New Hampshire Department of Health and Human Services

Division of Public Health Services

Bureau of Public Health Laboratories, Radiochemistry Laboratory

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Findings from Radiological Environmental Monitoring Program

The New Hampshire Department of Health and Human Services (DHHS), through its Division of Public Health Services (DPHS) has a well established, continual environmental monitoring program for the three nuclear facilities, which are: (i) Seabrook Nuclear Power Station (SNPS) located in the town of Seabrook on the east coast; (ii) Vermont Yankee Nuclear Power Station (VYNPS) located in the town of Vernon, Vermont across the Connecticut River on the western border; and (iii) Portsmouth Naval Shipyard (PNS) located in Kittery, Maine bordering Portsmouth, New Hampshire on the east coast. SNPS is operated by the NextEra Energy (Florida Power and Light), the Entergy Corporation operates VYNPS, and the US Navy operates PNS.

At DPHS the Radiochemistry Laboratory routinely performs radioanalysis of environmental samples of air, water, soil, sand, sediment, vegetation, milk, fish, lobster, mussels, atmospheric particulate material, and direct gamma radiation levels obtained from various sites within the State. During 2010 DHHS personnel collected a total of 1,325 samples from locations around SNPS, VYNPS, and PNS as well as samples from various control locations throughout New Hampshire. An estimated 10,000 individual measurements were performed on these samples.

Radioactivity levels in the vicinity of SNPS and VYNPS (within the 5 and 10 miles indicator zones) and outside of 50 miles (control zone) in various foods, environmental, and direct radiation measurements have been analyzed, evaluated, and summarized for more than 10 years. DHHS's radioanalytical data indicate no activity greater than the normal and expected background. Monitoring around PNS is currently limited to direct gamma radiation[1] level measurements via Thermoluminescent Dosimeters (TLDs).[2]

[1] Gamma radiation is a form of high-energy electromagnetic radiation produced from a radioactive source. Direct gamma radiation energy emanating from such a source could affect the body only when a person is located in an area where it exists.

[2] A TLD chip measures radiation exposure by measuring the amount of visible light emitted from a crystal in the detector when the crystal is heated. The amount of light emitted is proportional to the ionizing radiation it is exposed to.

Monitoring Results by Exposure Pathways

Analytical results are divided into four categories based on exposure pathways: airborne, direct radiation, ingestion, and waterborne.

Airborne Pathway

The airborne exposure pathway includes airborne particulates collected on fiberglass air filters. There has been no indication of natural and/or fission products or other nuclear plant-related radionuclides in the airborne particulate media.

Direct Exposure Pathway

The direct radiation exposure pathway includes gamma radiation levels in the environment using the Thermoluminescent Dosimeters. Statewide a total of 65 TLD stations continually detect the ambient gamma radiation exposures. Analysis of these data showed no radiation exposure levels above normal background levels over a 10-year period. These dosimetry data indicate that the Granite State reflects the natural variability of background radiation from one location to another.

Ingestion Pathway

The ingestion exposure pathway includes milk, marine biota and leafy vegetation samples. The gamma spectroscopy counting indicated positive results for common naturally occurring and some man made radionuclides (e.g., Cesium-137 [Cs-137] fallout from historical atmospheric nuclear weapons tests) at average environmental levels. In 2009, the Cs-137 levels in various samples ranged from not detectable to 0.15 Becquerel per kilogram (Bq/kg).[3] These results are also indicative of the normal (natural) background radiation levels in the food that were tested.

Waterborne Pathway

The waterborne exposure pathway includes surface (ocean) water, drinking water supply, shallow-well water, beach sand, and sea sediment. All water samples are analyzed for tritium, gross alpha/beta and/or gamma-emitting radionuclides. Tritium measurements have indicated no levels above reporting levels[4] as established by the New Hampshire Public Health Laboratories. For groundwater, the gross alpha/beta activity tested at all locations is steady over time and within normal historical range of background radiation levels. Gamma analysis of samples indicated no nuclear power plant-related gamma-emitting radionuclides above reporting levels.[5]

[3] Becquerel is the unit of radioactivity. One Becquerel (Bq) is 1 disintegration per second.

