Surveillance2012

Vermont Yankee Nuclear Power Station

Report on Public Health Monitoring

VERMONT

DEPARTMENT OF HEALTH
Agency of Human Services

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Report on Public Health Monitoring
January 2014

Executive Summary

The Vermont Department of Health has been monitoring and reporting on radiation emissions and radiological effluents (discharges) from the Vermont Yankee Nuclear Power Station since 1971. The purpose of this environmental surveillance is to protect the public's health from excess amounts of radiation.

This *2012 Surveillance Report* details more than 3,100 separate measurements of more than 1,500 samples of air, water, milk, soil, vegetation, sediment and fish taken during the year at the Vermont Yankee site boundary (property line), on site at Vermont Yankee, from the Connecticut River, and from the towns surrounding the station.

The Health Department enforces the state's Radiological Health Rule, which limits the amount of ionizing radiation that any member of the public could be exposed to if standing at the site boundary of the station. The Rule also limits the amount of gaseous, liquid, radioiodine and radioactive particulate effluents that any member of the public could possibly be exposed to as a result of operations at Vermont Yankee.

The Rule specifically limits the annual direct gamma radiation from Vermont Yankee to a measured exposure value of 20 milliroentgen above background radiation at the site boundary on land. The Rule also limits specific emissions or discharges from Vermont Yankee to an effective dose of no more than 5 millirem from each pathway to any member of the general public.

The Connecticut River site boundary around Vermont Yankee is regulated by the U.S. Nuclear Regulatory Commission, which limits the annual direct gamma radiation to any member of the general public at this boundary to 100 millirem.

2012 Surveillance Results:

- Measurements in this report confirm no dose in excess of any limit established by the Vermont Department of Health's Radiological Health Rule.
- The numerous samples and measurements of the environment on site and around Vermont Yankee in 2012 show no instances of non-compliance with the Radiological Health Rule, from either operations at Vermont Yankee or the tritium-contaminated plume of groundwater first detected in January 2010.
- The Health Department's continuing analysis of cancer statistics for people who live in the communities surrounding Vermont Yankee shows that cancer incidence and mortality do not differ significantly from people in the rest of Windham County, elsewhere in Vermont, or in the U.S. as a whole.

For questions or more information – The information presented in this report is sometimes complex. We invite interested readers to contact the Health Department's Radiological and Toxicological Sciences program at 802-865-7730 with any questions.

Introduction

This *2012 Surveillance Report* describes the amount and types of radiation found on and near the Vermont Yankee Nuclear Power Station located in Vernon, Vermont. As an operating nuclear power station, Vermont Yankee generates and emits ionizing radiation in the form of direct gamma radiation, and discharges radioactive materials that emit alpha-, beta- and gamma-radiations. A person could be exposed to radiation released from Vermont Yankee in air or liquid discharges from the station, or from unmonitored releases or leaks.

The Vermont Department of Health enforces the state's Radiological Health Rule, which limits the amount of ionizing radiation that a member of the public could be exposed to if standing at the site boundary (property line) of the station. The Rule also limits the amount of gaseous, liquid, radioiodine and radioactive particulate effluents that a member of the public could possibly be exposed to as a result of operations at Vermont Yankee.

The Rule specifically limits the annual direct gamma radiation from Vermont Yankee to a measured exposure value of 20 milliroentgen above background radiation at the site boundary on land. The Rule also limits specific emissions or discharges from Vermont Yankee to an effective dose of no more than 5 millirem from each pathway to any member of the general public.

The Health Department monitors radiation levels on and near Vermont Yankee. Because both naturally occurring and human-made radiation is all around us in the environment, the Health Department also tests other areas of the state to provide background data on types and amounts of environmental radiation. Background measurements are compared to the types and amounts of radiation found on site and in areas near Vermont Yankee. The two sets of values are compared to determine if Vermont Yankee's operations are resulting in an increased radiation risk to the public.

This report presents more than 3,100 measurements taken from over 1,500 samples that were obtained at Vermont Yankee and from background locations during 2012. Air, water, milk, soil, vegetation, fish and sediment samples were collected and tested. Maps of locations where many samples or measurements were taken, as well as the testing procedures, are provided.

Most samples are tested by the Health Department Laboratory located in Burlington, Vermont. Measurements of direct gamma radiation exposures using thermoluminescent dosimeters (TLDs) are tested by a National Voluntary Laboratory Accreditation Program vendor of dosimetry. Analyses for the hard-to-detect radioactive metals strontium-89, strontium-90, iron-55 and nickel-63 are performed by only a small number of laboratories in the U.S. The Health Department contracted with a certified laboratory to perform these tests on our environmental samples.

The primary human health concern with chronic low-level exposure to ionizing radiation is the potential to develop cancer. For this reason, the Health Department also presents cancer incidence and cancer mortality data for the area near Vermont Yankee, compared to the same type of data for Vermont as a whole, and for the U.S. population.

Tritium Contamination

Testing and evaluation of the tritium contamination described in the 2010 Surveillance report continued in 2012. Thirty-eight wells on site were tested routinely throughout the year. The concentration of tritium in the contaminated wells generally continued to decline over the year and decreased from 2011. One water sample taken at the interface of the soil and the Connecticut River had detectable amounts of tritium. No tritium was found in any river water downstream from the station.

Results Presented in this Report:

- Direct gamma radiation measured continuously from more than 70 sites
- Air samples tested for radioactive particulates, gases, vapors and radioactive iodine collected by continuous air samplers
- Groundwater, drinking water wells and Connecticut River water near Vermont Yankee tested for tritium, gamma-emitting materials, total alpha radioactivity, total beta radioactivity, and hard-to-detect radioactive metals (iron-55, nickel-63, strontium-89 and strontium-90)
- Milk, vegetation, maple products, river sediments, fish and off-site soil tested for natural and human-made radioactive materials

These data show no radiation dose in excess of the Health Department's limits as a result of Vermont Yankee operations in 2012.

The full *Surveillance 2012* report is published at the Vermont Department of Health web site: www.healthvermont.gov. For questions about the content, call the Health Department's Radiological and Toxicological Sciences program at 802-865-7730.

Program Results Summary

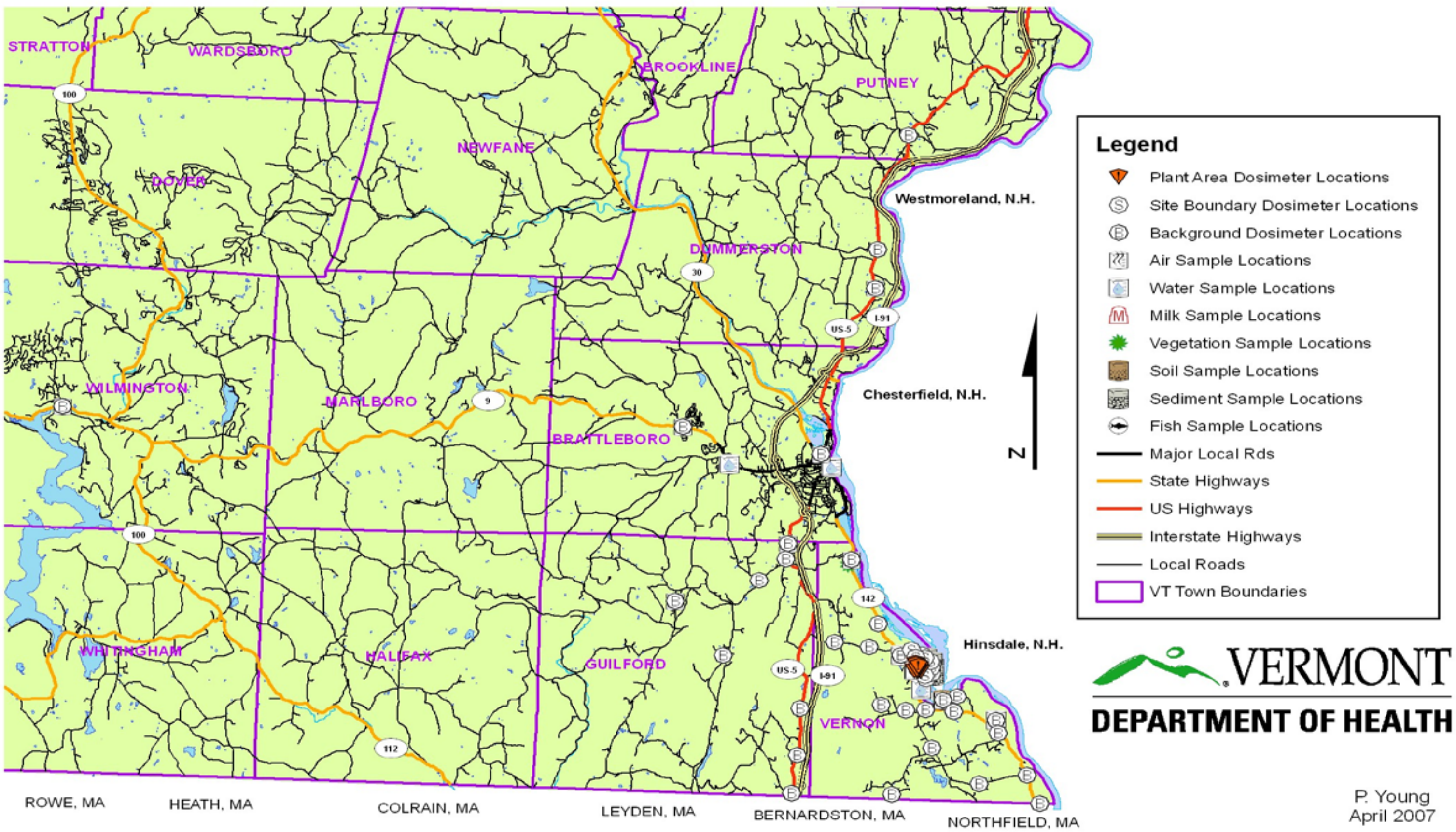
An overview of the 2012 sample data is presented in this summary. Detailed descriptions of sample measurement techniques and analyses are presented in further sections of this report. The total number, type of sample collected, type of analysis performed and summary results are reported in Table 1. Routine environmental sampling sites are shown in Maps 1 and 2. Map 1 shows all of the locations where routine samples were taken. Map 2 shows the sample locations in Vernon.

Table 1. 2012 Summary of Samples, Tests and Results

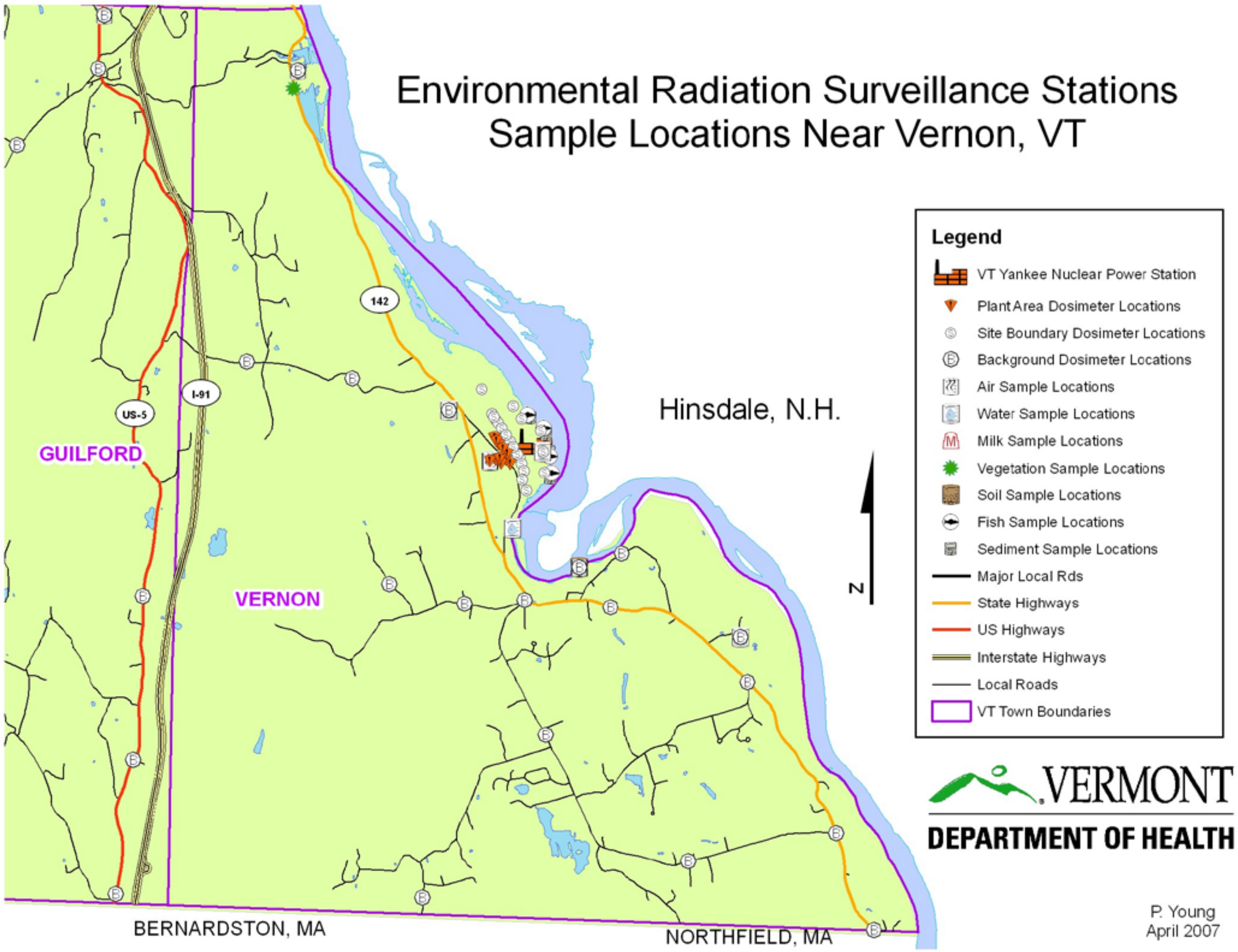
Sample Type	Sites	Number of Tests	Test Type	Results
Direct Gamma Radiation	72	287	Thermoluminescent dosimeters	Less than 20 milliroentgen per year at the land site boundary; no single quarter exceeded 10 milliroentgen.
Air: Particulates, Gases and Vapors	10	119	Total Alpha Radioactivity	Alpha radioactivity within the historical range. No increase observed as a result of operations at Vermont Yankee.
		119	Total Beta Radioactivity	Beta radioactivity within the historical range. No increase observed as a result of operations at Vermont Yankee.
		119	Iodine-131	No iodine-131 was detected in air samples.
		119	Gamma (gas/vapors) Radioactivity	Gamma radioactivity detected was of natural origin.
		4 *(quarterly composites)*	Gamma (particulates) Radioactivity	Gamma radioactivity detected was of natural origin.
Water	10	120	Total Alpha Radioactivity	Alpha radioactivity within the historical range. No increase observed as a result of operations at Vermont Yankee.
		120	Total Beta Radioactivity	Beta radioactivity within the historical range. No increase observed as a result of operations at Vermont Yankee.
	55	883	Tritium	All off-site, on-site active drinking water locations less than the lower limit of detection. Fifteen (15) on-site groundwater monitoring wells test positive for tritium. Range of positive well results: 511 to 88,300 pCi/L. *In 2011, the range of results was 504 -453,000 pCi/L.* One positive result at interface of plume and Connecticut River.
		830	Gamma Radioactivity	All detected gamma radioactivity of natural origin.
	54	211	Iron-55, Nickel-63, Strontium-89, Strontium-90	All samples less than the lower limit of detection.
Milk	2	20	Iodine-131	All samples less than the lower limit of detection.
		20	Gamma Radioactivity	All samples less than the lower limit of detection.
Vegetation	6	9	Gamma Radioactivity	No human-made radioactivity was detected.
Soil (routine)	5	5	Gamma Radioactivity	All detected gamma radioactivity attributable to natural, Chernobyl or above-ground nuclear weapons testing origin.
Sediments	18	36	Gamma Radioactivity	Detected gamma radioactivity attributable to natural, Chernobyl or above-ground nuclear weapons testing origin.
Fish	4	57	Gamma Radioactivity	All detected gamma radioactivity attributable to natural, Chernobyl or above-ground nuclear weapons testing origin.
		47	Strontium-90	All detected radioactivity attributable to natural, Chernobyl or above-ground nuclear weapons testing origin.
		10	Iron-55, Nickel-63, Strontium-89, Strontium-90	All detected radioactivity attributable to natural, Chernobyl or above-ground nuclear weapons testing origin.
Total number of tests		**3135**	*Representing 182 sample sites*	

