

# Radiation Effects on Health: Protect the Children of Fukushima

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## **Talk at the July 27, 2011 meeting of the Committee on Welfare and Labor of the House of Representatives.**

I am Kodama, head of the Radioisotope Center, the University of Tokyo. I was astonished on March 15<sup>th</sup>.

The radioisotope centers of the University of Tokyo at twenty-seven locations are responsible for protection against radiation and conducting decontamination work. As a physician of internal medicine, I have been involved for scores of years in decontamination, among other locations, at radiation facilities of the University of Tokyo Hospital.

On March 15, as you may see in this diagram, we first experienced a radiation dose of 5  $\mu$ Sv (micro Sievert) per hour at Tōkai-mura in Ibaraki prefecture and immediately reported to the Ministry of Education, Culture, Sports, Science and Technology by way of the “Article Ten Report” in accordance with the standard set under the Nuclear and Industrial Safety Agency’s “Special Law Relating to Measures against Nuclear Disasters.” After that a radiation dose above 0.5  $\mu$ Sv was measured in Tokyo. This was transient, the dose going down quickly. Next, on March 22, it rained in Tokyo bringing down radioactive materials with a dose of around 0.2  $\mu$ Sv, and this, with those particles staying in the soil, seems to be the cause of the high dose until today.

At that point, Chief Cabinet Secretary Edano commented that, “for the time being there is not much worry concerning health.” I thought that in fact the situation would turn out to be disastrous. The reason is that the current law relating to prevention of radiation poisoning is based on the idea of handling a small amount of high radiation dosage.

In that case, the total dose is not much of an issue; rather, the density of radiation in each individual is the focus. However, following the recent accident at the Fukushima Nuclear Power Plant, 5  $\mu$ Sv within 100 kilometers and 0.5  $\mu$ Sv within 200 kilometers from the complex were recorded. And as all of you know now, radiation reached further beyond to affect Ashigara and Shizuoka tea leaves.

When we examine radiation poisoning, we look at the entire amount. TEPCO and the government have never clearly reported on the total amount of radiation doses resulting from the Fukushima nuclear accident. When we calculate on the basis of the knowledge available at our Radioisotope Center, in terms of the quantity of heat, the equivalent of 29.6 Hiroshima a-bombs leaked. Converted to uranium, an amount equivalent to 20 Hiroshima a-bombs is estimated to have leaked.

What is further dreadful is that, according to what we know so far, when we compare the amount of radiation that remained after the a-bomb and that of radiation from the nuclear plant, that of the former goes down to one-thousandth after one year whereas radioactive contaminants of the latter are reduced to only one-tenth.

In other words, in thinking about the Fukushima nuclear power plant disaster, the first premise is that, as in the case of Chernobyl, an amount of radiation equivalent to tens of a-bombs was released and far greater contamination remains afterward compared with the a-bomb.

If such is the case—we work in the field of systems biology, which focuses on complex interactions in biological systems—where the total amount is low, it suffices to look at the density of radiation in an individual. Not so where the total amount is gigantic. We are talking about particles here. Spread of particles belongs to the field of non-linear science, which is the most difficult area in hydrodynamics calculations. In other words, when nuclear fuel, which can be compared to sand grains embedded in something like synthetic resin, melts down and leaks out, a large amount of ultrafine particles is released.

When particles are released, what will happen? The problem of rice straw that recently surfaced is exactly that. For example, the figure was 57,000 Bq/kg (becquerels per kilogram) in Fujiwara in Iwate; 17,000 in Ōsaki in Miyagi; 106,000 in Minami-Sōma in Fukushima; 97,000 in Shirakawa also in Fukushima; 64,000 in Iwate. The figures never hew to concentric circles. How much falls and where depends upon the weather at that time and whether the material has absorbed, for example, water.

