Physicists detect low-level radioactivity from Japan arriving in Seattle

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University of Washington physicists are detecting radioactivity from Japanese nuclear reactors that have been in crisis since a mammoth March 11 earthquake, but the levels are far below what would pose a threat to human health.

On March 16, the scientists began testing air filters on the ventilation intake for the Physics-Astronomy Building on the UW campus, looking for evidence of dust particles containing radioactivity produced in nuclear fission.

The first positive results came from filters that were in place from noon on March 17 to 2 p.m. on March 18. Readings peaked three days later and then dropped, but have risen slightly since then.

"It's a faint signal. You have to filter a lot of air to see it," said Michael Miller, a UW research associate professor of physics. "We've definitely seen it fluctuate up and down, and we are correlating those peaks and drops with any changes in normal background radiation levels."

The measurements were begun because of concerns about effects of radioactivity on very sensitive physics experiments. They also document that radioactivity in airborne particles arriving in the United States is well within safety limits, said R.G. Hamish Robertson, a UW physics professor and director of the Center for Experimental Nuclear Physics and Astrophysics.

Using the air filters allowed sampling of 10 times more air than in methods used previously and proved to be a key in successfully detecting larger dust particles that had attracted radioactivity from the Japanese nuclear plants, Robertson said.

The readings allowed the physicists to make some detailed findings, including:

- The presence of cesium isotopes in ratios that indicate the radioactivity was a result of fission in a nuclear reactor, not nuclear weapons.
- The presence of relatively short-lived iodine 131 and tellurium isotopes, indicating the material came primarily from fuel rods, not spent fuel.
- The absence of iodine 133, an isotope with an even shorter half-life than iodine 131, signaling that at least a week must have passed since the reactors were stopped.

"What that means is that they were successful in shutting down the reactors at the time of the earthquake," Robertson said. "The lack of iodine 133 indicates that the chain reaction was shut down."

The researchers speculate that, because they see only three of the many possible products of nuclear fission, the material that arrived in Seattle came from the evaporation of contaminated steam released from the reactors. Similar tests following the Chernobyl nuclear reactor meltdown in 1986 found a much broader spectrum of elements, indicating that material from actively burning fuel was being sent into the atmosphere.

While the radioactivity is arriving in the United States at levels far lower

than are considered harmful to humans, it can raise havoc with sensitive physics experiments. That includes one called Majorana, in which the UW physicists are deeply involved, that is being planned for a lab nearly 1 mile down in the proposed Deep Underground Science and Engineering Laboratory in the old Homestake Mine in Lead, S.D.

The experiment is designed to determine the precise mass of subatomic particles called neutrinos, and any radioactive dust particles that make it into the lab could wreck the experiment, Miller said. Increased atmospheric radioactivity could cause problems for experiments in other laboratories as well, he said.

"This work helps us to understand filtering efficiency, how well the filters keep the radioactive materials out of the lab," he said.

The findings are contained in a paper the scientists posted on an open-access website called arXiv.org. Besides Robertson and Miller, authors are graduate students Jonathan Diaz and Alexis Schubert and research associates Andreas Knecht and Jarek Kaspar, all with the UW experimental nuclear physics center.

The paper will be updated as new results warrant and eventually will be submitted for publication in a peer-review journal.

More information: The paper documenting the findings is at arxiv.org/abs/1103.4853

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https://phys.org/news/2011-03-physicists-low-level-radioactivity-japan-seattle.html