Map 1

Environmental Radiation Surveillance Stations
Sample Locations



Map 2


Environmental Radiation Surveillance Stations
Sample Locations Near Vernon, VT
Legend
VT Yankee Nuclear Power Station
Plant Area Dosimeter Locations
Site Boundary Dosimeter Locations
Background Dosimeter Locations
Air Sample Locations
Water Sample Locations
Milk Sample Locations
Vegetation Sample Locations
Soil Sample Locations
Fish Sample Locations
Sediment Sample Locations
Major Local Rds
State Highways
US Highways
Interstate Highways
Local Roads
VT Town Boundaries
Hinsdale, N.H.
GUILFORD
VERNON
BERNARDSTON, MA
NORTHFIELD, MA
US-5
I-91
142
N
VERMONT
DEPARTMENT OF HEALTH
P. Young
April 2007

Types of Ionizing Radiation

There are three main types of ionizing radiation that could be released from Vermont Yankee: alpha particles, beta particles and gamma rays. The risk of adverse health effects from ionizing radiation is linked to the type and energy of radiation, and the length and method of exposure to the radiation. The Health Department tests for these forms of radiation in many sample types.

Alpha and Beta (particle) Radiation

Alpha and beta radiation are particle forms of radiation energy. Alpha- and beta-charged particles can only travel a short distance and are completely blocked by simple materials.

Alpha radiation is the most biologically hazardous form of ionizing radiation. For the same amount of alpha, beta and gamma radiation energy, the alpha radiation causes about 20 times more tissue damage. It is also the type of radiation that people can most easily shield against. A sheet of paper can stop an alpha particle, and so can the dead layer of skin that covers the outer surface of our bodies. Alpha particles can only cause harm if alpha-emitting materials are inhaled, ingested or otherwise taken into the body. The most common alpha radiation exposure for people is from naturally-occurring radon gas in their homes.

Table 2. Examples of Radioactive Elements that Produce Alpha-Radiations

Naturally-occurring alpha emitters	
Uranium-238	Radon-222
Thorium-232	Polonium-210
Radium-226	Bismuth-212
Human-made alpha emitters	
Americium-241	Plutonium-239

Beta radiation is also easily stopped by simple materials like plastics, aluminum and wood. Beta radiations may be able to go through the first few millimeters of human skin. Beta radiation can cause damage to internal tissues and organs if a beta-emitting material is inhaled, ingested or otherwise taken into the body.

Alpha and beta-emitting materials are released from the station's air stack at Vermont Yankee. They may also be emitted in liquid discharges from contaminated reactor systems.

Figure 1. Relative Ability of Ionizing Radiations to go through Materials

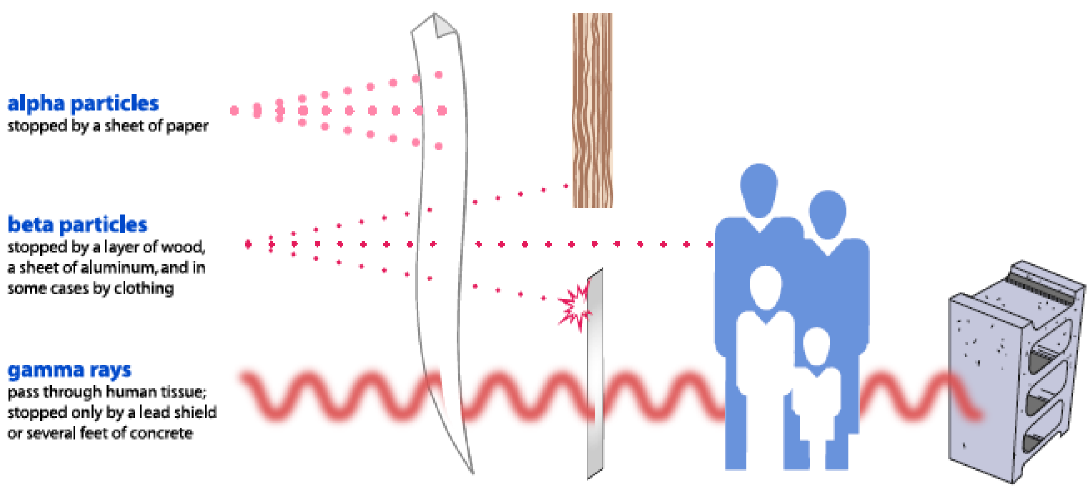


Table 3. Examples of Radioactive Elements that Produce Beta-Radiations

Naturally-occurring beta emitters	
Carbon-14	Potassium-40
Radium-228	Hydrogen-3, "tritium" (also human-made)
Human-made beta emitters	
Iodine-131	Technetium-99
Strontium-90	Hydrogen-3, "tritium" (also naturally-occurring)
Nickel-63	Iron-59

Gamma Radiation

Direct gamma radiation is an electromagnetic wave of energy similar to light, except that it passes through most materials in the form of an energy wave. Gamma radiation can also scatter off materials. Direct gamma radiation loses strength as it travels away from the source. It is also reduced after large numbers of collisions with electrons in the atom.

Gamma radiation passes through the skin and may pass through the whole body. If gamma radiation passes through the body, it may damage tissues. People can be affected by gamma radiation if they are located in an area where direct gamma radiation exists, or if they ingest a gamma-emitting material.

Direct gamma radiation is emitted from reactor and turbine systems such as those at Vermont Yankee. Gamma-emitting materials may also be released as gases or particles from the station's air stack.

Table 4. Examples of Radioactive Elements that Produce Gamma-Radiations

Naturally-occurring gamma emitters		
Beryllium-7	Potassium-40	Thallium-208
Bismuth-212	Bismuth-214	Lead-210
Lead-212	Lead-214	Polonium-210
Actinium-228	Radium-224	Radium-226
Radium-228	Thorium-228	Thorium-229
Thorium-230	Thorium-231	Thorium-232
Thorium-234	Uranium-233	Uranium-234
Uranium-235	Uranium-238	
Human-made gamma emitters		
Antimony-124	Antimony-126	Barium-140/ Lanthanum-140
Cerium-144/ Promethium-144	Cesium-134	Cesium-136
Chromium-51	Cobalt-56	Cobalt-58
Cobalt-60	Iodine-131	Iodine-132
Iodine-133	Iodine-135	Krypton-85
Krypton-88	Manganese-54	Neptunium-239
Plutonium-239	Plutonium-240	Ruthenium-103
Tellurium-132	Strontium-85	Strontium-89
Zinc-65	Xenon-133	Xenon-133m
Xenon-135	Zirconium-95/Niobium-95	

Ionizing Radiation Risks

The radiations to which people may be exposed as a result of Vermont Yankee operations are ionizing radiations. According to the International Agency for Research on Cancer (IARC), ionizing radiation can cause cancer in humans. The energy released by ionizing radiation may directly or indirectly damage the DNA of human cells and over time cause cancer. It has been shown that people who are exposed to high doses of ionizing radiation, in excess of 10,000 millirem, have a statistically higher risk of cancer. As with other cancer-causing agents, it is not possible to prove that low doses of ionizing radiation are without risk. The risk of developing cancer from chronic exposure to very low doses of radiation, such as the doses detailed in this report, is considered very low.

The risk management approach used for public health protection with ionizing radiation is called the ALARA Principle. The ALARA Principle states that every reasonable effort must be made to maintain radiation exposures ***A****s* ***L****ow* ***A****s* ***R****easonably* ***A****chievable*. The Health Department's Radiological Health Rule not only requires that exposures to ionizing radiation be less than specific limits, but also that Vermont Yankee and all other radiation users in industry, medicine and education use the ALARA Principle.

For more information about ionizing radiation risk:

- The National Academies of Science

  National Research Council. *Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII Phase 2*. Washington, DC: The National Academies Press, 2006.

- The Health Physics Society

  Health Physics Society, *Radiation Risk in Perspective*: *Position Statement of the Health Physics Society*. McLean, VA: The Health Physics Society, 2010

- The International Agency for Research on Cancer

  The International Agency for Research on Cancer, *Radiation, Volume 100D*. France: The World Health Organization, 2012

Cancer Prevalence, Incidence & Mortality

The primary health concern with chronic low-level exposure to ionizing radiation is the potential to develop cancer. Starting in 2007, the Health Department began presenting cancer-related health outcome data for the population in the area of Vermont Yankee. The Health Department tabulates, analyzes and provides data for cancer incidence (new cancer cases diagnosed) and cancer mortality (people dying from cancer) for Windham County and for the six towns nearest Vermont Yankee that make up the Emergency Planning Zone. The Health Department evaluates trends in all cancer types (all ages, all sites) and evaluates thyroid cancers, leukemia and pediatric (childhood) cancers separately because these types of cancers can be associated with excess radiation exposure or radiation exposure during fetal development.

Cancer Prevalence

Cancer is not one disease, but a group of more than 100 different diseases. Cancer is very common. Roughly one out of every two men and one out of every three women will develop some type of cancer in their lifetime. A cancer usually develops gradually as a result of a complex mix of factors related to personal behaviors, environment and genetics. Each type of cancer is caused by a different set of factors, some well-established, some uncertain, and some unknown.

Cancer *prevalence* means the number of people alive today who have ever been diagnosed with cancer. According to 2012 Behavioral Risk Factor Surveillance System (BRFSS) data, approximately 35,000 or 7 percent of Vermonters age 18 and older have ever been told by a doctor they had cancer. This includes people who are newly diagnosed, in active treatment, or have completed active treatment, and people living with progressive symptoms of their disease.

With 9 percent of people age 50 and older living with cancer in the U.S., it is not unusual to know several people who have cancer. As a population ages, the occurrence of new cancer cases can be expected to increase. With treatment advances, people are living longer with a cancer diagnosis. The number of cancer survivors has doubled in the past 20 years.

Cancer Incidence

Cancer *incidence* means the number of newly diagnosed cases during a specific time period. Incidence data in Table 5 were compiled from Vermont Cancer Registry data. Incidence rates are shown for all cancers, thyroid cancers, leukemia, and childhood (pediatric) cancers for the 10 year period 2001 to 2010.

The data in Table 5 indicate that:

- Incidence rates for thyroid cancer and leukemia in the Emergency Planning Zone are not different from Windham County, Vermont as a whole, or the U.S. population.

- The incidence of thyroid cancer in Windham County is not different from Vermont, but it is lower than the U.S. rate.

- Incidence rates for pediatric cancers in the six towns could not be calculated as there were too few cases (fewer than six) over the time period studied (10 years).

- For all cancer types combined, the rate of cancer incidence in the six towns near Vermont Yankee (Brattleboro, Dummerston, Guilford, Halifax, Marlboro and Vernon) is lower than the Vermont rate but is not different from Windham County or the U.S. population.

- The U.S. incidence rates and mortality rates are all races population rates. Analysis prior to the 2011 report compared only U.S. white population incidence and mortality rates to Vermont rates. This change is consistent with current Health Department publications that compare Vermont (all races) to U.S. (all races) rates.

Table 5. Cancer Incidence Rates Near Vermont Yankee, in Vermont & U.S.

Age Adjusted Vermont and U.S. Cancer Incidence, All Sites,
Males and Females per 100,000 population, 2001-2010.

	Rate	Lower CL	Upper CL	Avg. cases per year
U.S.	482.9	482.1	483.7	134,919
Vermont	495.2	489.9	500.5	3,465
Windham County	478.2	459.6	497.4	258
Emergency Planning Zone	455.6	428.8	483.8	112

Age Adjusted Vermont and U.S. Cancer Incidence, Thyroid,
Males and Females per 100,000 population, 2001-2010.

	Rate	Lower CL	Upper CL	Avg. cases per year
U.S.	11.4	11.3	11.5	3,225
Vermont	11.2	10.4	12.1	73
Windham County	7.6	5.3	10.6	4
Emergency Planning Zone	7.5	4.2	12.4	2

Age Adjusted Vermont and U.S. Cancer Incidence, Leukemia,
Males and Females per 100,000 population, 2001-2010.

	Rate	Lower CL	Upper CL	Avg. cases per year
U.S.	13.5	13.4	13.6	3,732
Vermont	13.6	12.7	14.5	91
Windham County	15.7	12.5	19.6	8
Emergency Planning Zone	11.4	7.5	16.8	3

Age Adjusted Vermont and U.S. Cancer Incidence, Pediatric Cancers (Ages 0-19),
Males and Females per 100,000 population, 2001-2010.

	Rate	Lower CL	Upper CL	Avg. cases per year
U.S.	17.2	16.9	17.5	1,330
Vermont	18.2	16.1	20.4	29
Windham County	14.5	8.2	23.7	2
Emergency Planning Zone	--	--	--	--

-- Rates are only presented when the total number of cases is greater than 5.
Emergency Zone towns include: Brattleboro, Dummerston, Guilford, Halifax, Marlboro, and Vernon.
All rates are age adjusted to the 2000 U.S. standard population and rates are per 100,000 population.
Incidence rates are for invasive cancers and in situ urinary bladder cancers. Cancer diagnoses exclude basal cell and squamous cell skin cancers.

Cancer Mortality

In Table 6, mortality rates from the U.S., Vermont, Windham County, and the Emergency Planning Zone towns are presented for the 10 years 2001 to 2010. The Vermont data are from the Vermont Department of Health's Vital Statistics System. Data for U.S. cancer mortality rates are from the Vital Statistics System of the United States. Cancer mortality data are presented for all cancers, thyroid cancers, leukemia and pediatric cancers.