I have been making the 700 kilometer trip to Minami-Sōma every week—the Radioisotope Center of the University of Tokyo has so far carried out decontamination work seven times. When we first went to Minami-Sōma, there was only one NaI counter. On March 19, when the Ministry of Agriculture and Forestry reportedly issued an official notice [including instruction to use only fodder stored indoors], food, water, and gasoline were about to be exhausted in Minami-Sōma. Its mayor's heartfelt SOS appeal posted on March 24 is widely known.

If a single notice is sent out in that kind of situation, no one will either see it or know of it. That rice straw was in such a dangerous condition was totally unknown to farmers. Starting on the day they learned about it in late March, farmers have been buying fodder from overseas, bearing the cost of hundreds of thousand yen, and further, they have switched the water for cows to the same underground water that they themselves use.

Then, as we see it, what must be done first is guarantee that thorough measurement is conducted in contaminated areas. When we went to Minami-Sōma in late May, the story was that they had only one detector as mentioned earlier, but in reality twenty personal dosimeters had arrived from the US army. However, the Board of Education at city hall had difficulty understanding the accompanying English manual. When we showed them how to use the equipment, they started using those twenty detectors for the first time. Such is the situation at the actual place.

Inspection of food has been talked about. Instead of the germanium counter, a far larger number of imaging-based semiconductor detectors have now been produced. Why doesn't the government try to use them everywhere, providing funds to make them available throughout the country? The fact that no such thing whatsoever has been done after three months fills my entire being with anger.

Second. Since the time of Prime Minister Obuchi (1998-2000), I have been responsible for the Cabinet Office's antibody preparations. The 3 billion yen support for most advanced research goes toward the cure of cancer with antibiotic medicine to which isotopes are added. In other words my job is to feed isotopes into the human body. Thus, the issue of internal exposure to radiation is central to my research.

So I would like to explain how internal exposure occurs. The greatest problem of internal exposure is cancer. Cancer occurs from a breakage of DNA. As you know, DNA is normally in double spiraling

strands. When it is in this form, it is quite stable. When molecular division occurs, this double helix structure comes apart to form two separate strands, which double themselves, and ends in a four-strand structure. It is extremely dangerous during this mutation process.

The top part of this diagram shows that DNA in the normal double helix structure is stable, but that at a mutation stage, it is vulnerable if hit by radiation especially in cells of fetuses, children, hair, white blood cells, and outer skin of internal organs. The bottom left shows the normal double helix DNA situation. When hit by radiation, it may develop a polyp or a benign tumor. In 10 to 30 years, however, with the presence of another factor, cancer may occur.

For this reason, with pregnant women, fetuses, and young children, all at stages of active growth, radiation poisoning can be extremely dangerous. Further, in the case of adults, parts of the body where growth is active—hair, blood, and surface skin of the intestines, whose cells actively split and multiply—are the first places to be attacked. Now let me discuss examples we know from concrete occurrences when isotopes are injected into the body.

In reality, the mutation of a single gene does not lead to cancer. After the first attack of radiation, another separate factor can contribute to cancerous mutation. This concerns such factors as driver mutation and passenger mutation. Please consult the reference materials attached at the end of the handout.

First, the most widely known is the  $\alpha$  (alpha) ray. I was stunned to hear of a University of Tokyo professor who claims that it's safe to drink plutonium, but the  $\alpha$ -ray is the most dangerous. Doctors specializing in the liver such as myself are thoroughly familiar with what is called Thorotrast liver damage. In short, internal exposure has generally been talked about in terms of such-and-such levels of  $\mu\text{Sv}$ , but that is totally meaningless. I-131 concentrates in the thyroid gland. Thorotrast gathers in the liver. Cesium gathers in the outer skin of the urinal tract and bladder. Unless these concentration points in the body are taken into consideration, it is totally meaningless no matter how many times the whole-body scan is performed.

In the case of Thorotrast, we have small figures here and I would like you to look at larger figures later, but at any rate it is a "contrast medium" used in Germany starting in 1890. Since around 1930, it was used in Japan as well. But it has come to be known that cancer of the liver generates after 20 or 30 years in 25 to 30 percent of the cases in which Thorotrast was administered.

