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U.S. safe from Japan radiation, Berkeley lab expert says

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Tom McKone, a senior staff scientist in Lawrence Berkeley National Laboratory's (Berkeley Lab's) Environmental Energy Technologies Division, is an expert on health-risk assessments associated with exposure to environmental contaminants such as pesticides and radioactive material. He is also an expert in modeling the transport of chemicals across vast distances, and determining how this transport affects human health.

McKone is also an adjunct professor and researcher with the School of Public Health at the University of California, Berkeley. He has been a member of several National Academy of Sciences committees and served six years on the EPA Science Advisory Board. He received his PhD in nuclear engineering and spent two years as a post doc at the Nuclear Regulatory Commission.

He shed light on the crisis in Japan in an e-mail exchange with Berkeley Lab's communications and media relations department.

Q: Why isn't there a reason to worry about health risks in the U.S. from the nuclear crisis in Japan?

Although the prevailing wind patterns move east from Japan toward U.S. lands, it is thousands of miles from Japan to Alaska, Hawaii, and the U.S. mainland. Any fission products released in Japan are diluted by factors of ten billion or more over these distances just by the volume of

air in which the radioactivity disperses.

Even a Chernobyl-scale release from Japan would result in U.S. exposures on the order of microsieverts (the added exposure from a transcontinental plane flight). Background radiation in the U.S. varies between 1 and 3 millisievert—so this change would be much less than the geographic variation we observe in the U.S. from natural background.

Q: How easily is radioactive material transported in the environment? How much would be lost or mitigated as it's transported across the Pacific Ocean to the U.S.

Radioactive materials are transported in the environment primarily by moving air masses and to some extent by ocean circulation. The wind pushes a radioactive plume away from the source and spreads it out in an ever-increasing volume. Eventually, this material will be diluted into the total volume of the Northern Hemisphere (about 4 billion cubic kilometers or about 800 million cubic miles). The level of dilution over the Pacific Ocean reduces concentrations by a factor of billions before reaching the U.S. There is also both dry and wet deposition and radioactive decay that remove radiation from the moving plume.

In the roughly four days that it takes air masses to cross the ocean, Iodine-131 will be depleted some 40 percent by radioactive decay and another 20 to 30 percent by deposits to the ocean. The solid radionuclides such as cesium and strontium will not experience as much radioactive decay and deposition, but will be diluted by the volume of the atmosphere.

Q: What are the health risks to people in Japan, both

now and in the months and years to come?

The risks for the Japanese will vary with their distance from the plant, and based on our experiences from Chernobyl, will be much lower than what people now fear. In the short term, there is concern about iodine exposures that could lead in a few years to thyroid cancer and thyroid nodules—especially in the young. These can be treated and are mostly cured or prevented with potassium iodide (KI). In Chernobyl, where the populations were not evacuated or treated with KI, there were about 4000 cases of thyroid cancer among the millions exposed, but fewer than 1 percent became fatal.

In the long term (decades), increased risk of other cancers is also a concern, but again based on the Chernobyl experience, it is likely to be very limited. In Fukushima, wind direction, distance and atmospheric dilution make a big difference, and will likely protect the population from any significant long-term health consequences.

Within the first 30 kilometers (20 miles) of the Daiichi site, the dilution rate is on the order of 10 billion cubic meters (cubic yards) per hour. When one goes out to 80 kilometers (50 miles), the dilution rate of the atmosphere is on the order of 25 billion cubic meters per hour. This means that people beyond the 20 to 30-kilometer boundaries are not likely to experience radiation doses of more that 1 to 5 millisievert over background.

Another concern is the food supply. As we have already seen, iodine isotopes are showing up on leafy vegetables and milk near Fukushima. This will be an issue out to as much as 80 kilometers for about a month. Cesium and strontium can also deposit on vegetation and be transferred to the food supply. These are issues that will be monitored for a longer period and perhaps over a larger geographic region.

Q: How does the crisis in Japan compare to Chernobyl in terms of radiation released into the atmosphere?

As my colleague in the School of Public Health, Professor Kirk Smith has stated, Chernobyl relative to Fukushima is “like the forest fire compared to the camp fire.” Even in the worst case of a full meltdown of multiple reactors at the Daiichi site and combustion or explosion of the spent fuel in the plant’s storage pools, it will not release as much radioactivity or propel it as high in the atmosphere as Chernobyl.

The Chernobyl reactor had a graphite core that caught fire. The ferocious heat propelled radioactive particles into the upper atmosphere, spreading fallout across Europe. In contrast to the regional contamination from Chernobyl, the Daiichi contamination is very unlikely to extend beyond 30 kilometers from the site.

Q: You’ve mentioned that, in the U.S., stress over radiation is more of a health risk than radiation itself. Can you elaborate?

There is a growing literature in health sciences about the role of stress in disease. We have learned that, at times of stress, our bodies can be flooded with stress hormones that are as damaging as environmental pollutants and at higher blood concentrations than many environmental pollutants. Exposures to stress hormones have been linked to a number of chronic diseases including cancer, heart disease, and diabetes.

As noted by the World Health Organization in its long-term study of the health impacts of Chernobyl, “Persistent myths and misperceptions about the threat of radiation have resulted in ‘paralyzing fatalism’ among

residents of affected areas." The WHO also observed that "poverty, 'lifestyle' diseases now rampant in the former Soviet Union and mental health problems pose a far greater threat to local communities than does radiation exposure."

Provided by Lawrence Berkeley National Laboratory

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