The data in Table 6 indicate:

- For the years 2001 to 2010, cancer mortality rates for all cancers combined and the leukemia mortality rates in the six towns of the Emergency Planning Zone around Vermont Yankee do not differ from those for Windham County, Vermont or the U.S.
- Similar results were seen in mortality rates in the 2011 report.
- Mortality rates for thyroid and pediatric cancers in the six towns could not be calculated as there were too few deaths (fewer than six) over the time period studied (10 years).

Table 6. Cancer Mortality Rates Near Vermont Yankee, in Vermont & U.S.

Age Adjusted Vermont and U.S. Cancer Mortality, All Sites, Males and Females per 100,000 population, 2001-2010.

	Rate	Lower CL	Upper CL	Avg. deaths per year
U.S.	183.2	183.0	183.4	561,166
Vermont	180.9	177.8	184.2	1,256
Windham County	179.9	168.6	191.7	97
Emergency Zone	183.1	166.4	201.4	46

Age Adjusted Vermont and U.S. Cancer Mortality, Thyroid, Males and Females per 100,000 population, 2001-2010.

	Rate	Lower CL	Upper CL	Avg. deaths per year
U.S.	0.5	0.5	0.5	1,503
Vermont	0.5	0.4	0.7	4
Windham County	--	--	--	<1
Emergency Zone	--	--	--	0

Age Adjusted Vermont and U.S. Cancer Mortality, Leukemia, Males and Females per 100,000 population, 2001-2010.

	Rate	Lower CL	Upper CL	Avg. deaths per year
U.S.	7.2	7.2	7.3	21,965
Vermont	7.5	6.9	8.2	51
Windham County	9.0	6.6	12.1	5
Emergency Zone	9.1	5.6	14.4	2

Age Adjusted Vermont and U.S. Cancer Mortality, Pediatric Cancers (Ages 0-19), Males and Females per 100,000 population, 2001-2010.

	Rate	Lower CL	Upper CL	Avg. deaths per year
U.S.	2.6	2.5	2.6	2,117
Vermont	2.6	1.9	3.5	4
Windham County	--	--	--	<1
Emergency Zone	--	--	--	<1

-- Rates are only presented when the total number of deaths is greater than 5.
Emergency Zone towns include: Brattleboro, Dummerston, Guilford, Halifax, Marlboro, and Vernon.
All rates are age adjusted to the 2000 U.S. standard population and rates are per 100,000 population.

Cancer Surveillance Methodology

The rates in this report are calculated at a 95 percent confidence level. This means, for example, given a reported incidence rate of 495.2 per 100,000 for Vermont in 2001-2010, that we are 95 percent confident (not due to chance alone) that the true 2001 to 2010 Vermont rate is in the range of 489.9 to 500.5 per 100,000. In the six towns near Vermont Yankee, the cancer incidence rate for all types of cancer combined is 455.6 cases per 100,000 people. Statistically speaking, this means we are 95 percent confident that the actual rate is between 428.8 cases and 483.8 cases per 100,000 people. Because the *ranges* for these populations do not overlap, we conclude that there is a meaningful statistical difference between the two rates.

In Table 6, it may appear that the cancer mortality rate, all sites, all ages, in the Emergency Planning Zone around Vermont Yankee is higher than in Windham County or Vermont. However, the confidence intervals (ranges) for these rates overlap, and the cancer mortality rates are *not* statistically different. In Windham County, the death rate from cancer, all sites, males and females, was 179.9 deaths per 100,000 people, while the death rate in the six towns near Vermont Yankee was 183.1 deaths per 100,000 people. The same conclusion is drawn for Vermont as a whole. All sites, all ages cancer mortality rates are not significantly different.

Data Limitations

One limitation of these data is that the numbers of cancer cases and the number of cancer deaths in the six towns near Vermont Yankee are small. There are challenges associated with computing rates for small geographical areas, such as the Vermont Yankee Emergency Planning Zone, with an estimated population of 20,000 people in 2010. When the rates are based on a small number of cases, it is almost impossible to distinguish random fluctuation from true changes in the underlying risk of disease. This is an issue in a state like Vermont, which has many communities with small populations. To improve rate stability, the cases have been combined for the 10 year period from 2001 through 2010. For more information about cancer and for resources to assist those living with cancer in Vermont: http://healthvermont.gov/prevent/cancer/cancer_programs.aspx.

Environmental Surveillance Methods

The types of surveys and analyses performed by the Vermont Department of Health are described here in relationship to their role in protecting the public from ionizing radiation resulting from operations at Vermont Yankee.

Direct Gamma Radiation Monitoring

Direct gamma radiation in air is measured by the Health Department by using thermoluminescent dosimeters (TLDs). Gamma radiation energy interacts with and changes the materials inside the TLDs. The more gamma energy, the more change occurs in the materials. The TLDs are then tested in a laboratory, by reversing the physical changes. When this occurs, light is emitted, and the amount of light measured in the process is directly related to the amount of gamma radiation energy the TLD received in the environment. These instruments are calibrated to provide a measure of radiation *exposure,* reported in milliroentgen.

TLDs are placed in the environment to measure how much direct gamma radiation is being given off from Vermont Yankee and how much exists from natural or other human-made sources in background areas of Vermont. The Health Department's dosimeters are located on the site boundary (property line), in the area of the station and at background locations in Windham County. A total of 72 locations are monitored. Samples are tested quarterly.

Vermont Yankee emits direct gamma radiation from components and nuclear reactor systems. Direct gamma radiation may also result when gases and particulates are released from the station's air stack. Measuring the amount emitted ensures that no member of the public is exposed to increased levels of gamma radiation as a result of operations at Vermont Yankee.

Continuous Flow Air Sampling

Continuous air samplers are located in Vernon, Guilford, Dummerston, Wilmington and Brattleboro. In 2011, an additional air sampler was added in Burlington. These air samplers have a mechanical pump that pulls air through two types of sample media. The samplers have an in-line flow meter that tracks the volume of air pulled through the sample. The air samplers run continuously.

The samplers collect alpha-, beta- and gamma-emitting materials in air. Each sampler has two collection media to capture these radioactive materials. The first medium is a glass fiber filter. As outdoor air is pulled through the sampler, particulates are collected on the glass fiber filter. Particulates that contain alpha-, beta- and gamma-emitting materials are collected on the glass fiber filter.

Located behind the glass fiber filter is the second medium, a charcoal cartridge. The cartridge is treated with triethylenediamine (TEDA), a compound that attracts radioactive iodine vapors. As air passes through, radioactive iodine as well as other gamma-emitting gases and vapors are collected.

The filter is sent to the Health Department Laboratory where the alpha- and beta-emitting materials are counted on a gas flow proportional counter. The charcoal cartridge is tested by the Health Department Laboratory on a gamma spectrometer. Samples are collected and tested monthly. In addition, every three months the filters are grouped together and tested by gamma spectroscopy. These grouped samples are called quarterly composites.

Measurements of total alpha and beta radiation, gamma radiation and specifically iodine-131 ensure that operations at—and discharges from—Vermont Yankee are within limits and do not result in an increased radiation exposure to the public.

Water Monitoring

Water samples are collected both on site at Vermont Yankee and off site at nearby locations. Off-site water samples include drinking water wells, a municipal water supply, and samples from the Connecticut River. These locations allow the Health Department to determine if radioactive materials have left the Vermont Yankee site and entered these waters. On-site groundwater monitoring wells are sampled and tested to determine if any radioactive materials are leaking from systems at Vermont Yankee. Several on-site wells are located side-by-side. These are coupled wells. They are in the same location, with one well set slightly deeper than the other. The shallower well is designated with an “S” after the well number, the deeper well has a “D” designation. On-site drinking water wells are also sampled and tested to ensure that the drinking water supplies are not contaminated.

Water samples can be tested for total alpha and beta radioactivity, and gamma-emitting materials. Alpha and beta radioactivity are tested with a gas proportional counter. Gamma-emitting materials are measured with a gamma spectrometer.

Water samples are also tested for tritium. Tritium is a radioactive form of hydrogen, and is a weak beta-emitter. Tritium is created when water passes through the reactor core and the hydrogen atoms in the water molecules and other trace elements like boron absorb neutrons from the fission of the reactor fuel. Tritiated water can leave the power station in the same ways that non-radioactive water leaves the station: in the air, in groundwater, and through discharges into surface water. Tritium is also created by cosmic radiation in the atmosphere. Tritium is tested with a liquid scintillation counter.

Since 2010, water samples have also been tested for four hard-to-detect radioactive metals: strontium-89, strontium-90, iron-55, and nickel-63. The Health Department contracts with a certified laboratory to perform these analyses. Strontium-90 is associated with nuclear reactor fission, but was also released in significant quantities in the 1940s, 50s and 60s during above-ground nuclear weapons testing, and as a result of global nuclear events like Chernobyl. Nickel-63 and iron-55 are associated with nuclear facility operations. These radioactive metals can be released from leaking reactor systems or through permitted discharges. They are not identifiable by routine laboratory test methods.

Monitoring Food Chain Inputs

The Health Department also routinely tests milk, sediment, soil, vegetation and fish in the Vernon and Brattleboro area.

Milk Sampling

Milk samples are collected from two farms located in the vicinity of Vermont Yankee. Raw cows' milk samples are taken monthly and tested for gamma-emitting materials and specifically for iodine-131 (I-131).

Sediment Sampling

Sediments from the bottom of the Connecticut River are collected twice a year. They are tested for gamma-emitting materials.

Soil and Vegetation Sampling

Soil and vegetation are collected in areas near Vermont Yankee and tested for gamma-emitting materials. A variety of natural and cultivated plants are sampled to determine if radioactive materials are accumulating in the food chain. Vegetation samples are taken both in the immediate vicinity of Vermont Yankee and in the surrounding community. Soil samples are collected in areas near Vermont Yankee.

Fish Sampling

Fish are collected monthly at two sites in the Connecticut River by an environmental contractor. One site is outside the Vermont Yankee discharge and the other site is about nine miles upstream from Vermont Yankee, where the Route 9 bridge crosses the Connecticut River. Fish are caught by a method known as electro-fishing. This involves putting a weak electric current in the water. Fish exposed to the current are temporarily stunned and float to the surface where they are collected. Sport and pan fish species are caught and tested: large and small mouth bass, yellow perch and pumpkinseed.

Before testing, fish are divided into edible and inedible portions. The extent of the testing that can be done depends on the mass of fish collected. Fish are tested for gamma-emitting materials and strontium-90 and other hard-to-detect radioactive metals strontium-89, nickel-63, iron-55.

Laboratory Testing and Measurements

Laboratory instruments at the Health Department that are used to test samples are able to measure very small amounts of radioactivity. Each instrument has a limit as to how low it can measure or identify radioactivity. This limit is determined by the Health Department radiochemists and reported as the *Lower Limit of Detection* (LLD). Lower Limits of Detection are calculated for each sample, taking into account the specific instrument and sample characteristics such as type (*e.g.* water, soil, milk, air), length of time the sample is tested, and the amount of the sample tested. The Health Department's Lower Limits of Detection for routine gamma spectroscopy tests are presented in Table 8.

All the Health Department's instruments meet strict quality control checks. Data reported by the Health Department is thoroughly reviewed by both the radiochemists and data review personnel.

Units of Measurement

For most results in this report, radioactivity is reported in units of *picocuries per mass or volume* of sample. One picocurie is one trillionth of a curie or 0.000000000001 curie. Curies and picocuries are units that measure the amount of radiation "activity" in the sample.

Direct gamma exposure is measured and reported in milliroentgen. Milliroentgen is a unit of exposure to ionizing radiation. One milliroentgen is equal to one thousandth of a roentgen or 0.001 roentgens.

Table 7. Units of Measurement

Type	Unit	Abbreviation	Measures (amount of)	Equivalent to
Radiation units	curie	Ci	activity of a radioactive material	1,000,000,000,000 picocuries (pCi)
	picocurie	pCi	activity of a radioactive material	0.000000000001 curie (Ci)
	roentgen	R	*exposure* to ionizing radiation	1000 milliroentgens (mR)
	milliroentgen	mR	*exposure* to ionizing radiation	0.001 roentgen (R)
	roentgen **e**quivalent **m**an	rem	*dose* equivalent of ionizing radiation	1000 millirem (mrem)
	milli**rem**	mrem	*dose* equivalent of ionizing radiation	0.001 roentgen equivalent man (rem)
Mass & Volume units	gram	g	mass	0.001 kilogram (kg)
	kilogram	kg	mass	1000 grams (g)
	liter	L	volume of liquid	1000 milliliters (mL)
	milliliter	mL	volume of liquid	0.001 liter (L)
	cubic meter	m^3	volume of air	1,000,000 centimeters^3 (cm^3)

Roentgens are units of radiation exposure in air. To determine the effect that the exposure would have on a person, roentgens are converted to **rem** (“**r**oentgen **e**quivalent **m**an”). A rem accounts for both the amount of radiation energy absorbed by a person and the potential biological effects of that energy in the human body. The Health Department’s Radiological Health Rule provides limits for gamma radiation emitted from Vermont Yankee in units of measured exposure and relates it to a *biological dose*. As the Vermont Yankee site boundary TLDs measure exposure in milliroentgen, the corresponding limit in milliroentgen applies. Personal TLDs, like those worn by workers in nuclear power, medical or research facilities, are calibrated to provide a measure of *biological dose* for the wearer and are reported in millirem.

Uncertainty of Radiation Measurements

Measurements reported by a laboratory have an amount of *uncertainty* associated with them. Uncertainty is sometimes called error. Uncertainty results from variability in sampling and testing. The smaller the uncertainty associated with a measurement, the more accurate the number reported is likely to be. The uncertainty associated with a measurement is calculated by radiochemists and reported as a plus/minus (+/-) value. All of the measurements in this report are presented at the 95 percent confidence level. This means it is 95 percent certain (not due to chance alone) that the results are within the value and error range reported. Uncertainty can be minimized by increasing instrument efficiency, sample size and counting time.

Uncertainty of Thermoluminescent Dosimeter (TLD) Measurements

Dosimeter measurements over time are estimates and are also subject to uncertainty. The error for the sum of the quarterly results is the total propagated error at the 95 percent confidence level. The formula for the propagation of error is a root-mean-square formula:

$$[(\sigma_1^2) + (\sigma_2^2) + (\sigma_3^2) + (\sigma_4^2)]^{1/2}$$

Where (σ_1^2) is the uncertainty for quarter 1, (σ_2^2) is the uncertainty for quarter 2, (σ_3^2) is the uncertainty for quarter 3 and (σ_4^2) is the uncertainty for quarter 4. The Health Department regulates the direct gamma radiation exposure on the reported measurement.