The reason that it takes 20 years before a first episode occurs is this. First, the  $\alpha$ -ray nuclide—and Thorotrast is an  $\alpha$ -ray nuclide—harms nearby cells. What is damaged most severely is the gene called P53. At present we know the entire sequence of genomes through genetic science, and we also know that the sequence of the genomes of one individual differs from that of another in approximately 3 million places. Thus, handling all humans in the same way is quite meaningless today. When we observe the internal radioactive syndrome from the perspective of "personalized medicine," it is important to observe which particular genes are hit and what mutations are occurring.

In the case of Thorotrast, it is proven that the P53 gene is hit during the first stage. It then takes 20 to 30 years for the succeeding secondary and tertiary mutations to occur, resulting in cancer of the liver and leukemia.

Next, I-131. As you know, iodine concentrates in the thyroid gland. Concentration occurs in small children as they characteristically develop the gland in their growth period. However, when a Ukrainian scholar pointed out in 1991 that "cancer in the thyroid gland is occurring frequently," Japanese and American researchers contributed articles to Nature claiming that "a causal relationship remains unclear." The reason is that a lack of data preceding 1986 (when the Chernobyl meltdown occurred) made it impossible to establish statistical significance.

However, as Professor Nagataki mentioned earlier, statistical significance became clear 20 years later. What was clarified 20 years later was that occurrences of children's thyroid cancer in and around Chernobyl began in 1986, and after peaking in 1995, disappeared in 2004. This provided evidence of the causal relationship even without data from the past. Thus, epidemiological evidence is extremely hard, and in most cases, proof is impossible until all episodes finish running their course.

Thus, a totally different approach is needed for "protecting children," which is our task. What is being done now is this. Professor Fukushima Akiharu of the state-run Japan Bioassay Research Center observes the effects of chemical substances on the human body. He has been examining matter that collects in the urinary tract in Chernobyl. In consultation with Ukrainian doctors, he and his colleagues collected over 500 cases of operations for prostatic hyperplasia, non-cancerous enlargement of the prostate. In a prostate operation, some bladder tissue also comes off. Examination of this clarified that the mutation of P53 had markedly increased in the highly contaminated area, though the amount of radiation in urine is very small—6 Bq/l— in that area. Moreover, it was found to be in the precancerous state of a malignant kind. In our view, MAP kinase (Mitogen-activated protein kinases) called P38 and a signal called NF- $\kappa$ B (nuclear factor-kappa B, or nuclear factor kappa-light-chain-enhancer of activated B cells in full) are activated, resulting in inflammation of the bladder. It has been reported that cancer is already present in the outer skin in a large percentage of cases.

What shocked me was that, as already reported, 2 to 13 Bq of cesium was measured in the mother's milk in seven individuals.

Please turn to the next page. Our Radioisotope Center has been sending researchers weekly on a 700 kilometer trip, usually four people at a time, to Minami-Sōma to cooperate with decontamination efforts. What is happening in Minami-Sōma is just as you see. The definition [of the danger zone] such as 20 kilometers or 30 kilometers, is totally meaningless. It's absolutely useless unless you make minute measurements from kindergarten to kindergarten. At present, 1,700 Minami-Sōma children are being bused to areas between 20 to 30 kilometers, but in fact, in central Minami-Sōma facing the sea, the radioactive dose at seventy percent of the schools is relatively low. And yet children are forced to travel daily by school bus, and at a cost of one million yen, to schools closer to Iitate-mura, located 30 kilometers from the power plant. Please stop this immediately.

The greatest hurdle now is that the country does not guarantee compensation except in cases of forced evacuation, as President Shimizu of TEPCO and Minister of Economy, Trade and Industry Kaieda stated at a recent House of Councilors' committee meeting. Please separate the two issues. Please immediately separate the demarcation issue for compensation problems from the issue of children.

I beg you to do your utmost to protect children.

