly external radioactive exposure of the nuclear bombs, without any scientific knowledge from the first five years, including no records of miscarriages, neonatal mortality or congenital defects, could be

¹³ TEPCO. „Current Status of Fukushima Daiichi Nuclear Power Station“, 27.1.2012. www.tepco.co.jp/en/nu/fukushima-np/f1/images/f12np-gaiyou_e_3.pdf

¹⁴ WHO 2013, p. 41.

¹⁵ BMG. „Radioactive Contamination of Wild Boar“, German Ministry of Health.

bmg.gv.at/home/Schwerpunkte/VerbraucherInnenengesundheit/Radioaktive_Belastung_von_Wildschweinen

¹⁶ Hawley, C. „A Quarter Century after Chernobyl: Radioactive Boar on the Rise in Germany“, Spiegel Online, 30.07.2010.

www.spiegel.de/international/zeitgeist/a-quarter-century-after-chernobyl-radioactive-boar-on-the-rise-in-germany-a-709345.html

¹⁷ WHO 2013, p. 8, 67.

¹⁸ WHO 2013, p. 18, 140.

¹⁹ International Agency for Research on Cancer. „X- and gamma radiation, and neutrons. Ionizing radiation“ in „Monographs on the evaluation of carcinogenic risks to humans“, Volume 75, 1999. monographs.iarc.fr/ENG/Monographs/vol75/mono75.pdf

²⁰ WHO 2013, p. 30.

²¹ Preston DL et al. „Cancer incidence in atomic bomb survivors. III. Leukemia, lymphoma and multiple myeloma, 1950-1987“,

transferred to a scenario where children and fetuses were exposed to mostly internal radioactivity after a nuclear catastrophe is not adequately addressed by the report's authors.

5. Recent clinical findings were not taken into considerations

According to the report, "no clinical conditions have been identified" as a result of the Fukushima nuclear catastrophe.²² Not mentioned in the report are the three cases of thyroid cancers nor the reported increase in infant mortality following the Fukushima nuclear meltdowns. While it is difficult to prove causality and further research is definitely necessary to investigate the extent and the probable cause of these phenomena, omitting them from the report altogether once more throws doubts on the report's neutrality.

On February 13th, 2013, the Fukushima prefectural government announced that three cases of thyroid cancer had been diagnosed and that the children had to undergo surgery.^{23 24} Further details regarding the three cases were not published, but these findings are highly unusual, as spontaneous thyroid cancer in children below the age of 18 are very rare, especially when they appear in clusters such as the one in Fukushima.²⁵ While the report concedes that protracted exposure to radioactive iodine could cause thyroid abnormalities and that even low doses of radiation may increase the risk of non-cancer thyroid nodules in exposed individuals, quantitative assessment of these phenomena was not undertaken.²⁶

While it is extremely difficult to detect the effects of low-dose radiation on large populations, a statistical evaluation of Japanese infant mortality found distinct peaks in May 2011 and December 2011, two and nine months after the beginning of the nuclear catastrophe in Fukushima. An analysis of West German infant mortality data after the Chernobyl disaster also found peaks in the same time span after the nuclear meltdown. In December 2011, nine months after Fukushima, the number of live births in Japan was significantly lower than the average of the past nine years. A similar decline in live births was found in February 1987 in the most fallout-affected region of Southern Germany. In both scenarios, the effect on birth rates appears to be limited to a single month.²⁷ As stated above, the WHO health risk assessment specifically states that no impact on fetal development or perinatal mortality would be expected, as the assumed radiation dose was deemed too low for such effects to take place.²⁸ An alternative explanation of the recent findings is not offered by the report, nor are these findings included in the final health risk assessment.

6. Non-cancer diseases are not included in the health risk calculations

Non-cancer health effects, such as cardiovascular diseases (CVD), infertility or thyroid disease were not assessed quantitatively in the report. Furthermore, the possibility of such effects occurring as a result of the Fukushima nuclear catastrophe was disregarded altogether.²⁹ The authors assumed that only high levels of radioactivity could lead to such effects, discounting the research on the effects of low-dose radiation.^{30 31}

²² WHO 2013, p. 27.

²³ „2 more thyroid cancer cases identified in Fukushima“, Kyodo News, 13.02.2013. english.kyodonews.jp/news/2013/02/209091.html

²⁴ „2 more thyroid cancer cases identified in Fukushima“, Mainichi Newspaper, 13.02.2013. mainichi.jp/english/english/newsselect/news/20130213p2g00m0dm091000c.html

²⁵ Albright JT et al. „Pediatric head and neck malignancies: US incidence and trends over 2 decades“, Arch Otolaryngol Head Neck Surg, Jun 2002;128(6), p. 655-9.

²⁶ WHO 2013, p. 22,67.

²⁷ Körblein, A. „Infant mortality in Japan after Fukushima“. Strahlentelex, No. 622-623, 6.12.2012. www.strahlentelex.de/Infant_mortality_in_Japan_after_Fukushima.pdf

²⁸ WHO 2013, p. 8, 67.

²⁹ WHO 2013, p. 67.