Table 8. Health Department Gamma Spectroscopy Calculated Lower Limit of Detections

Radioactive element	Calculated Lower Limit of Detection: fish, water, vegetation & milk (pCi/L or pCi/kg)	Calculated Lower Limit of Detection: soil, sediment (pCi/kg)
Antimony-124	3	24
Antimony-126	3	23
Barium-133	4	30
Beryllium-7	24	183
Cadmium-109	48	349
Cerium-139	3	18
Cerium-141	4	29
Cerium-144	16	115
Cesium-134	4	25
Cesium-136	3	23
Cesium-137	4	24
Chromium-51	24	182
Cobalt-57	2	14
Cobalt-58	3	23
Cobalt-60	3	23
Iodine-131	3	23
Manganese-54	4	24
Mercury-203	3	22
Potassium-40	48	367
Ruthenium-103	3	22
Ruthenium-106	29	220
Silver-110m	3	23
Strontium-85	4	26
Tin-113	4	31
Yttrium-88	4	26
Zinc-65	6	46

Direct Gamma Radiation Results

Thermoluminescent dosimeters (TLDs) are located along the Vermont Yankee site boundary (property line) and in public areas in Vernon and in other Windham County towns. Thirteen TLDs placed at the Vermont Yankee site boundary are evaluated for compliance with the regulations detailed in the Health Department's Radiological Health Rule. The Health Department limits the measured exposure at the site boundary to no more than 20 milliroentgen per year above background radiation, and no more than 10 milliroentgen per calendar quarter above background radiation.

Site boundary TLDs:

- VY North Fence
- VY North Fence #2
- VY SW Fence
- VY SW Fence #2
- VY Parking Lot A
- VDH T07A
- Governor Hunt Road # 39
- VDH T07B
- VDH DR42
- VDH DR48
- VDH DR51A
- VDH DR52A
- VDH DR53A

Five additional TLDs—VDH DR43, DR44, DR45, DR46 and DR47—are located on the Connecticut River site boundary and are subject to the U.S. Nuclear Regulatory Commission limit of 100 millirem per year.

Additional Health Department TLDs are located in other areas of Vernon, and in Guilford, Brattleboro, Dummerston, Putney and Wilmington. These provide the background measurements of direct gamma radiation from both natural and human-made sources unrelated to the operation of Vermont Yankee. All TLDs are collected and tested every three months (quarterly).

Comparison to Background Levels

To determine the amount of direct gamma radiation exposure attributed to emissions from Vermont Yankee, the background gamma radiation is subtracted from the site boundary (property line) measurements. Background gamma radiation unrelated to Vermont Yankee may be from naturally-occurring sources, other industrial applications, and global contaminants remaining from above-ground weapons testing during the 1940s, 50s and 60s and global nuclear incidents like Chernobyl.

To measure the background of direct gamma radiation the additional 34 TLDs are placed in locations beyond the immediate area of Vermont Yankee's operations. These locations are as far west as Wilmington, as far north as Putney, and as far south as the Massachusetts state line in Guilford and Vernon. Each quarter's average exposure to these 34 TLDs is calculated and used to estimate environmental background radiation. Background gamma radiation levels for the four quarters of 2012 are presented in Table 9.

The exposures reported in Tables 10 and 11 show the total (gross) dosimeter measurement and the net value. The net value is calculated by subtracting the background radiation measurement from the total radiation measurement. For regulatory purposes, the net values are compared to the quarterly and annual limits.

Table 9. 2012 Average Direct Gamma Background Radiation Results

Calendar **Quarter**	Average Background Exposure Measurements (milliroentgen)
January 1 to March 31	14.0 ± 2.0
April 1 to June 30	14.1 ± 2.1
July 1 to September 30	14.9 ± 2.3
October 1 to December 31	14.0 ± 2.3
Total for Calendar **Year 2012**	57.0 ± 4.4
Calendar Year 2011	56.1 ± 7.3
Calendar Year 2010	59.2 ± 7.1
Calendar Year 2009	57.9 ± 4.8
Calendar Year 2008	56.4 ± 4.6
Calendar Year 2007	56.2 ± 5.2

2012 Direct Gamma Radiation Exposure Results

The following tables are the results of the Health Department's TLD measurements of direct gamma radiation. Table 10 contains the results for the Vermont Yankee site boundary, and the dosimeters in the immediate area around the power station. Table 11 contains the results for the 34 dosimeters placed in locations beyond the immediate area of Vermont Yankee.

In 2012:

- 287 TLDs were tested for direct gamma radiation.
  - 135 of those provided background exposure measurements
  - 152 of those provided exposure measurements at the site boundary and in the immediate area of Vermont Yankee

Dosimeter locations on the site boundary bordered by land and used for direct gamma radiation compliance measurements reflect Vermont Yankee property purchases on or before August 1, 2008. The site boundary dosimeter location data are bolded in Table 10.

For 2012, the net site boundary results used for verifying compliance ranged from 0 to 14.7 milliroentgen.

Map 3 shows the locations of the site boundary and station area dosimeters. Maps 4 and 5 show the locations of the background dosimeters. The ID numbers on the maps can be matched to the locations in Tables 10 and 11.

For 2012, the quarterly limit of 10 milliroentgen and the annual limit of 20 milliroentgen were not exceeded.

Map 3

VT Yankee Nuclear Power Station
Site Boundary and Plant Area Dosimeter Locations

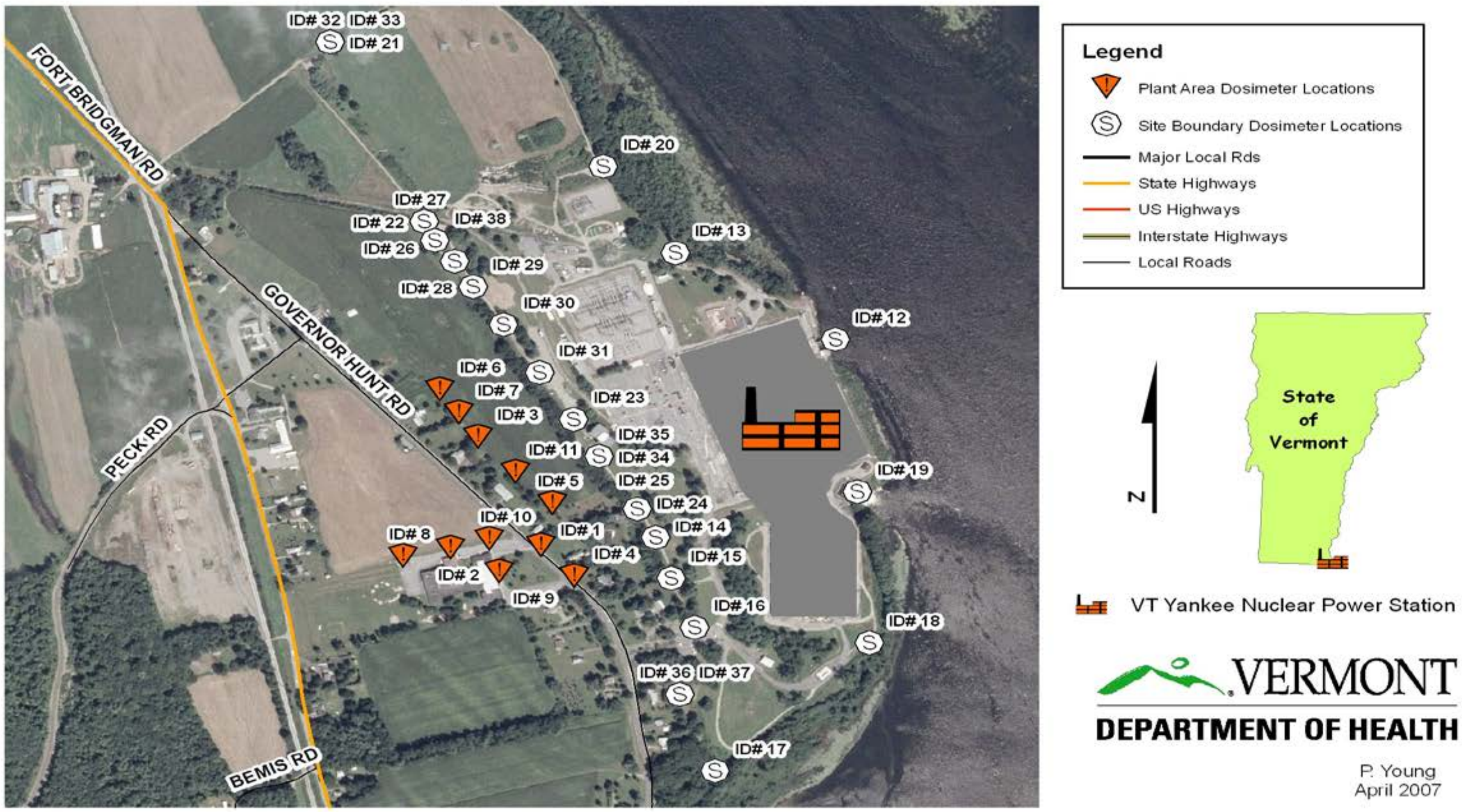


Table 10. 2012 Thermoluminescent Dosimeter Exposure Measurements and Net Gamma Radiation: Station Area & Site Boundary Locations

2012 **Site Boundary and Station Area** Dosimeter Exposure (milliroentgen)

Location	Map ID #	Qtr1 Gross	1SD Error	Avg Bkgrd	Qtr1 Net	Net Q1 >=0	2SD Error	Qrtr2 Gross	1SD Error	Avg Bkgrd	Qtr2 Net	Net Q2 >=0	2SD Error	Qrtr3 Gross	1SD Error	Avg Bkgrd	Qtr3 Net	Net Q3 >=0	2SD Error	Qrtr4 Gross	1SD Error	Avg Bkgrd	Qtr4 Net	Net Q4 >=0	2SD Error	Annual Net	2SD Error
Gov Hunt Road #39	**1**	**15.8**	**0.7**	**14.0**	**1.8**	**1.8**	**1.3**	**16.4**	**0.7**	**14.1**	**2.3**	**2.3**	**1.5**	**16.8**	**0.9**	**14.9**	**1.9**	**1.9**	**1.8**	**16.1**	**1.0**	**14.0**	**2.1**	**2.1**	**2.0**	**8.1**	**3.3**
VDH DR06	2	14.6	0.8	**14.0**	0.5	0.5	1.6	15.4	0.9	**14.1**	1.3	1.3	1.8	14.3	0.8	**14.9**	-0.6	0.0	1.6	14.4	1.4	**14.0**	0.4	0.4	2.8	2.2	4.1
VDH DR51A	**3**	**14.8**	**0.8**	**14.0**	**0.8**	**0.8**	**1.5**	**16.2**	**0.8**	**14.1**	**2.1**	**2.1**	**1.5**	**16.2**	**1.0**	**14.9**	**1.3**	**1.3**	**2.0**	**15.9**	**0.9**	**14.0**	**1.9**	**1.9**	**1.8**	**6.1**	**3.4**
VDH DR52A	**4**	**16.7**	**0.8**	**14.0**	**2.7**	**2.7**	**1.5**	**17.4**	**1.0**	**14.1**	**3.3**	**3.3**	**1.9**	**16.6**	**0.9**	**14.9**	**1.7**	**1.7**	**1.7**	**16.4**	**1.0**	**14.0**	**2.4**	**2.4**	**1.9**	**10.1**	**3.5**
VDH DR53A	**5**	**17.4**	**0.7**	**14.0**	**3.4**	**3.4**	**1.3**	**18.0**	**0.6**	**14.1**	**3.8**	**3.8**	**1.2**	**17.8**	**1.2**	**14.9**	**2.9**	**2.9**	**2.4**	**18.5**	**1.8**	**14.0**	**4.5**	**4.5**	**3.6**	**14.7**	**4.7**
VDH T07A	**6**	**14.6**	**0.6**	**14.0**	**0.6**	**0.6**	**1.3**	**15.5**	**0.9**	**14.1**	**1.3**	**1.3**	**1.7**	**15.7**	**1.0**	**14.9**	**0.8**	**0.8**	**1.9**	**15.2**	**1.1**	**14.0**	**1.2**	**1.2**	**2.1**	**4.0**	**3.5**
VDH T07B	**7**	**15.2**	**0.8**	**14.0**	**1.2**	**1.2**	**1.5**	**16.1**	**0.8**	**14.1**	**1.9**	**1.9**	**1.6**	**16.8**	**0.8**	**14.9**	**1.9**	**1.9**	**1.6**	**15.7**	**1.1**	**14.0**	**1.7**	**1.7**	**2.1**	**6.7**	**3.5**
Vernon School (air sampler)	8	14.9	0.6	**14.0**	0.9	0.9	1.1	15.6	0.9	**14.1**	1.5	1.5	1.7	16.2	0.6	**14.9**	1.3	1.3	1.3	15.2	1.6	**14.0**	1.2	1.2	3.1	4.9	3.9
Vernon School Nurse	9	17.3	0.7	**14.0**	3.3	3.3	1.3	16.1	0.9	**14.1**	2.0	2.0	1.7	17.3	0.9	**14.9**	2.4	2.4	1.8	16.0	1.2	**14.0**	2.0	2.0	2.3	9.6	3.6
Vernon School Pole	10	14.1	0.6	**14.0**	0.1	0.1	1.1	14.2	0.7	**14.1**	0.0	0.0	1.3	14.6	1.0	**14.9**	-0.3	0.0	1.9	14.4	1.1	**14.0**	0.4	0.4	2.1	0.4	3.3
VY Parking Lot A	**11**	**16.3**	**1.4**	**14.0**	**2.3**	**2.3**	**2.7**	**17.7**	**0.9**	**14.1**	**3.5**	**3.5**	**1.8**	**18.1**	**0.7**	**14.9**	**3.2**	**3.2**	**1.5**	**17.1**	**0.9**	**14.0**	**3.1**	**3.1**	**1.8**	**12.2**	**4.0**
VDH DR45	12	27.2	1.8	**14.0**	13.2	13.2	3.4	27.4	1.6	**14.1**	13.3	13.3	3.1	25.8	1.1	**14.9**	10.9	10.9	2.1	28.5	1.9	**14.0**	14.5	14.5	3.7	51.9	6.3
VDH DR46	13	20.0	0.9	**14.0**	6.0	6.0	1.8	18.9	0.6	**14.1**	4.8	4.8	1.3	18.5	1.2	**14.9**	3.6	3.6	2.4	20.1	1.2	**14.0**	6.1	6.1	2.3	20.5	3.9
VDH DR08	15	18.1	1.0	**14.0**	4.1	4.1	2.0	18.1	0.8	**14.1**	4.0	4.0	1.5	20.0	1.0	**14.9**	5.1	5.1	1.9	19.4	1.4	**14.0**	5.4	5.4	2.6	18.6	4.1
VDH DR41	16	15.9	1.1	**14.0**	1.9	1.9	2.2	15.9	0.6	**14.1**	1.7	1.7	1.2	15.5	0.9	**14.9**	0.6	0.6	1.8	15.5	1.2	**14.0**	1.5	1.5	2.4	5.8	3.9
VDH DR42	**17**	**14.3**	**0.7**	**14.0**	**0.3**	**0.3**	**1.3**	**15.2**	**0.6**	**14.1**	**1.1**	**1.1**	**1.2**	**13.6**	**0.5**	**14.9**	**-1.3**	**0.0**	**1.0**	**14.8**	**1.0**	**14.0**	**0.8**	**0.8**	**1.9**	**2.1**	**2.8**
VDH DR43	18	16.1	0.9	**14.0**	2.1	2.1	1.7	16.5	0.6	**14.1**	2.4	2.4	1.1	17.0	1.3	**14.9**	2.1	2.1	2.6	17.0	1.0	**14.0**	3.0	3.0	1.9	9.6	3.8
VDH DR44	19	19.9	1.2	**14.0**	5.9	5.9	2.4	18.9	1.8	**14.1**	4.8	4.8	3.6	19.3	1.1	**14.9**	4.4	4.4	2.1	20.2	2.1	**14.0**	6.2	6.2	4.1	21.4	6.3
VDH DR47	20	16.8	0.6	**14.0**	2.7	2.7	1.2	16.8	0.7	**14.1**	2.6	2.6	1.3	17.0	1.0	**14.9**	2.1	2.1	2.0	16.9	0.9	**14.0**	2.9	2.9	1.8	10.3	3.3
VDH DR48	**21**	**12.4**	**0.5**	**14.0**	**-1.6**	**0.0**	**1.0**	**13.2**	**0.8**	**14.1**	**-1.0**	**0.0**	**1.5**	**12.8**	**0.8**	**14.9**	**-2.1**	**0.0**	**1.5**	**12.7**	**1.0**	**14.0**	**-1.3**	**0.0**	**1.9**	**0.0**	**3.0**
VDH T01	22	13.9	0.6	**14.0**	-0.1	0.0	1.2	14.7	0.7	**14.1**	0.5	0.5	1.4	14.8	0.8	**14.9**	-0.1	0.0	1.6	14.6	1.3	**14.0**	0.6	0.6	2.5	1.1	3.6
VDH DR49	22	13.0	0.5	**14.0**	-1.0	0.0	1.0	13.8	0.7	**14.1**	-0.4	0.0	1.3	13.9	0.6	**14.9**	-1.0	0.0	1.2	13.7	0.8	**14.0**	-0.3	0.0	1.5	0.0	2.5
VDH DR51	23	18.8	0.7	**14.0**	4.8	4.8	1.4	18.3	0.7	**14.1**	4.2	4.2	1.4	17.9	1.1	**14.9**	3.0	3.0	2.2	18.5	0.8	**14.0**	4.5	4.5	1.6	16.6	3.4
VDH DR52	24	20.0	1.0	**14.0**	6.0	6.0	1.9	20.5	1.2	**14.1**	6.4	6.4	2.4	20.2	1.3	**14.9**	5.3	5.3	2.6	21.4	2.3	**14.0**	7.4	7.4	4.4	25.0	5.9
VDH DR53	25	20.6	0.8	**14.0**	6.6	6.6	1.5	20.7	0.7	**14.1**	6.5	6.5	1.5	20.6	1.1	**14.9**	5.7	5.7	2.2	20.9	1.1	**14.0**	6.9	6.9	2.2	25.6	3.7
VDH T03	26	14.6	0.7	**14.0**	0.6	0.6	1.4	14.4	0.5	**14.1**	0.3	0.3	1.0	15.4	1.0	**14.9**	0.5	0.5	1.9	14.3	1.1	**14.0**	0.3	0.3	2.1	1.6	3.3