Another thing I would like to request from the viewpoint of those working at the actual site is, to distinguish between decontamination related to urgent evacuation and officially defined decontamination. We have been engaged to a fair extent in decontamination related to urgent evacuation. For example, see the foot of the slide shown in this diagram. This is where small children put their hands down [at the bottom of a slide]. Each time that rain pours on the slide, the dose is concentrated. The measurement differs between the right and left sides. Where the average dose is 1  $\mu$ , we observe a measurement over 10  $\mu$ . We must hasten to conduct decontamination in such areas.

When a building, foliage, and an entire area are all contaminated, even if you wash contaminants

away from one place, it is extremely difficult to handle the totality. In seriously performing decontamination, you need to take into consideration how problematic the situation is and how much it will cost. Let me use the example of the cadmium poisoning disease that frequently occurred from the 1910s to the early 1970s in Fuchū-machi (now Toyama city) in Toyama prefecture. The cadmium-contaminated area was approximately 3,000 hectares. Currently 800 billion yen in public funds is allocated for decontamination of up to 1,500 hectares in Toyama. If the area turns out to be 1,000 times greater, how much public funds will have to be invested? Thus, I would like to make the following urgent suggestions.

First, please, as national policy, radically improve inspection of food, soil, and water with the use of the newest and most powerful equipment available in Japan that employs imaging, and systematically eliminate environmental radioactivity. By now, semi-conductor imaging is simple. Introduce the use of the newest tools equipped with imaging and other capabilities. This is totally possible with today's Japanese scientific technology.

Second, please urgently establish a new law to reduce children's exposure to radiation. What I am currently doing is illegal on every count. The current law on prevention of radiation poisoning defines the radiation doses and nuclides that can be handled by different facilities. Our Radioisotope Center mobilizes its 27 branch centers to support Minami-Sōma, but many of these branches have not obtained permission to use cesium. It is also illegal to carry cesium-contaminated materials by car. However, because we cannot hand over high dose materials to mothers and teachers, in our decontamination work we bring everything back to Tokyo packed in oil drums. Reception of such things is illegal—completely illegal.

For leaving this situation intact, the Diet is to be blamed. Throughout Japan, many institutions, for example isotope centers at state universities, own germanium counters and the newest detectors. With these organizations fettered [by law], how can the nation maximize its effort to protect children? This reflects the Diet's total indolence.

Third, please assemble, as national policy, the technologies for decontaminating soil and the power of the private sector. For example, chemical makers like Toray and Kurita, radioactive decontamination equipment makers like Chiyoda TechnoAce and Attox, and firms like Takenaka Corporation, have a variety of knowhow about decontamination. Assemble these potentials and immediately build a decontamination research center at the actual site. It may require tens of trillions of yen of public funds. At present, I am seriously concerned that this develop into interest-driven public enterprise. Given the national financial situation, there is not a moment to spare. The question is how to really decontaminate. When 70,000 people are uprooted from their homes, what on earth is the Diet doing?

This is all for now.

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Fukushima, The Asia-Pacific Journal Vol 9, Issue 32 No 4, August 8, 2011 [Illustrations and diagrams are not reproduced here].:

<http://japanfocus.org/-Kodama-Tatsuhiko/3587>

\* YouTube of the original talk with English subtitles is available. [CC function must be turned on to view subtitles.]. Kodama's August 24, 2011 interview with the Japan Times is available here:

[Fukushima fallout said 30 times Hiroshima's](#), ESSF (article 22739).

\* Translation by Kyoko Selden. This translation is based on the original YouTube version posted on the Peace Philosophy Centre site with a helpful transcript. The images are based on the handout materials shared by Kodama Akihiko.

Kyoko Selden is a translator and editor who taught Japanese language and literature at Cornell University. Her translations include Kayano Shigeru's *Our Land Was a Forest*, Honda Katsuichi's *Harukor: Ainu Woman's Tale*, *The Atomic Bomb: Voices From Hiroshima and Nagasaki*, and most recently, *More Stories By Japanese Women Writers, An Anthology*. She is an Asia-Pacific Journal associate.