The Boice Report #52

John D. Boice, Jr., NCRP President
ICRP Main Commissioner
UNSCEAR U.S. Alternate Representative
Vanderbilt Professor of Medicine

Fukushima—Five Years After: Thyroid Cancer

In September 2011 I attended the 1st International Expert Symposium in Fukushima on Radiation and Health, just six months after the Great East Japan earthquake, tsunami, and nuclear power plant (NPP) accident. I got off the bus and walked close to the mangled structures resulting from the force of the tsunami. My cumulative dose was 70 µSv (less than the cosmic-ray dose received during my flight from Washington, DC, to Tokyo). I reprised this experience this past September. I attended the 5th International Expert Symposium sponsored by the Nippon Foundation and then visited the Fukushima Daiichi reactors. This time, I didn't have to wear a hazmat suit, and the reactor repairs, pavement of land, removal of many spent fuel rods, and other recovery activities were clearly evident. There were no mangled structures to see, and my cumulative exposure was negligible and not recordable. I left impressed by the remediation that Tokyo Electric Power Company accomplished in the past five years.

John Boice, September 2011, preparing to visit the damaged Fukushima reactors
Photo courtesy of John Boice

Environmental radiation levels. That is not to say that the radiation levels are normal around the damaged reactor. While driving to the NPP site after leaving J-Village (the sports complex-turned-staging ground for workers hired to work on the crippled reactors), the monitors on the road started with 0.04 µSv h^{-1}. Normal background readings are 0.01 µSv h^{-1}. Then the levels increased to 0.3 µSv h^{-1} and while there was traffic on the road there were no people in the towns we were passing. There were hardware stores, restaurants, and shopping centers, but they were uninhabited and grass and vines were growing everywhere. It was like the old movie *On the Beach* or the films on the rapture when everyone was taken and the towns were uninhabited. Then the level reached 0.5 µSv h^{-1}, then 0.7 µSv h^{-1}, and finally 0.9 µSv h^{-1} as we approached the plant. People are not allowed to return to their homes with such elevated background levels. In fact, 88,000 Japanese who were evacuated because of the NPP reactor accident may not be able to return for quite a long time.

Fukushima is not Chernobyl. While the Japanese government lost credibility because of the failure to communicate effectively, they did most things right. There was sheltering in place, evacuation, and restriction of the food supply. In contrast, after Chernobyl there was little immediate action and the drinking of contaminated milk by children resulted in an epidemic of thyroid cancers. This will not be the case following Fukushima. The population doses were very low and the pathway from ingesting large quantities of milk or contaminated food was restricted. Dose was mainly from inhalation and external exposures.

The Symposium. The focus of the 5th symposium was to address the thyroid cancer issues that arose after screening 300,000 children with sophisticated ultrasound equipment. "The survey was initiated to be responsive to public concerns and not for scientific reasons." Lumps and bumps were detected and fine-needle biopsies uncovered thyroid carcinomas and tumors at a high rate. Even though the tumors could not possibly be related to radiation exposure, they nonetheless were real, and public anxiety has increased.

We know a lot about thyroid cancer. Radiation causes thyroid cancer, but not the next day and not within the next several years after exposure. There is a minimum latency, i.e., time from exposure to the development of detectable tumors, on the order of about five years. This is seen in practically all comprehensive, high-quality studies. Detecting excesses within one or two years of exposure is

not a realistic possibility, especially given the tiny-to-negligible doses received by practically all children. Thyroid cancer is caused by radiation, but not at tiny doses. The World Health Organization (WHO), the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the International Atomic Energy Agency, Fukushima Medical University, and measurements of children made shortly after the accident all point to extremely small population exposures. Radiation causes cancer, but primarily among those who are young at time of exposure. The screening survey found the opposite: no thyroid tumors were detected among children under the age of five at the time of the NPP accident, and the detected tumors were all among the older children and teenagers who are at much lower risk.

It is the general consensus that these detected tumors are related to the screening and not to radiation. Some may never have come to clinical attention (overdiagnosis), and some may have come to clinical attention, but later. When populations not within the Fukushima fallout areas were screened, thyroid tumor rates were comparable to those in the populations in the fallout areas, though numbers were small. The rates of detected thyroid tumors also did not vary by areas with different estimates of environment deposition, i.e., there was no ecological indication of a dose response. Comprehensive screening studies in Korea have shown the effects of introducing thyroid-screening programs into the population on a large scale. Substantial increases in thyroid cancer occurred among the entire population after the screening started, while the mortality rate stayed flat. When population screening was reduced in Korea, the rates of thyroid cancer decreased.

There is little if any *scientific* reason to continue the screening activities, and certainly not for studying radiation effects. Doses are trivial and there is not enough statistical power to find an effect (even if there is one). All the surveys to date are noninformative with regard to a radiation association. However, there are public desires (e.g., mothers with young children), societal pressures, health care issues, and governmental responsibilities that will come into play in deciding whether to continue these surveys. If continued, it should be made very clear that this is a survey for the health of the people and not a scientific study. It would be to provide reassurance and for health care activities. Lumps and bumps would be detected by the ultrasensitive ultrasound devices, and tumors would be detected—caused by genetics or other factors, but not by radiation.

While the health effects possibly related to radiation exposure will be small to nonexistent, the economic burden, cleanup, and public anxiety may last for decades. The world needs to be aware of, concerned about, and helpful to the people of Fukushima.

5th International Expert Symposium on Fukushima, September 2016

After visiting the Fukushima reactor site, standing, left to right: Trent Peerla-Proulx (International Commission on Radiological Protection [ICRP] intern), Tomoko Komazawa (Fukushima Medical University), Haruyuki Ogino (ICRP), Kanae Hirano (interpreter), Hyeong Sik Ahn (Korea University School of Medicine), Gerry Thomas (Imperial College, United Kingdom), Chris Clement (ICRP, Scientific Secretary), Ken Aoo (Nippon Foundation), Viktor Ivanov (National Medical Research Radiological Centre, Russia), Malcom Crick (UNSCEAR), James Huffman (Nippon Foundation), Pavel Rumyantsev (Endocrine Research Center, Russia), John Boice (NCRP), Wolfgang Weiss (formerly, Federal Office for Radiation Protection, Germany), Vladimir Saenko (Nagasaki University), Valentina Drozd (Belarussian Medical Academy of Post-Graduate Education), Christoph Reiners (Wurtzburg University), and Mykola Tronko (Institute of Endocrinology and Metabolism, Ukraine); kneeling: Zhanat Carr (WHO).
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