Site boundary dosimeter measurements are bolded.

Table 10 (continued). 2012 Thermoluminescent Dosimeter Exposure Measurements and Net Gamma Radiation: Station Area & Site Boundary Locations

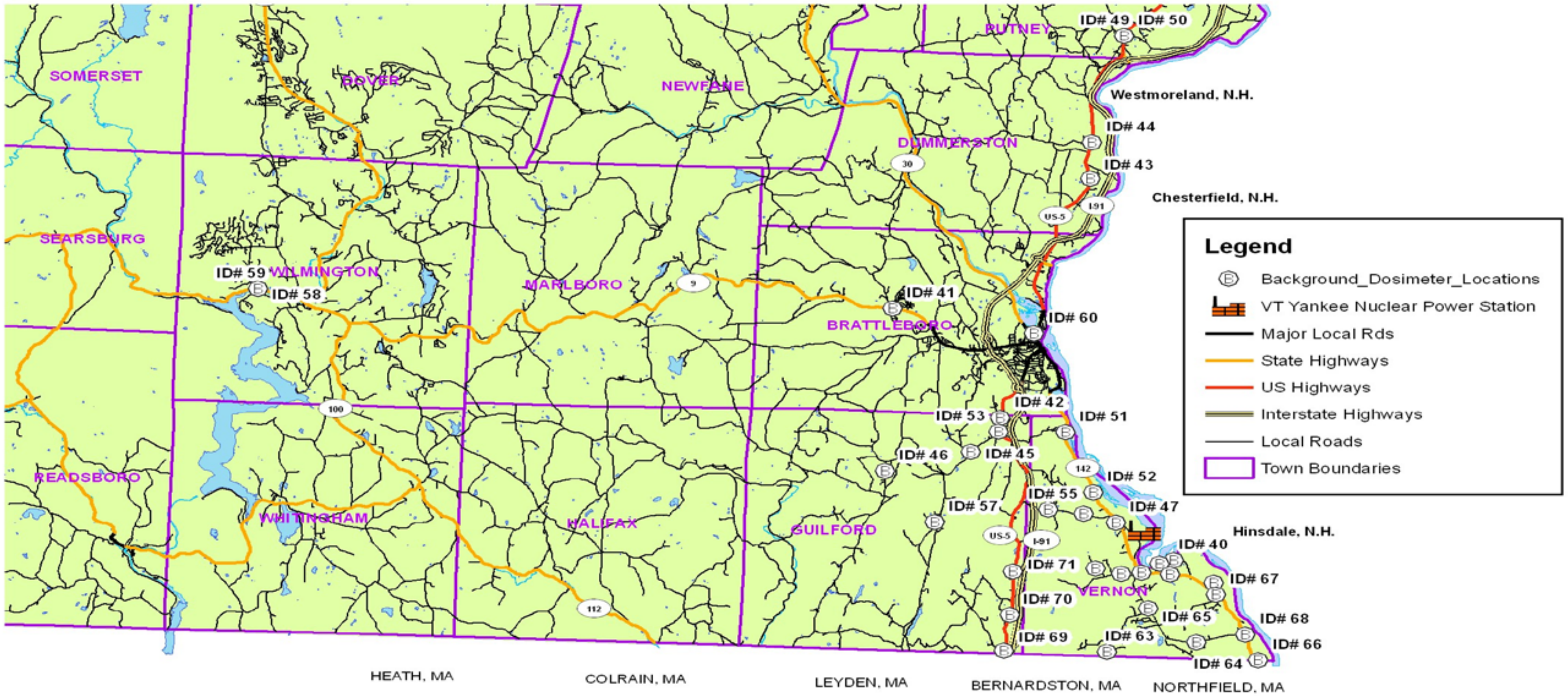
2012 **Site Boundary and Station Area** Dosimeter Exposure (milliroentgen)

Location	Map ID #	Qtr1 Gross	1SD Error	Avg Bkgrd	Qtr1 Net	Net Q1 >=0	2SD Error	Qrtr2 Gross	1SD Error	Avg Bkgrd	Qtr2 Net	Net Q2 >=0	2SD Error	Qrtr3 Gross	1SD Error	Avg Bkgrd	Qtr3 Net	Net Q3 >=0	2SD Error	Qrtr4 Gross	1SD Error	Avg Bkgrd	Qtr4 Net	Net Q4 >=0	2SD Error	Annual Net	2SD Error
VDH T05	28	15.5	0.6	**14.0**	1.5	1.5	1.2	15.4	0.8	**14.1**	1.2	1.2	1.5	15.9	0.7	**14.9**	1.0	1.0	1.3	15.5	1.1	**14.0**	1.5	1.5	2.2	5.2	3.2
VDH T04	29	14.5	0.5	**14.0**	0.5	0.5	1.1	15.6	0.6	**14.1**	1.4	1.4	1.2	16.3	1.7	**14.9**	1.4	1.4	3.2	15.2	1.0	**14.0**	1.2	1.2	1.9	4.6	4.1
VDH T06	30	16.6	0.8	**14.0**	2.6	2.6	1.5	16.3	0.6	**14.1**	2.1	2.1	1.2	16.5	1.4	**14.9**	1.6	1.6	2.8	16.4	1.2	**14.0**	2.4	2.4	2.4	8.7	4.2
VDH DR07	31	17.4	0.9	**14.0**	3.4	3.4	1.8	17.6	0.7	**14.1**	3.5	3.5	1.4	17.8	1.3	**14.9**	2.9	2.9	2.6	18.5	0.8	**14.0**	4.5	4.5	1.5	14.2	3.7
VY North Fence	**32**	**14.5**	**0.6**	**14.0**	**0.4**	**0.4**	**1.2**	**15.1**	**0.6**	**14.1**	**0.9**	**0.9**	**1.2**	**15.1**	**0.8**	**14.9**	**0.2**	**0.2**	**1.5**	**14.1**	**0.7**	**14.0**	**0.1**	**0.1**	**1.4**	**1.6**	**2.7**
VY North Fence #2	**33**	**14.4**	**0.7**	**14.0**	**0.4**	**0.4**	**1.4**	**14.8**	**0.5**	**14.1**	**0.7**	**0.7**	**1.0**	**14.9**	**0.6**	**14.9**	**0.0**	**0.0**	**1.2**	**14.5**	**1.1**	**14.0**	**0.5**	**0.5**	**2.1**	**1.5**	**3.0**
VY Parking Lot #2	34	19.6	0.9	**14.0**	5.6	5.6	1.8	20.0	0.7	**14.1**	5.9	5.9	1.3	21.9	1.0	**14.9**	7.0	7.0	2.0	20.2	1.3	**14.0**	6.2	6.2	2.6	24.7	4.0
VY Parking Lot, ID	35	19.5	1.2	**14.0**	5.5	5.5	2.3	19.6	0.8	**14.1**	5.4	5.4	1.5	21.8	1.3	**14.9**	6.9	6.9	2.5	19.5	1.4	**14.0**	5.5	5.5	2.8	23.4	4.6
VY SW Fence	**36**	**13.2**	**0.9**	**14.0**	**-0.8**	**0.0**	**1.7**	**14.2**	**0.9**	**14.1**	**0.0**	**0.0**	**1.8**	**15.1**	**0.7**	**14.9**	**0.2**	**0.2**	**1.3**	**13.7**	**1.2**	**14.0**	**-0.3**	**0.0**	**2.3**	**0.2**	**3.6**
VY SW Fence #2	**37**	**13.0**	**0.6**	**14.0**	**-1.0**	**0.0**	**1.2**	**14.0**	**0.7**	**14.1**	**-0.1**	**0.0**	**1.4**	**14.6**	**1.2**	**14.9**	**-0.3**	**0.0**	**2.3**	**14.2**	**0.9**	**14.0**	**0.2**	**0.2**	**1.7**	**0.2**	**3.4**
VDH T02	38	14.5	0.6	**14.0**	0.5	0.5	1.2	13.8	0.6	**14.1**	-0.4	0.0	1.1	15.3	0.9	**14.9**	0.4	0.4	1.7	14.2	0.6	**14.0**	0.2	0.2	1.2	1.1	2.7
Meteorology Tower	n/a	13.7	0.8	**14.0**	-0.3	0.0	1.5	14.5	0.6	**14.1**	0.4	0.4	1.2	15.4	0.9	**14.9**	0.5	0.5	1.7	14.2	1.1	**14.0**	0.2	0.2	2.2	1.1	3.4

Site boundary dosimeter measurements are bolded.

Map 4

Environmental Radiation Surveillance Stations
Background Dosimeter Locations



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Map 5

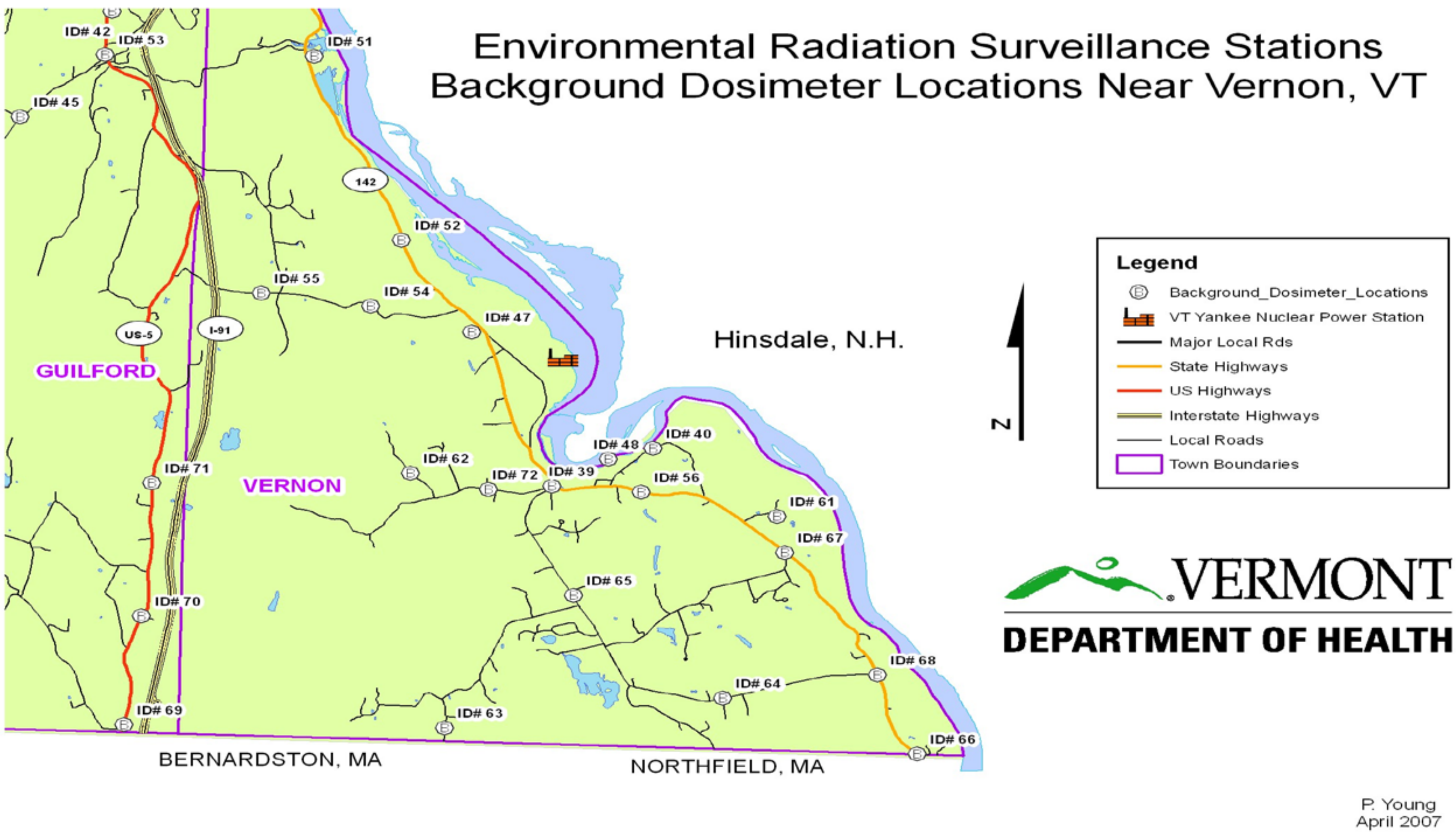
Environmental Radiation Surveillance Stations
Background Dosimeter Locations Near Vernon, VT
Hinsdale, N.H.
GUILFORD
VERNON
BERNARDSTON, MA
NORTHFIELD, MA
142
US-5
I-91
ID# 42
ID# 53
ID# 51
ID# 45
ID# 52
ID# 55
ID# 54
ID# 47
ID# 48
ID# 40
ID# 62
ID# 72
ID# 39
ID# 56
ID# 71
ID# 61
ID# 67
ID# 65
ID# 70
ID# 68
ID# 64
ID# 69
ID# 63
ID# 66
N
Legend
Background_Dosimeter_Locations
VT Yankee Nuclear Power Station
Major Local Rds
State Highways
US Highways
Interstate Highways
Local Roads
Town Boundaries
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Table 11. 2012 Thermoluminescent Dosimeter Exposure Measurements and Net Gamma Radiation: Background Locations

