LA-UR-11-10615
Approved for public release; distribution is unlimited.

Title: Measuring Radioactivity from Fukushima Daiichi in New Mexico

Author(s): McNaughton, Michael

Intended for: NMCF, 2011-05-12 (Espanpola, New Mexico, United States)

Disclaimer:
Los Alamos National Laboratory, an affirmative action/equal opportunity employer,is operated by the Los Alamos National Security, LLC for the National NuclearSecurity Administration of the U.S. Department of Energy under contract DE-AC52-06NA25396. By acceptance of this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Departmentof Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

Measuring Radioactivity from Fukushima Daiichi in New Mexico
Michael McNaughton, May 10, 2011

On March 11, 2011, the Fukushima Daiichi nuclear power plant was damaged by the tsunami that followed the "Great East Japan Earthquake," and the reactor subsequently leaked radioactive material. In response, LANL augmented the routine ambient (AIRNET) and stack (Rad-NESHAP) measurements with three high-volume samplers: #167 at the Old White Rock Fire Station; #173 at the TA-49 gate, and #211 at the Los Alamos Medical Center.

Previous accidents, such as the Three-Mile-Island accident in 1979 and the Chernobyl accident in 1986, indicated that the most likely releases were (a) the noble gases: krypton and xenon; and (b) the volatile elements: cesium, tellurium, and iodine. At the latitude of Fukushima, the predominant winds across the Pacific Ocean are from west to east, and models predicted that the plume would arrive in the western US on about March 18. By this time the shorter-lived isotopes would have decayed. Therefore, the expected radionuclides were xenon-133, cesium-134, cesium-136, cesium-137, tellurium-132, iodine-131, and iodine-132.

As expected, cesium-134, cesium-136, cesium-137, tellurium-132, iodine-131, and iodine-132 were all detected by all three high-volume samplers during March 17-21. The concentrations peaked during the March 24-28 period. After this, concentrations of all nuclides declined. In general, the concentrations were consistent with those measured by the EPA RadNet system and many other monitoring systems throughout the world.

At the time of writing, preliminary results from the AIRNET and Rad-NESHAP systems are being reported. More detailed results are described in LA-UR-11-10304 and will be reported in full in the annual environmental report for 2011.

All previous releases from nuclear reactors have been dominated by noble gases, primarily krypton and xenon, which are not measured by the high-volume samplers or the AIRNET system. However, in sufficient concentrations these and other fission products would be detected by NEWNET.

Consistent with this possibility, all NEWNET detectors recorded an increase of 0.2 µR/h from March 19-21, followed by an additional increase of 0.1 µR/h on March 24 (Figure 1). The consistency of the NEWNET stations is indicated by the error bars, which represent the standard error of the mean of the individual stations.

Over the next 10 days, the NEWNET readings declined with approximately the 5-day half life of xenon-133, returning to near normal levels on April 2. After this, any further decrease was masked by high radon concentrations on April 3, by a weather system that moved into New Mexico on April 4, and by rainfall on April 6-9. Furthermore, it is likely that all NEWNET detectors responded to a gradually increasing trend in terrestrial radiation during the month of March as the ground dried out.

It is difficult to distinguish the hypothetical effects of xenon-133 from the fluctuations of radon decay products. However, at present we do not have an alternative hypothesis for the sharp increase that was observed in all NEWNET stations from March 19-21. Perhaps some of the increase was caused by radon or terrestrial radiation, in which case the observed increase is an upper limit to that caused by releases from Fukushima.

LANL data are consistent with those of the EPA RadNet monitoring system. The EPA has repeatedly stated that "The levels detected are far below levels of concern."

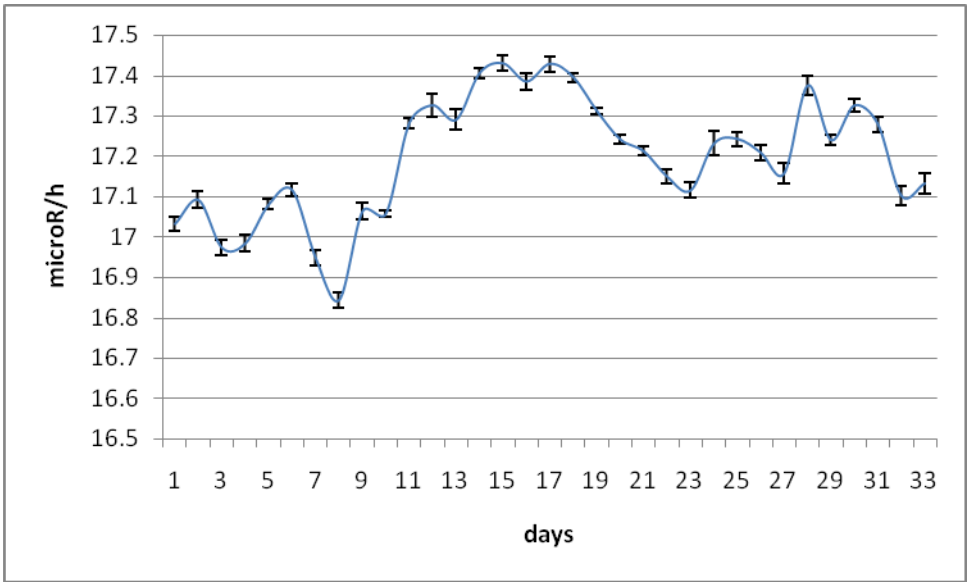

Figure 1. Average radiation (microR/h) recorded by NEWNET from March 11 (day 1) through April 12 (day 33). The annual average is 17 microR/h. The increased radiation from day 9 (March 19) through day 23 (April 2) may be caused by xenon-133 and other fission products from the Fukushima Daiichi nuclear power station. The fluctuations during days 1-9 and days 23-33 are caused by natural radon decay products. In addition, during these 33 days, there is probably a gradual increase in natural terrestrial radiation as the ground becomes dry.

References

LA-UR-11-10304: "Los Alamos Air Monitoring Data Related to the Fukushima Daiichi Reactor," Los Alamos National Laboratory Report (2011).

EPA RadNet: The EPA RadNet data are available at
http://www.epa.gov/japan2011/rert/radnet-data-map.html