³⁰ Yablokov A et al. „Chernobyl: Consequences of the Catastrophe for People and the Environment“, Annals of the New York Academy of Sciences, Volume 1181, December 2009. bit.ly/mo29TZ

³¹ Little MP et al. „A Model of Cardiovascular Disease Giving a Plausible Mechanism for the Effect of Fractionated Low-Dose Ionizing Radiation Exposure.“ PLoS Comput Biol. 2009 October; 5(10). www.ncbi.nlm.nih.gov/pmc/articles/PMC2759077

7. The report relies solely on TEPCO's own data to assess workers' health risks

The WHO report also comments on the health risks of TEPCO workers and contractors due to exposure to radioactivity. Since the report bases its assumptions solely on measurements provided by TEPCO itself,^{xxxv} these estimates cannot be considered adequate assessments of the workers' health risks, especially after reports of misleading information, falsified dosimetry readings and other irregularities have severely compromised the validity of the TEPCO data.^{32 33}

8. The authors' neutrality has to be doubted

One of the main points of criticism of the WHO dose assessment of May 2012 was its apparent lack of neutrality. With an expert panel comprised mainly of scientists associated with the International Atomic Energy Agency (IAEA) and members of nuclear regulatory bodies accused of collusion with the nuclear industry, and with findings that differ so significantly from other, independent research publications, the dose assessment gave the impression of attempting to downplay the effects of the nuclear catastrophe, rather than constituting a meaningful scientific approach to the issue of radiation exposure in Fukushima. It remains unclear why a report, written mainly by the IAEA and collaborating nuclear institutions, would need to be published in the name of the WHO.

This current WHO report was again composed in large parts by scientists with an evident conflict of interest. The report has not undergone the usual scientific process of peer-review, nor were scientists with more critical views of the health effects of radioactivity invited to join the expert panel. Concerning the very relevant issue of childhood leukemia, the WHO's health risk assessment relies heavily on the expertise of one Prof. Wakeford, who is cited as an expert on "radiation effects in infants and children, particularly on childhood leukaemia."³⁴ However, Prof. Wakeford has worked for more than thirty years for the company British Nuclear Fuels plc and has been paid for consultancies at the nuclear power company EDF Energy plc, Auegan plc, which makes money by handling radioactive waste, British Nuclear Fuels plc and Sellafield Ltd, a company battling with the legacy of numerous nuclear accidents and spills.³⁵ Unlike in the first WHO report on Fukushima, these obvious conflicts of interest have been disclosed in the current report, but it remains unclear why, for a critical assessment of a nuclear catastrophe, the WHO relies on a scientist, who has worked most of his life for the British nuclear industry.

In order to understand why the WHO has to rely so heavily on experts from the nuclear sector, it has to be reiterated at this point that the WHO is subordinate in questions of nuclear safety to the IAEA. According to Articles 1.3. and 3.1. of the "Agreement between the IAEA and the WHO" from 1959, the WHO is bound by agreement not to publish anything concerning radiation without consent by the IAEA.³⁶ The IAEA, however, was founded with the specific mission to "promote safe, secure and peaceful nuclear technologies" and to "accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world."³⁷ With these motives, the IAEA and its national member organizations cannot be seen as impartial voices on nuclear energy. The influence of the IAEA on the work of the WHO has therefore rightly been criticized for obstructing independent research on the health effects of nuclear radiation.

³² „63 workers exposed to higher radiation than logged in their records.“ Asahi Shimbun, 2.3.2013.

ajw.asahi.com/article/0311disaster/fukushima/AJ201303020048

³³ „TEPCO subcontractor used lead to fake dosimeter readings at Fukushima plant.“ Asahi Shimbun, 21.7.2012.

ajw.asahi.com/article/0311disaster/fukushima/AJ201207210069

³⁴ WHO 2013, p. 120.

³⁵ WHO 2013, p. 120.

³⁶ WHO. „Agreement between the International Atomic Energy Agency and the World Health Organization.“ WHO Website. apps.who.int/gb/bd/PDF/bd47/EN/agreements-with-other-inter-en.pdf

³⁷ IAEA. „Atoms for Peace“, IAEA Website. www.iaea.org/About/

Conclusion

As doctors and scientists, we are fully aware of the difficulties in calculating comprehensive health risks of a large catastrophe for such a large population and know of the problems that naturally arise in such an attempt. It is extremely important to base calculations such as these on reliable and valid data, which has been approved by a scientific consensus either through an impartial expert panel composed of scientists with contrary views, or through a critical peer review process. The possibility of a manipulation of data by a group, organization or industry with vested interests should be avoided at all costs. The calculations should encompass the entire population affected by the catastrophe and should give special consideration to groups with heightened vulnerability. Clinical findings should be thoroughly assessed and included in the final considerations.

After careful lecture of the WHO's health risk assessment, none of these fundamental principles seem to have been adhered to. The true health risks for the people of Fukushima and Japan remain to be assessed by independent scientific researchers, free of the suspicion of collusion and interference by the nuclear industry and the nuclear regulatory bodies. Attempts by the nuclear lobby, including the IAEA and many of the authors of this current WHO report, to downplay the effects of the continued emission of radioactive isotopes in air, soil and water through dubious risk assessments are to be disregarded by scientists, doctors and politicians, primarily concerned with giving the affected people proper recommendations and support. What is needed is for the WHO to regain its independence in assessing health risks related to radiation and reaffirm its claim to be guided solely by concerns for people's health and not by the interests of a specific industry.