

# The Impact of the Nuclear Crisis on Global Health

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Due to my personal concerns regarding the ignorance of the world's media and politicians about radiation biology after the dreadful accident at Fukushima in Japan, I organized a 2 day symposium at the NY Academy of Medicine on March 11 and 12, 2013, titled '[The Medical and Ecological Consequences of Fukushima](#),' which was addressed by some of the world's leading scientists, epidemiologists, physicists and physicians who presented their latest data and findings on Fukushima.[1]

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## Background

The Great Eastern earthquake, measuring 9.0 on the Richter scale, and the ensuing massive tsunami on the east coast of Japan induced the meltdown of three nuclear reactors within several days. During the quake the external power supply was lost to the reactor complex and the pumps, which circulate up to one million gallons of water per minute to cool each reactor core, ceased to function. Emergency diesel generators situated below the plants kicked in but these were soon swamped by the tsunami. Without cooling, the radioactive cores in units 1, 2 and 3 began to melt within hours. Over the next few days, all three cores (each weighing more than 100 tonnes) melted their way through six inches of steel at the bottom of their reactor vessels and oozed their way onto the concrete floor of the containment buildings. At the same time the zirconium cladding covering thousands of uranium fuel rods reacted with water, creating hydrogen, which initiated hydrogen explosions in units 1, 2, 3 and 4.



Massive quantities of radiation escaped into the air and water — three times more noble gases (argon, xenon and krypton) than were released at Chernobyl, together with huge amounts of other volatile and non-volatile radioactive elements, including cesium, tritium, iodine, strontium, silver, plutonium, americium and rubidium. Eventually sea water was — and is still — utilized to cool the molten reactors.

Fukushima is now described as the greatest industrial accident in history.

The Japanese government was so concerned that they were considering plans to evacuate 35 million people from Tokyo, as other reactors including Fukushima Daiichi on the east coast were also at risk. Thousands of people fleeing from the smoldering reactors were not notified where the radioactive plumes were travelling, despite the fact that there was a system in place to track the plumes. As a result, people fled directly into regions with the highest radiation concentrations, where they were exposed to high levels of whole-body external gamma radiation being emitted by the radioactive elements, inhaling radioactive air and swallowing radioactive elements.[2] Unfortunately, inert potassium iodide was not supplied, which would have blocked the uptake of radioactive iodine by their thyroid glands, except in the town of Miharu. Prophylactic iodine was eventually distributed to the

staff of Fukushima Medical University in the days after the accident, after extremely high levels of radioactive iodine — 1.9 million becquerels/kg were found in leafy vegetables near the University.[3] Iodine contamination was widespread in leafy vegetables and milk, whilst other isotopic contamination from substances such as caesium is widespread in vegetables, fruit, meat, milk, rice and tea in many areas of Japan.[4]

The Fukushima meltdown disaster is not over and will never end. The radioactive fallout which remains toxic for hundreds to thousands of years covers large swathes of Japan and will never be “cleaned up.” It will contaminate food, humans and animals virtually forever. I predict that the three reactors which experienced total meltdowns will never be disassembled or decommissioned. TEPCO (Tokyo Electric Power Company) — says it will take at least 30 to 40 years and the International Atomic Energy Agency predicts at least 40 years before they can make any progress because of the extremely high levels of radiation at these damaged reactors.

This accident is enormous in its medical implications. It will induce an epidemic of cancer as people inhale the radioactive elements, eat radioactive food and drink radioactive beverages. In 1986, a single meltdown and explosion at Chernobyl covered 40% of the European land mass with radioactive elements. Already, according to a [2009 report published by the New York Academy of Sciences](#), over one million people have already perished as a direct result of this catastrophe. This is just the tip of the iceberg, because large parts of Europe and the food grown there will remain radioactive for hundreds of years.[5]

## **Medical Implications of Radiation**

### *Fact number one*

No dose of radiation is safe. Each dose received by the body is cumulative and adds to the risk of developing malignancy or genetic disease.

### *Fact number two*

Children are ten to twenty times more vulnerable to the carcinogenic effects of radiation than adults. Females tend to be more sensitive compared to males, whilst foetuses and immuno-compromised patients are also extremely sensitive.

### *Fact number three*

High doses of radiation received from a nuclear meltdown or from a nuclear weapon

explosion can cause acute radiation sickness, with alopecia, severe nausea, diarrhea and thrombocytopenia. Reports of such illnesses, particularly in children, appeared within the first few months after the Fukushima accident.

#### *Fact number four*

Ionizing radiation from radioactive elements and radiation emitted from X-ray machines and CT scanners can be carcinogenic. The latent period of carcinogenesis for leukemia is 5-10 years and solid cancers 15-80 years. It has been shown that all modes of cancer can be induced by radiation, as well as over 6000 genetic diseases now described in the medical literature.