2012 **Background** Dosimeter Exposure (milliroentgen)

Location	Map ID #	Qtr1 Gross	1SD Error	Avg Bkgrd	Qtr1 Net	Net >=0	2SD Error	Qrtr2 Gross	1SD Error	Avg Bkgrd	Qtr2 Net	Net >=0	2SD Error	Qrtr3 Gross	1SD Error	Avg Bkgrd	Qtr3 Net	Net >=0	2SD Error	Qrtr4 Gross	1SD Error	Avg Bkgrd	Qtr4 Net	Net >=0	2SD Error	Annual Net	2SD Error
142/Pond Road (N)	39	13.8	0.6	**14.0**	-0.2	0.0	1.2	13.2	0.8	14.1	-1.0	0.0	1.6	14.3	0.9	14.9	-0.6	0.0	1.8	14.8	1.3	14.0	0.8	0.8	2.5	0.8	3.7
A&M Auto/Smead Rd	40	13.4	0.8	**14.0**	-0.6	0.0	1.5	13.8	0.7	14.1	-0.4	0.0	1.3	14.3	0.6	14.9	-0.6	0.0	1.2	14.1	1.5	14.0	0.1	0.1	3.0	0.1	3.8
West Brattleboro State Police	41	12.8	1.0	**14.0**	-1.3	0.0	2.0	13.2	0.6	14.1	-1.0	0.0	1.1	13.6	0.6	14.9	-1.3	0.0	1.2	12.7	0.9	14.0	-1.3	0.0	1.7	0.0	3.1
D&E Tree, Rt 5, Guilford	42	13.0	0.7	**14.0**	-1.0	0.0	1.3	13.1	0.7	14.1	-1.0	0.0	1.4	14.1	0.7	14.9	-0.8	0.0	1.3	13.5	1.7	14.0	-0.5	0.0	3.4	0.0	4.1
Dummerston AOT	43	14.6	0.6	**14.0**	0.6	0.6	1.2	15.0	0.6	14.1	0.8	0.8	1.2	15.5	0.7	14.9	0.6	0.6	1.3	14.0	1.5	14.0	0.0	0.0	2.9	2.0	3.7
Dummerston School	44	14.7	0.8	**14.0**	0.7	0.7	1.5	14.8	0.9	14.1	0.7	0.7	1.8	15.8	0.8	14.9	0.9	0.9	1.5							2.3	2.8
Guilford Center Rd/Tater Rd	45	13.7	0.6	**14.0**	-0.3	0.0	1.1	14.0	0.7	14.1	-0.2	0.0	1.4	14.8	0.7	14.9	-0.1	0.0	1.4	14.0	1.0	14.0	0.0	0.0	1.9	0.0	2.9
Guilford Town Garage	46	15.2	0.8	**14.0**	1.2	1.2	1.6	14.9	0.7	14.1	0.8	0.8	1.4	15.1	0.8	14.9	0.2	0.2	1.5	14.6	0.8	14.0	0.6	0.6	1.5	2.8	3.0
Miller Farm	47	12.6	0.7	**14.0**	-1.4	0.0	1.4	12.3	0.6	14.1	-1.9	0.0	1.2	13.2	0.6	14.9	-1.7	0.0	1.1	11.9	0.6	14.0	-2.1	0.0	1.1	0.0	2.4
Power Line River Crossing	48	14.1	0.7	**14.0**	0.1	0.1	1.3	13.9	0.6	14.1	-0.3	0.0	1.2	14.7	1.0	14.9	-0.2	0.0	1.9	14.2	1.4	14.0	0.2	0.2	2.8	0.3	3.8
Putney Pole	49	14.9	0.7	**14.0**	0.9	0.9	1.3	14.7	0.6	14.1	0.6	0.6	1.1	15.5	0.6	14.9	0.6	0.6	1.2	14.9	1.3	14.0	0.9	0.9	2.5	3.0	3.2
Putney Town Clerk	50	13.1	0.7	**14.0**	-0.9	0.0	1.3	13.0	0.7	14.1	-1.1	0.0	1.4	13.3	0.9	14.9	-1.6	0.0	1.8	12.8	0.7	14.0	-1.2	0.0	1.4	0.0	3.0
Renaud Brothers	51	16.1	0.6	**14.0**	2.1	2.1	1.1	15.8	0.8	14.1	1.7	1.7	1.5	16.3	0.8	14.9	1.4	1.4	1.6	14.0	1.3	14.0	0.0	0.0	2.5	5.2	3.6
Rt 142 N Trans Line	52	13.8	0.8	**14.0**	-0.2	0.0	1.6	14.3	0.7	14.1	0.1	0.1	1.3	14.5	0.7	14.9	-0.4	0.0	1.4	14.1	0.9	14.0	0.1	0.1	1.7	0.2	3.0
Rt 5/Guilford Ctr Rd	53	13.8	0.7	**14.0**	-0.2	0.0	1.4	13.7	1.1	14.1	-0.5	0.0	2.1	14.2	0.7	14.9	-0.7	0.0	1.4	14.3	1.6	14.0	0.3	0.3	3.1	0.3	4.2
Tyler Hill Road	54	14.4	0.8	**14.0**	0.4	0.4	1.5	15.1	0.8	14.1	1.0	1.0	1.5	15.4	0.6	14.9	0.5	0.5	1.2	13.7	1.4	14.0	-0.3	0.0	2.6	1.9	3.6
Tyler Rd/Franklin Rd	55	14.3	0.9	**14.0**	0.3	0.3	1.8	14.4	1.1	14.1	0.3	0.3	2.1	15.2	0.7	14.9	0.3	0.3	1.4	14.8	1.7	14.0	0.8	0.8	3.3	1.7	4.5
Vernon Fire Station	56	13.2	0.7	**14.0**	-0.8	0.0	1.3	13.9	0.7	14.1	-0.2	0.0	1.3	13.8	0.7	14.9	-1.1	0.0	1.3	13.1	0.9	14.0	-0.9	0.0	1.7	0.0	2.8
Weatherhead Hollow Rd	57	12.5	0.6	**14.0**	-1.5	0.0	1.3	13.1	0.9	14.1	-1.1	0.0	1.8	13.9	0.8	14.9	-1.0	0.0	1.6	12.7	0.8	14.0	-1.3	0.0	1.5	0.0	3.1
Wilmington AOT Pole	58	13.8	0.6	**14.0**	-0.2	0.0	1.1	14.1	0.8	14.1	-0.1	0.0	1.5	14.9	0.6	14.9	0.0	0.0	1.1	14.4	1.1	14.0	0.4	0.4	2.1	0.4	3.0
Wilmington AOT (air sampler)	59	15.9	0.9	**14.0**	1.9	1.9	1.8	16.5	0.7	14.1	2.3	2.3	1.3	17.8	0.7	14.9	2.9	2.9	1.3	17.1	0.8	14.0	3.1	3.1	1.5	10.2	3.0
Windham County Court	60	14.9	0.9	**14.0**	0.9	0.9	1.8	15.3	0.9	14.1	1.2	1.2	1.7	16.5	1.0	14.9	1.6	1.6	2.0	14.8	0.8	14.0	0.8	0.8	1.6	4.5	3.6
Blodgett Farm	61	15.3	1.0	**14.0**	1.3	1.3	1.9	14.7	0.7	14.1	0.5	0.5	1.4	14.8	0.8	14.9	-0.1	0.0	1.5	13.5	0.9	14.0	-0.5	0.0	1.7	1.8	3.2
Fairman Road	62	13.8	0.6	**14.0**	-0.2	0.0	1.2	13.7	0.8	14.1	-0.4	0.0	1.5	15.1	0.7	14.9	0.2	0.2	1.4	13.5	1.2	14.0	-0.5	0.0	2.3	0.2	3.3

Table 11. 2012 Thermoluminescent Dosimeter Exposure Measurements and Net Gamma Radiation: Background Locations (continued)

2012 **Background** Dosimeter Exposure (milliroentgen)

Location	Map ID #	Qtr1 Gross	1SD Error	Avg Bkgrd	Qtr1 Net	Net >=0	2SD Error	Qrtr2 Gross	1SD Error	Avg Bkgrd	Qtr2 Net	Net >=0	2SD Error	Qrtr3 Gross	1SD Error	Avg Bkgrd	Qrtr3 Net	Net >=0	2SD Error	Qrtr4 Gross	1SD Error	Avg Bkgrd	Qtr4 Net	Net >=0	2SD Error	Annual Net	2SD Error
Huckle Hill Rd VT	63	15.6	0.6	**14.0**	1.6	1.6	1.3	16.5	0.9	14.1	2.3	2.3	1.7	17.8	0.9	14.9	2.9	2.9	1.7	16.6	1.7	14.0	2.6	2.6	3.2	9.4	4.2
Pond Rd & Houghton	64	13.2	0.7	**14.0**	-0.8	0.0	1.4	14.0	0.6	14.1	-0.2	0.0	1.2	14.8	0.7	14.9	-0.1	0.0	1.4	13.6	1.2	14.0	-0.4	0.0	2.4	0.0	3.3
Pond Rd/Vernon Rec	65	12.3	0.6	**14.0**	-1.7	0.0	1.2	12.3	0.6	14.1	-1.8	0.0	1.3	13.0	0.5	14.9	-1.9	0.0	1.0	12.1	1.0	14.0	-1.9	0.0	2.0	0.0	2.8
Rt 142 & Depot St	66	13.9	0.7	**14.0**	-0.1	0.0	1.5	14.0	1.1	14.1	-0.2	0.0	2.1	14.8	0.7	14.9	-0.1	0.0	1.4	14.0	1.5	14.0	0.0	0.0	3.0	0.0	4.2
Rt 142 & Newton Rd	67	12.2	0.6	**14.0**	-1.8	0.0	1.1	12.1	0.8	14.1	-2.1	0.0	1.6	13.2	0.5	14.9	-1.7	0.0	1.0	12.2	1.0	14.0	-1.8	0.0	1.9	0.0	2.9
Rt 142 & Pond Rd (S)	68	13.9	0.6	**14.0**	-0.1	0.0	1.2	13.9	0.9	14.1	-0.2	0.0	1.7	14.6	0.6	14.9	-0.3	0.0	1.2	13.7	1.1	14.0	-0.3	0.0	2.2	0.0	3.2
Route 5/Wolosko Rd	69	15.4	0.8	**14.0**	1.4	1.4	1.6	15.9	1.2	14.1	1.8	1.8	2.4	17.1	0.9	14.9	2.2	2.2	1.7	16.0	1.5	14.0	2.0	2.0	2.9	7.5	4.4
Rt 5/Andrews Cmtry	70	14.1	0.8	**14.0**	0.1	0.1	1.5	13.9	0.6	14.1	-0.3	0.0	1.2	15.3	0.7	14.9	0.4	0.4	1.4	14.1	1.5	14.0	0.1	0.1	2.8	0.6	3.7
Rt 5/Tkaczyk Frm Rd	71	14.4	0.9	**14.0**	0.4	0.4	1.7	14.2	1.0	14.1	0.1	0.1	2.0	15.0	0.6	14.9	0.1	0.1	1.2	14.5	1.0	14.0	0.5	0.5	1.9	1.0	3.5
West Rd/Edgewood	72	13.3	0.9	**14.0**	-0.7	0.0	1.8	13.9	0.6	14.1	-0.3	0.0	1.1	14.3	0.6	14.9	-0.6	0.0	1.1	13.7	1.0	14.0	-0.3	0.0	2.0	0.0	3.1
Average Background (Avg)				**14.0**						**14.1**						**14.9**						**14.0**				**57.0**	

Continuous Flow Air Sampling Results

The Health Department uses continuously operating air samplers to monitor the air near Vermont Yankee. They are located in Vernon, Guilford, Brattleboro, Dummerston and Wilmington. The locations of the air samplers are shown on Map 6. In 2011, to provide comparison, another air sampler was sited in Burlington at the Health Department.

Air filters are tested monthly for alpha- and beta-emitting materials and are then grouped quarterly to test for gamma-emitting materials. Air cartridges are collected and tested monthly for iodine-131 (I-131) and other gamma-emitting materials at the Health Department Laboratory. Data associated with the air filters, are provided in Appendix A. For 2012:

- 119 air cartridges were tested for iodine-131 and gamma-emitting materials.
- 119 air filters were tested for total alpha and beta radioactivity.
- 4 sets of air filters were grouped and tested for gamma-emitting materials.