[4] DPHS reporting limit for tritium in water is 500 picocurie per liter.

[5] Above the Minimum Detectable Activity (MDA) for all radionuclide that are detected by the gamma detection system.

RadNet

New Hampshire also participates in a system for daily monitoring of air samples through an electronic radiological surveillance system called RadNet. This is part of an Environmental Protection Agency (EPA) nationwide continual radiation monitoring network system for the nation's air, drinking water, milk, and precipitation. These systems enable the State's public health and emergency management agencies to have an independent source of data regarding radiation levels and to detect any radiation levels above normal "background" levels. A RadNet detection system is located on the roof of the Laboratory building at 29 Hazen Drive. New Hampshire's Radiochemistry Laboratory participates in this EPA program by collecting and measuring radiation levels in air filters and snow/rain water. Radiation levels found in analyzing the air samples collected, as part of the RadNet program did not show any results above the expected background level.

Radiological Emergency Response

Under the Radiological Emergency Response Plan (RERP[6]) the Radiochemistry Laboratory oversees the deployment of sampling and monitoring teams and receives samples from the field. The Laboratory participates in annual combined functional drills and exercises related to radiological emergency response with several other state agencies including Homeland Security and Emergency Management. Drills are conducted 3-4 times per year in which the sample receipt is simulated. These drills are evaluated by the US Federal organizations such as the Federal Emergency Management Agency (FEMA) and the Nuclear Regulatory Commission (NRC). The Laboratory has the capability to receive and test samples for alpha, beta, and gamma activities and to report the results for protective action decision making. The decision-making may involve evacuation, sheltering, use of potassium iodide, control of access, decontamination, food and water control, relocation and other actions for the affected population.

On November 17, 2009 tritium was detected by Vermont Yankee in one of the on-site groundwater wells, which was traced to an underground pipe tunnel. On January 6, 2010, VYNPS's laboratory results for these wells showed tritium concentrations at more than 20 times greater than the sample taken two months earlier. Because these findings signaled an unintended and unmonitored release of radioactive material into the environment, VYNPS began its own investigation to identify the source of the tritium leak and the magnitude of contamination. Accordingly, DHHS, through its Emergency Services Unit (ESF-8) organized a team of State health and environmental experts from multiple agencies to independently monitor, test and report on the investigation, and to analyze possible risks to the New

[6] For further information see http://www.dhhs.nh.gov/dphs/radiological/emergency.htm.

Hampshire population and remediation actions. No levels of tritium above minimum detection limits were found beyond VYNPS boundaries.

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Common Naturally Occurring (Cosmogenic, Terrestrial) Radiation Emitters

Beryllium-7, Potassium-40, Polonium-210, Thallium-208, Actinium-228 Bismuth-212, Bismuth-214, Lead-210, Lead-212, Lead-214 Radium-224, Radium-226, Radium-228, Uranium-235, Uranium-238, Uranium-234 Thorium-231, Thorium-228, Thorium-229, Thorium-230, Thorium-232, Thorium-234

Manmade (Nuclear Facility, Atomic Weapon Testing) Radiation Emitters

Antimony-124, Antimony-126, Barium-140/Lanthanum-140, Cerium-144/Promethium-144 Cesium-134, Cesium-136, Cesium-137, Iodine-131, Iodine-132, Iodine-133, Iodine-135 Chromium-51, Manganese-54, Ruthenium-103, Tellurium-132, Neptunium-239 Cobalt-56, Cobalt-58, Cobalt-60 Plutonium-239, Plutonium-240 Strontium-85, Strontium-89, Strontium-90, Zinc-65, Zirconium-95/Niobium-95