But, as we increase the level of background radiation in our environment from medical procedures, X-ray scanning machines at airports, or radioactive materials continually escaping from nuclear reactors and nuclear waste dumps, we will inevitably increase the incidence of cancer as well as the incidence of genetic disease in future generations.



Iniencephaly as a result of radiation exposure (Photograph reproduced with permission of Dr Wladimir Wertelecki. See the film of Dr. Wertelecki's presentation, "[Congenital Malformations in Rivne Polossia and the Chernobyl Accident](#)," given at the [March 2011 Symposium](#)).

#### *Types of ionizing radiation*

1. X-rays are electromagnetic, and cause mutations the instant they pass through the body.
2. Similarly, gamma radiation is also electromagnetic, being emitted by radioactive materials generated in nuclear reactors and from some naturally occurring radioactive

elements in the soil.

3. Alpha radiation is particulate and is composed of two protons and two neutrons emitted from uranium atoms and other dangerous elements generated in reactors (such as plutonium, americium, curium, einsteinium, etc — all which are known as alpha emitters and have an atomic weight greater than uranium). Alpha particles travel a very short distance in the human body. They cannot penetrate the layers of dead skin in the epidermis to damage living skin cells. But when these radioactive elements enter the lung, liver, bone or other organs, they transfer a large dose of radiation over a long period of time to a very small volume of cells. Most of these cells are killed; however, some on the edge of the radiation field remain viable to be mutated, and cancer may later develop. Alpha emitters are among the most carcinogenic materials known.
4. Beta radiation, like alpha radiation, is also particulate. It is a charged electron emitted from radioactive elements such as strontium 90, cesium 137 and iodine 131. The beta particle is light in mass, travels further than an alpha particle and is also mutagenic.
5. Neutron radiation is released during the fission process in a reactor or a bomb. Reactor 1 at Fukushima has been periodically emitting neutron radiation as sections of the molten core become intermittently critical. Neutrons are large radioactive particles that travel many kilometers, and they pass through everything including concrete and steel. There is no way to hide from them and they are extremely mutagenic.

So, let's describe just five of the radioactive elements that are continually being released into the air and water at Fukushima. Remember, though, there are over 200 such elements each with its own half-life, biological characteristic and pathway in the food chain and the human body. Most have never had their biological pathways examined. They are invisible, tasteless and odourless. When the cancer manifests it is impossible to determine its aetiology, but there is a large body of literature proving that radiation causes cancer, including the data from Hiroshima and Nagasaki.

1. Tritium is radioactive hydrogen  $H^3$  and there is no way to separate tritium from contaminated water as it combines with oxygen to form  $H^3O$ . There is no material that can prevent the escape of tritium except gold, so all reactors continuously emit tritium into the air and cooling water as they operate. It concentrates in aquatic

organisms, including algae, seaweed, crustaceans and fish, and also in terrestrial food. Like all radioactive elements, it is tasteless, odorless and invisible, and will therefore inevitably be ingested in food, including seafood, for many decades. It passes unhindered through the skin if a person is immersed in fog containing tritiated water near a reactor, and also enters the body via inhalation and ingestion. It causes brain tumors, birth deformities and cancers of many organs.

2. Cesium 137 is a beta and gamma emitter with a half-life of 30 years. That means in 30 years only half of its radioactive energy has decayed, so it is detectable as a radioactive hazard for over 300 years. Cesium, like all radioactive elements, bio-concentrates at each level of the food chain. The human body stands atop the food chain. As an analogue of potassium, cesium becomes ubiquitous in all cells. It concentrates in the myocardium where it induces cardiac irregularities, and in the endocrine organs where it can cause diabetes, hypothyroidism and thyroid cancer. It can also induce brain cancer, rhabdomyosarcomas, ovarian or testicular cancer and genetic disease.
3. Strontium 90 is a high-energy beta emitter with a half-life of 28 years. As a calcium analogue, it is a bone-seeker. It concentrates in the food chain, specifically milk (including breast milk), and is laid down in bones and teeth in the human body. It can lead to carcinomas of the bone and leukaemia.
4. Radioactive iodine 131 is a beta and gamma emitter. It has a half-life of eight days and is hazardous for ten weeks. It bio-concentrates in the food chain, in vegetables and milk, then in the the human thyroid gland where it is a potent carcinogen, inducing thyroid disease and/or thyroid cancer. It is important to note that of 174,376 children under the age of 18 that have been examined by thyroid ultrasound in the Fukushima Prefecture, 12 have been definitively diagnosed with thyroid cancer and 15 more are suspected to have the disease. Almost 200,000 more children are yet to be examined. Of these 174,367 children, 43.2% have either thyroid cysts and/or nodules.[6]

In Chernobyl, thyroid cancers were not diagnosed until four years post-accident. This early presentation indicates that these Japanese children almost certainly received a high dose of radioactive iodine. High doses of other radioactive elements released during the meltdowns were received by the exposed population so the rate of cancer is almost certain to rise.