Air Filter Total Alpha and Beta Radioactivity Results

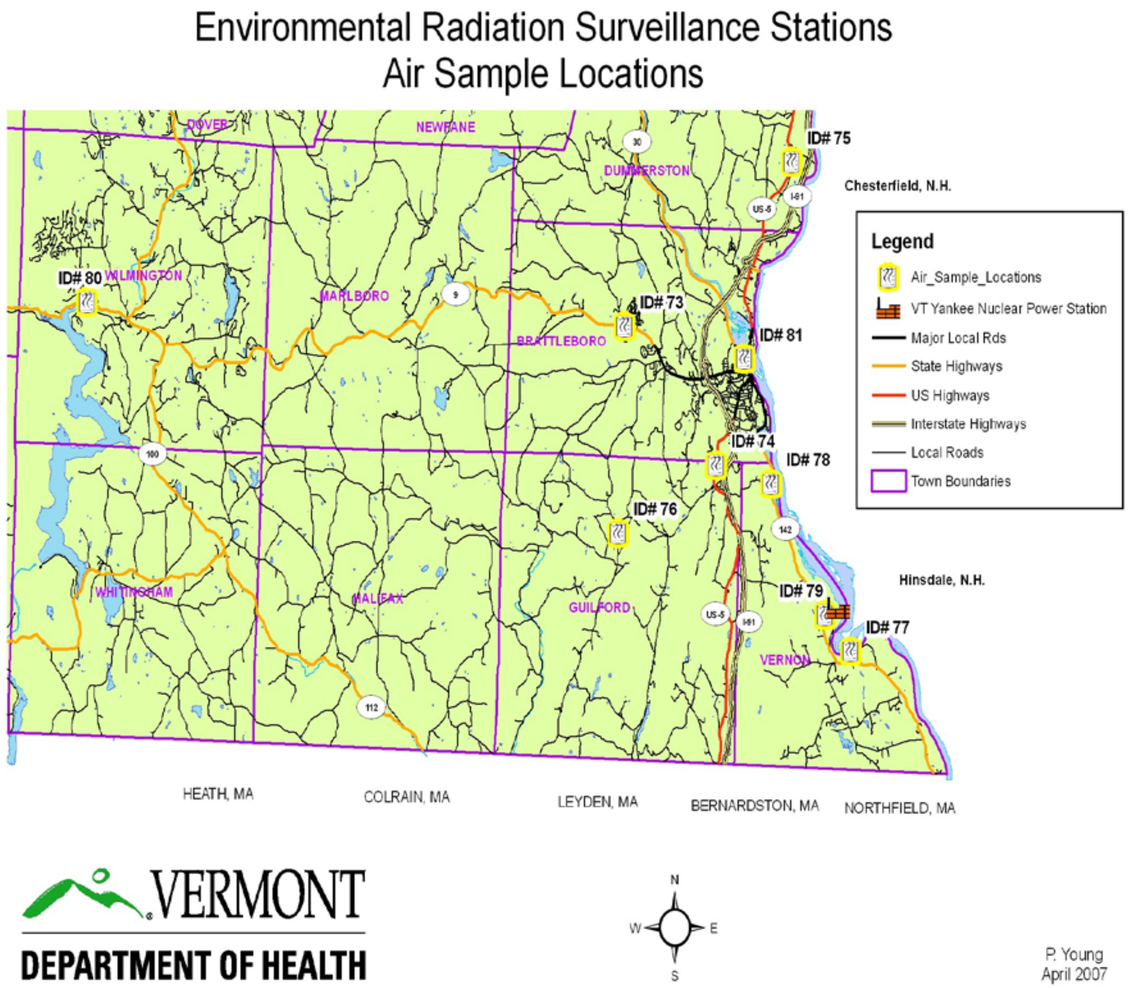
In 2012, the average result for total alpha radioactivity was 0.001473 picocuries per cubic meter (pCi/m^3). The 2012 average result for total beta radioactivity was 0.1300 pCi/m^3. The 2012 total alpha and beta radioactivity air filter results are presented in Appendix A.

Figures 2 and 3 show the average total alpha and beta radioactivity for the sample locations compared to the 2009, 2010 and 2011 results. Very low results that were uncertain because of noted collection problems were removed prior to calculating the average result. This is a conservative approach and results in an increased average.

Air Cartridge and Air Filter Gamma-Emitting Materials Results

No iodine-131 was detected in any air cartridge in 2012. Only naturally-occurring gamma-emitting were detected.

Map 6



Sample Location	Map ID	Sample Location	Map ID
D & E Tree	74	Vermont State Police-Brattleboro	73
Dummerston State Garage	75	Vernon Elementary School	79
Guilford Town Garage	76	Wilmington State Highway Garage	80
Power Line River Crossing	77	Windham County Courthouse	81
Renaud Brothers	78	108 Cherry St. Burlington	n/a

Figure 2. 2009-2012 Average Alpha Radioactivity in Air

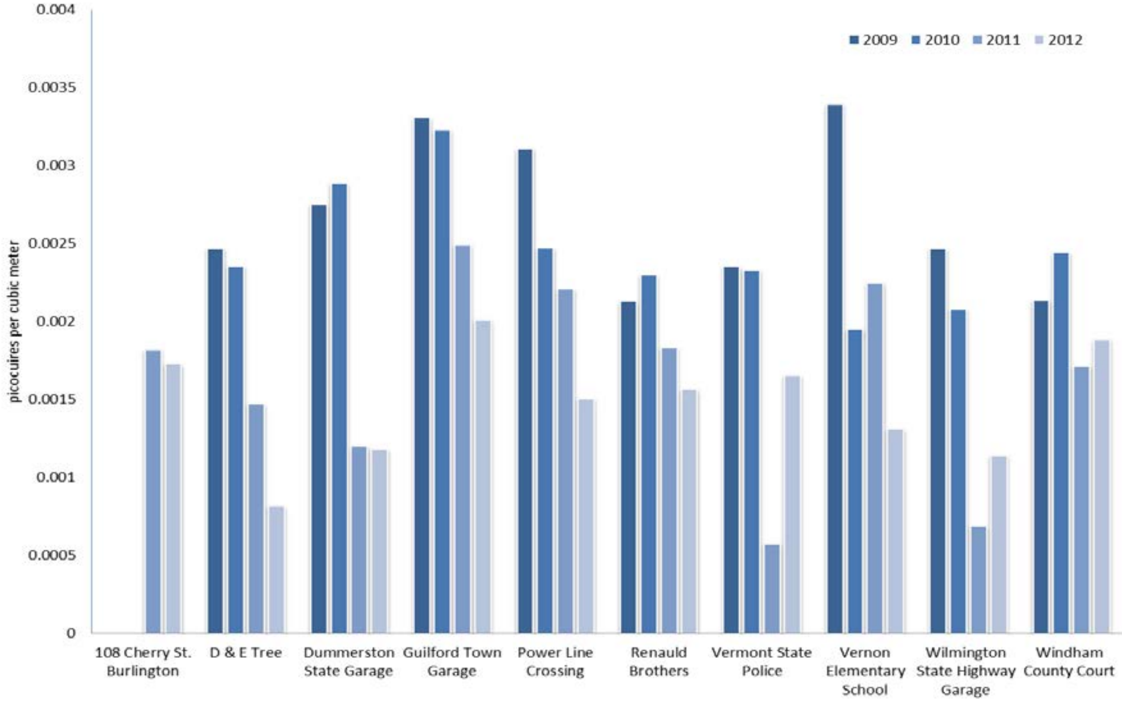


Figure 3. 2009-2012 Average Beta Radioactivity in Air

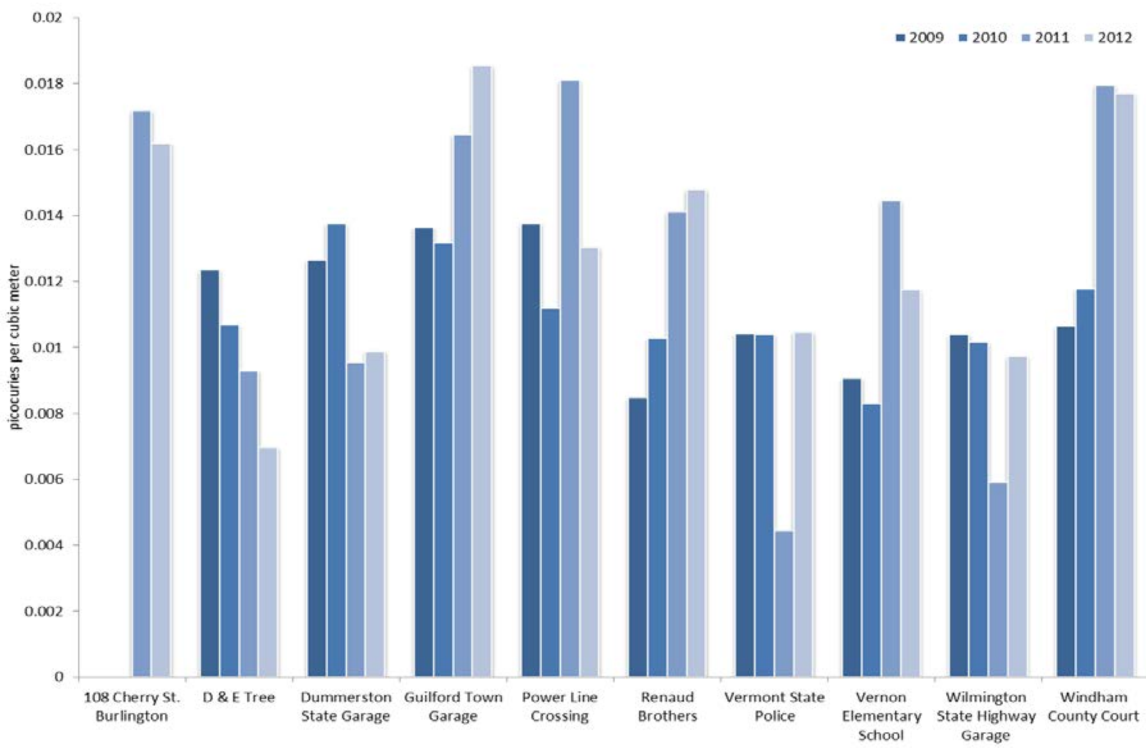


Table 12. 2012 Air Filter Composite Results (Gamma Spectroscopy)

Quarter	Last Date of Quarter	Element	Concentration +/- error (pCi)
1st Quarter	03/30/12	Beryllium-7	3740 +/- 340
2nd Quarter	6/30/12	Beryllium-7	4990 +/- 430
3rd Quarter	09/30/12	Beryllium-7	4360 +/- 390
4th Quarter	12/31/12	Beryllium-7	2550 +/- 260

In 2012, no alpha, beta or gamma radioactivity related to the operations of Vermont Yankee was identified in the continuous flow air samples. Results were within historical ranges.

Water Sampling Results

The Health Department has routinely collected off-site monthly water samples from six locations around Vermont Yankee. These routine water samples are tested for tritium, gamma-emitting materials, and total alpha and beta radioactivity. Collections are taken from drinking water wells (3), a public water supply (1) and the Connecticut River (2). These sample locations are shown on Map 7.

In addition, Vermont Yankee routinely collected at four Connecticut River sites monthly, stations 3-3, 3-4, 3-8 and the Discharge Forebay. These sample locations are shown in Map 8. Additional off-site samples are collected at private residences and a nursing home.

As a result of the tritium investigation, Vermont Yankee sampled on-site groundwater monitoring wells, on-site drinking water supplies, and an additional site in the Connecticut River next to where the plume was projected to enter the river. These on-site water sample sites are shown on Map 9. The Health Department received field duplicate water samples of these tritium-related monitoring sites. The Construction Office Building (COB) well, a well that had been used for drinking water until 2010, was also sampled in 2012.

Routine off-site water samples are tested for total alpha and beta radioactivity, gamma radioactivity and tritium. Water samples that were collected as a result of the tritium leak were tested by the Health Department for tritium and gamma-emitting materials. Other tests were performed by a contract laboratory and 144 water samples were sent to the contract laboratory as a quality control check for tritium and gamma spectroscopy tests. For 2012:

- 120 water samples were tested for total alpha and beta radioactivity.
- 883 water (ground, drinking, surface) samples were tested for tritium.
- 830 water samples were tested for gamma-emitting materials.

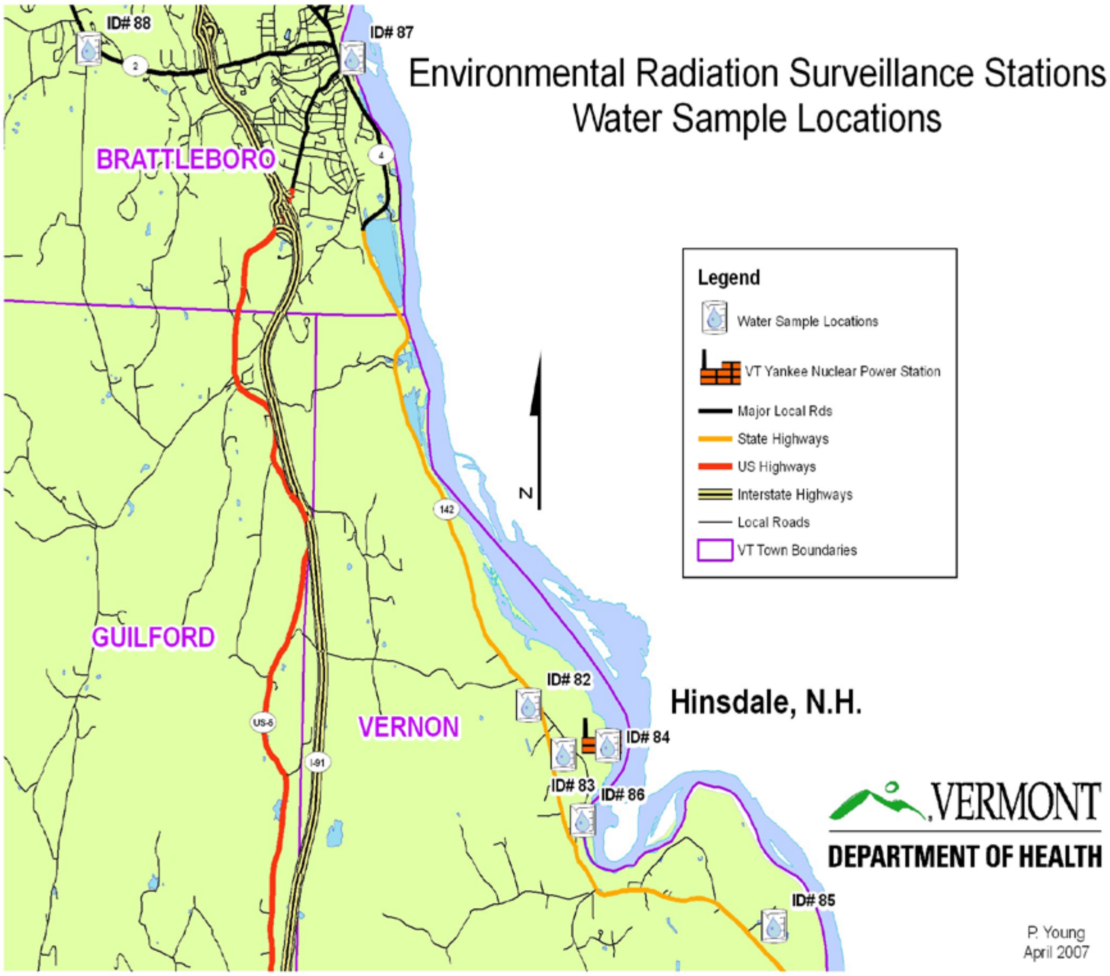
- 211 water samples were tested for hard-to-detect metals: iron-55, nickel-63, strontium-89, and strontium-90.