5. Plutonium, one of the most deadly radioactive substances, is an alpha emitter. It is highly toxic, and one millionth of a gram will induce cancer if inhaled into the lung. As an iron analogue, it combines with transferrin. It causes liver cancer, bone cancer, leukemia, or multiple myeloma. It concentrates in the testicles and ovaries where it can induce testicular or ovarian cancer, or genetic diseases in future generations. It also crosses the placenta where it is teratogenic, like thalidomide. There are medical homes near Chernobyl full of grossly deformed children, the deformities of which have never before been seen in the history of medicine.

The half-life of plutonium is 24,400 years, and thus it is radioactive for 250,000 years. It will induce cancers, congenital deformities, and genetic diseases for virtually the rest of time.

Plutonium is also fuel for atomic bombs. Five kilos is fuel for a weapon which would vaporize a city. Each reactor makes 250 kg of plutonium a year. It is postulated that less than one kilo of plutonium, if adequately distributed, could induce lung cancer in every person on earth.

## **Conclusion**

In summary, the radioactive contamination and fallout from nuclear power plant accidents will have medical ramifications that will never cease, because the food will continue to concentrate the radioactive elements for hundreds to thousands of years. This will induce epidemics of cancer, leukemia and genetic disease. Already we are seeing such pathology and abnormalities in birds and insects, and because they reproduce very fast it is possible to observe disease caused by radiation over many generations within a relatively short space of time.

Pioneering research conducted by [Dr Tim Mousseau](#), an evolutionary biologist, has demonstrated high rates of tumors, cataracts, genetic mutations, sterility and reduced brain size amongst birds in the exclusion zones of both Chernobyl and Fukushima. What happens to animals will happen to human beings.[7]

The Japanese government is desperately trying to “clean up” radioactive contamination. But in reality all that can be done is collect it, place it in containers and transfer it to another location. It cannot be made neutral and it cannot be prevented from spreading in the future. Some contractors have allowed their workers to empty radioactive debris, soil

and leaves into streams and other illegal places. The main question becomes: Where can they place the contaminated material to be stored safely away from the environment for thousands of years? There is no safe place in Japan for this to happen, let alone to store thousands of tons of high level radioactive waste which rests precariously at the 54 Japanese nuclear reactors.

Last but not least, Australian uranium fuelled the Fukushima reactors. Australia exports uranium for use in nuclear power plants to 12 countries, including the US, Japan, France, Britain, Finland, Sweden, South Korea, China, Belgium, Spain, Canada and Taiwan. 270,000 metric tons of deadly radioactive waste exists in the world today, with 12,000 metric tons being added yearly. (Each reactor manufactures 30 tons per year and there are over 400 reactors globally.)

This high-level waste must be isolated from the environment for one million years — but no container lasts longer than 100 years. The isotopes will inevitably leak, contaminating the food chain, inducing epidemics of cancer, leukemia, congenital deformities and genetic diseases for the rest of time.

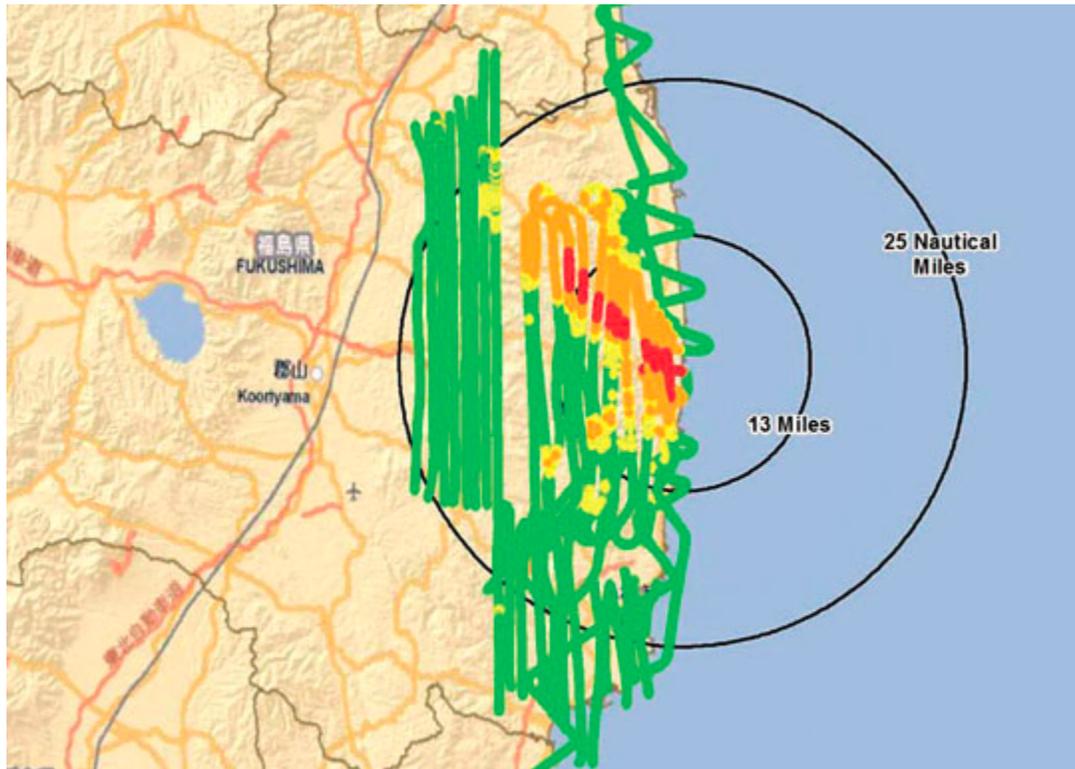
This, then, is the legacy we leave to future generations so that we can turn on our lights and computers or make nuclear weapons. It was Einstein who said “the splitting of the atom changed everything save man’s mode of thinking, thus we drift towards unparalleled catastrophe.”

The question now is: Have we, the human species, the ability to mature psychologically in time to avert these catastrophes, or, is it in fact, too late?

*Disclaimer: The views, opinions and perspectives presented in this article are those of the author alone and does not reflect the views of the Australian Medical Student Journal. The accuracy, completeness and validity of any statements made within this article are not guaranteed. We accept no liability for any errors or omissions.*

## References

1. Caldicott H. Helen Caldicott Foundation’s Fukushima Symposium. 2013; A book of the Symposium, [Crisis Without End](#) (The New Press, 2014) is now available, as well as the original [recordings of both days with some documentation](#), and [high quality, no-commercial film versions at Vimeo](#).
2. “[Japan sat on U.S. radiation maps showing immediate fallout from nuke crisis](#).” *The Japan Times*. June 19, 2012.



Fallout: Aerial monitoring results dated March 23, 2011, provided by the U.S. Department of Energy show that more than 125 microsieverts of radiation per hour were detected as far as 25 km northwest of the Fukushima No. 1 plant.

Kyodo — The government failed to make use of detailed U.S. maps showing how radiation spread shortly after the Fukushima nuclear crisis began, sources familiar with the matter revealed Monday.

The sources said the maps were neither publicized nor used to evacuate residents living near the poorly protected Fukushima No. 1 nuclear plant, which was racked by meltdowns and explosions after a massive earthquake and tsunami struck the area on March 11, 2011.

From March 17 to 19, U.S. military aircraft collected radiation data in an area with a 45-km radius from the plant for the U.S. Department of Energy. The data showed that more than 125 microsieverts of radiation per hour was leaking as far as about 25 km northwest of the plant, meaning residents in the area were being exposed to their annual permissible dose within just eight hours.

Before deciding to release the data on its own on March 23, the U.S. government provided the data via the Foreign Ministry to the Nuclear and Industrial Safety Agency — the regulator overseen by the Ministry of Economy, Trade and Industry — on March 18, and to the Education, Culture, Sports, Science and Technology Ministry on March 20, the sources said.

3. [“Fukushima Medical University Distributed Potassium Iodide to Medical Staff on March 15, 2011, Says It Was Their ‘Vested Interest’ As Medical Professionals.”](#) EXSKF Coverage of Fukushima I (Daiichi) Nuclear Accident, Nuclear Disaster in Japan, June 14, 2013
4. [“Tests find cesium 172 times the limit in Miyagi Yacon tea.”](#) *The Asahi Shimbun*. April 13, 2012.
5. Yablokov AV, Nesterenko VB, Nesterenko AV, Sherman-Nevinger JD. *Chernobyl: Consequences of the Catastrophe for People and the Environment*. Wiley.com; 2010.
6. Fukushima Health Management. [Proceedings of the 11th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey. Fukushima Health Management Survey Results of Thyroid Ultrasound Examination](#). Fukushima, Japan 2013.
7. Møller AP, Mousseau TA. [“The effects of low-dose radiation: Soviet science, the nuclear industry — and independence?”](#) *Significance*. 2013;10(1):14-9.