Due to the large number of results associated with tritium, gamma spectroscopy, and hard-to-detect analyses, the individual data for these tests are presented in Appendices B, C and D.

Water Total Alpha and Beta Radioactivity Results

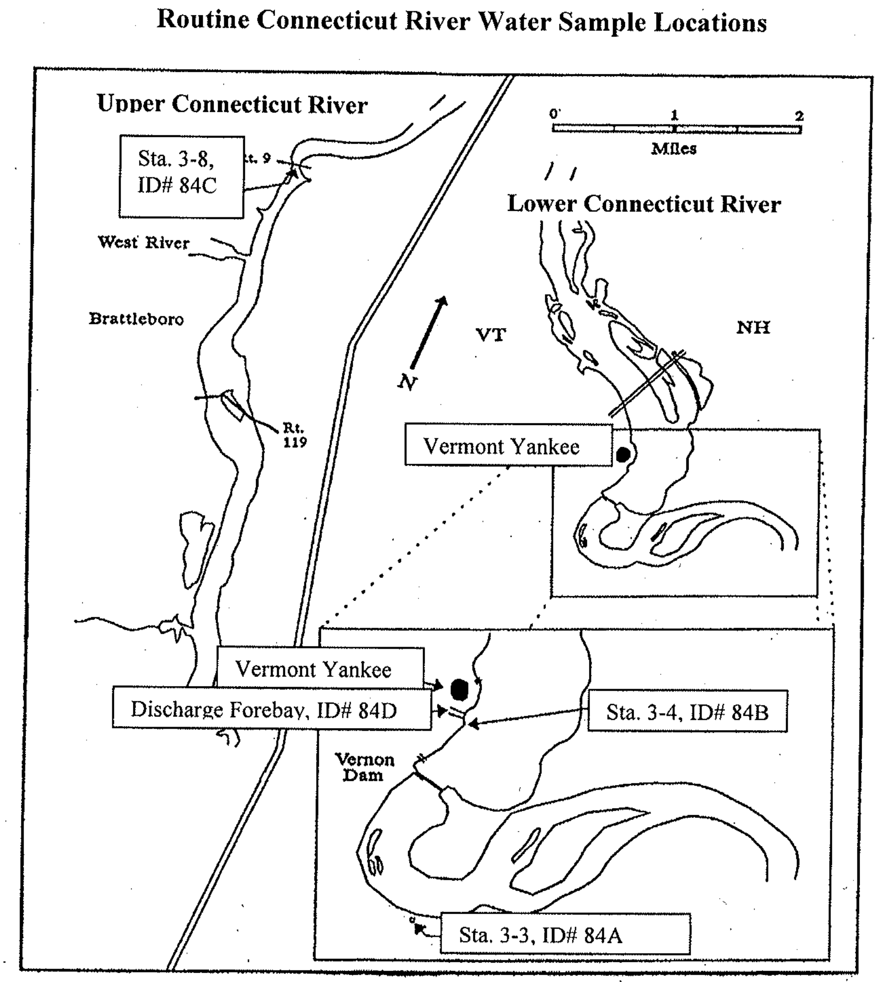
The alpha and beta radioactivity measured in the water samples is within the historical range for both types of radioactivity. Water alpha and beta radioactivity measurements around Vermont Yankee have both historically ranged from below the lower limit of detection to 15 picocuries per liter (pCi/L). The 2012 range for alpha radioactivity is -1.46 to 8.72 pCi/L. The 2012 range for beta radioactivity is from -0.14 to 8.56 pCi/L. Results from 2012 are presented in Table 14. Comparisons of 2009-2012 data are presented in Figures 4 and 5. Trends for both alpha and beta results are similar to past years: Vernon Elementary School and Blodgett Farm have historically had higher levels of natural radioactivity in the water.

Map 7



Sample Location	Map ID
Miller Farm	82
Vernon Elementary School	83
Blodgett Farm	85
Connecticut River, Downstream	86
Connecticut River, Upstream	87
Brattleboro Fire Dept., West Station	88

Map 8



Sample Location	Map ID
3-3 Connecticut River Station	84A
3-4 Connecticut River Station	84B
3-8 Connecticut River Station	84C
Discharge Forebay	84D

Table 13. 2012 Water Results for Total Alpha and Beta Radioactivity

Sample Location	Date of Sample	Total Alpha Radioactivity +/- error (pCi/L)	Total Beta Radioactivity +/- error (pCi/L)
3-3 Connecticut River Station	1/13/2012	-0.59 +/- 1.39	0.29 +/- 1.65
	2/16/2012	-0.59 +/- 1.49	1.58 +/- 1.67
	3/15/2012	0.00 +/- 1.44	3.36 +/- 1.64
	4/13/2012	0.79 +/- 1.38	0.73 +/- 1.62
	5/15/2012	-0.26 +/- 1.20	0.58 +/- 1.63
	6/13/2012	0.78 +/- 1.28	2.35 +/- 1.68
	7/16/2012	-0.27 +/- 1.35	1.72 +/- 1.68
	8/15/2012	0.86 +/- 1.42	0.86 +/- 1.41
	9/13/2012	0.28 +/- 1.40	3.80 +/- 1.40
	10/16/2012	1.08 +/- 1.43	2.86 +/- 1.11
	11/15/2012	1.27 +/- 1.22	2.66 +/- 1.06
	12/13/2012	0.54 +/- 1.36	0.72 +/- 1.35
3-4 Connecticut River Station	1/13/2012	0.61 +/- 1.54	0.86 +/- 1.66
	2/16/2012	-1.46 +/- 1.41	1.15 +/- 1.66
	3/15/2012	0.76 +/- 1.35	3.50 +/- 1.64
	4/13/2012	0.00 +/- 1.42	1.60 +/- 1.65
	5/15/2012	0.53 +/- 1.27	1.30 +/- 1.65
	6/13/2012	1.11 +/- 1.39	2.64 +/- 1.69
	7/16/2012	1.08 +/- 1.43	1.29 +/- 1.67
	8/15/2012	0.30 +/- 1.45	0.74 +/- 1.40
	9/13/2012	1.10 +/- 1.42	2.32 +/- 1.36
	10/16/2012	1.05 +/- 1.39	3.15 +/- 1.12
	11/15/2012	2.05 +/- 1.29	2.07 +/- 1.04
	12/13/2012	0.79 +/- 0.83	1.03 +/- 0.70
3-8 Connecticut River Station	1/13/2012	0.90 +/- 0.81	0.21 +/- 0.83
	2/16/2012	0.35 +/- 0.63	0.63 +/- 0.97
	3/15/2012	-0.32 +/- 0.8	1.77 +/- 1.08
	4/13/2012	0.78 +/- 1.37	2.03 +/- 1.66
	5/15/2012	3.07 +/- 1.62	3.04 +/- 1.70
	6/13/2012	0.82 +/- 1.35	2.64 +/- 1.69
	7/16/2012	-0.27 +/- 1.36	2.15 +/- 1.69
	8/15/2012	0.00 +/- 1.35	1.72 +/- 1.43
	9/13/2012	0.00 +/- 1.31	3.06 +/- 1.38
	10/16/2012	0.27 +/- 1.38	1.77 +/- 1.08
	11/15/2012	0.89 +/- 0.63	0.79 +/- 0.51
	12/13/2012	0.52 +/- 0.67	0.78 +/- 0.69

Table 13. 2012 Total Alpha and Beta Radioactivity Water Results (continued)

Sample Location	Date of Sample	Total Alpha Radioactivity +/- error (pCi/L)	Total Beta Radioactivity +/- error (pCi/L)
Blodgett Farm	1/10/2012	4.16 +/- 1.02	6.57 +/- 1.82
	2/7/2012	4.89 +/- 1.11	6.05 +/- 1.8
	3/6/2012	3.82 +/- 1.06	6.58 +/- 1.73
	4/3/2012	4.22 +/- 1.09	6.12 +/- 1.78
	5/8/2012	4.05 +/- 1.17	6.24 +/- 1.79
	6/5/2012	4.31 +/- 0.87	4.85 +/- 4.85
	7/10/2012	4.56 +/- 0.92	4.30 +/- 1.75
	8/7/2012	4.09 +/- 0.91	4.82 +/- 1.53
	9/11/2012	3.90 +/- 0.88	4.09 +/- 1.43
	10/8/2012	4.47 +/- 1.14	6.41 +/- 1.23
	11/6/2012	8.10 +/- 1.33	4.91 +/- 1.15
	12/4/2012	2.78 +/- 0.83	3.90 +/- 1.46
Brattleboro Fire Dept, West Station	1/10/2012	1.16 +/- 1.52	0.86 +/- 1.66
	2/7/2012	-0.17 +/- 0.87	1.08 +/- 0.85
	3/6/2012	-0.26 +/- 1.31	1.26 +/- 1.58
	4/3/2012	0.25 +/- 1.30	2.33 +/- 1.67
	5/8/2012	0.00 +/- 1.24	1.88 +/- 1.67
	6/5/2012	1.06 +/- 1.34	2.64 +/- 1.69
	7/10/2012	1.36 +/- 1.46	-0.14 +/- 1.62
	8/7/2012	0.80 +/- 1.33	0.37 +/- 1.39
	9/11/2012	0.44 +/- 0.78	2.45 +/- 0.72
	10/8/2012	-0.51 +/- 1.26	1.77 +/- 1.08
	11/6/2012	1.85 +/- 1.31	2.76 +/- 1.07
	12/4/2012	0.00 +/- 0.75	1.21 +/- 0.7
Connecticut River Downstream	1/10/2012	2.65 +/- 1.65	2.42 +/- 1.71
	2/7/2012	-0.89 +/- 1.48	4.03 +/- 1.74
	3/6/2012	3.31 +/- 1.75	4.34 +/- 1.67
	4/3/2012	1.55 +/- 1.40	2.62 +/- 1.68
	5/8/2012	1.08 +/- 1.32	1.16 +/- 1.65
	6/5/2012	0.82 +/- 1.36	3.08 +/- 1.71
	7/10/2012	1.71 +/- 1.55	2.43 +/- 1.70
	8/7/2012	2.85 +/- 1.54	2.70 +/- 1.46
	9/11/2012	0.85 +/- 1.44	3.80 +/- 1.40
	10/8/2012	0.00 +/- 1.40	1.87 +/- 1.08
	11/6/2012	0.75 +/- 1.17	2.65 +/- 1.06
	12/4/2012	1.05 +/- 1.37	1.93 +/- 1.39

Table 13. 2012 Total Alpha and Beta Radioactivity Water Results (continued)

Sample Location	Date of Sample	Total Alpha Radioactivity +/- error (pCi/L)	Total Beta Radioactivity +/- error (pCi/L)
Connecticut River Upstream	1/10/2012	2.33 +/- 1.60	1.71 +/- 1.69
	2/7/2012	-0.86 +/- 2.16	2.02 +/- 1.69
	3/6/2012	0.57 +/- 1.51	0.98 +/- 1.57
	4/3/2012	5.62 +/- 1.82	5.82 +/- 1.77
	5/8/2012	2.55 +/- 1.48	1.74 +/- 1.66
	6/5/2012	1.97 +/- 1.47	2.64 +/- 1.69
	7/10/2012	0.27 +/- 1.40	1.58 +/- 1.67
	8/7/2012	1.12 +/- 1.41	0.74 +/- 1.40
	9/11/2012	0.00 +/- 1.41	2.21 +/- 1.36
	10/8/2012	0.55 +/- 1.42	1.97 +/- 1.09
	11/6/2012	3.43 +/- 1.51	4.65 +/- 1.51
	12/4/2012	1.10 +/- 1.43	1.69 +/- 1.38
Discharge Forebay	1/13/2012	2.29 +/- 1.58	1.14 +/- 1.67
	2/16/2012	0.00 +/- 1.47	1.58 +/- 1.67
	3/15/2012	1.29 +/- 1.41	2.1 +/- 1.60
	4/13/2012	1.08 +/- 1.43	2.62 +/- 1.68
	5/15/2012	0.54 +/- 1.30	0.87 +/- 1.64
	6/13/2012	0.54 +/- 1.33	1.91 +/- 1.67
	7/16/2012	0.00 +/- 1.35	2.00 +/- 1.69
	8/15/2012	0.00 +/- 1.38	0.74 +/- 1.40
	9/13/2012	-0.27 +/- 1.30	2.20 +/- 1.35
	10/16/2012	1.03 +/- 1.37	1.48 +/- 1.07
	11/15/2012	1.03 +/- 1.23	0.30 +/- 0.99
	12/13/2012	0.64 +/- 0.83	1.27 +/- 0.71
Miller Farm	1/10/2012	0.42 +/- 0.72	8.56 +/- 1.87
	2/7/2012	-0.21 +/- 0.72	6.62 +/- 1.81
	3/6/2012	-0.04 +/- 0.75	2.94 +/- 1.63
	4/3/2012	-0.36 +/- 0.72	2.91 +/- 1.69
	5/8/2012	0.16 +/- 0.86	6.52 +/- 1.80
	6/5/2012	0.71 +/- 0.52	3.23 +/- 1.71
	7/10/2012	0.47 +/- 0.54	3.58 +/- 1.73
	8/7/2012	0.27 +/- 0.52	5.16 +/- 1.53
	9/11/2012	0.80 +/- 0.66	5.88 +/- 1.46
	10/8/2012	0.38 +/- 0.47	3.85 +/- 1.14
	11/6/2012	0.94 +/- 0.80	3.66 +/- 1.10
	12/4/2012	0.15 +/- 0.50	3.03 +/- 1.42

Table 13. 2012 Total Alpha and Beta Radioactivity Water Results (continued)

Sample Location	Date of Sample	Total Alpha Radioactivity +/- error (pCi/L)	Total Beta Radioactivity +/- error (pCi/L)
Vernon Elementary School	1/10/2012	5.71 +/- 1.12	4.71 +/- 1.77
	2/7/2012	4.32 +/- 1.08	4.17 +/- 1.75
	3/6/2012	5.06 +/- 1.14	5.32 +/- 1.70
	4/3/2012	5.63 +/- 1.14	7.71 +/- 1.82
	5/8/2012	6.97 +/- 1.36	5.65 +/- 1.78
	6/5/2012	8.08 +/- 1.17	6.17 +/- 1.79
	7/10/2012	6.74 +/- 1.10	6.02 +/- 1.80
	8/7/2012	7.18 +/- 1.15	6.05 +/- 1.56
	9/11/2012	5.93 +/- 1.03	4.55 +/- 1.43
	10/8/2012	8.64 +/- 1.22	7.16 +/- 1.24
	11/6/2012	8.72 +/- 1.37	6.37 +/- 1.18
	12/4/2012	6.97 +/- 1.13	4.50 +/- 1.47

Figure 4. 2009-2012 Average Alpha Radioactivity in Water

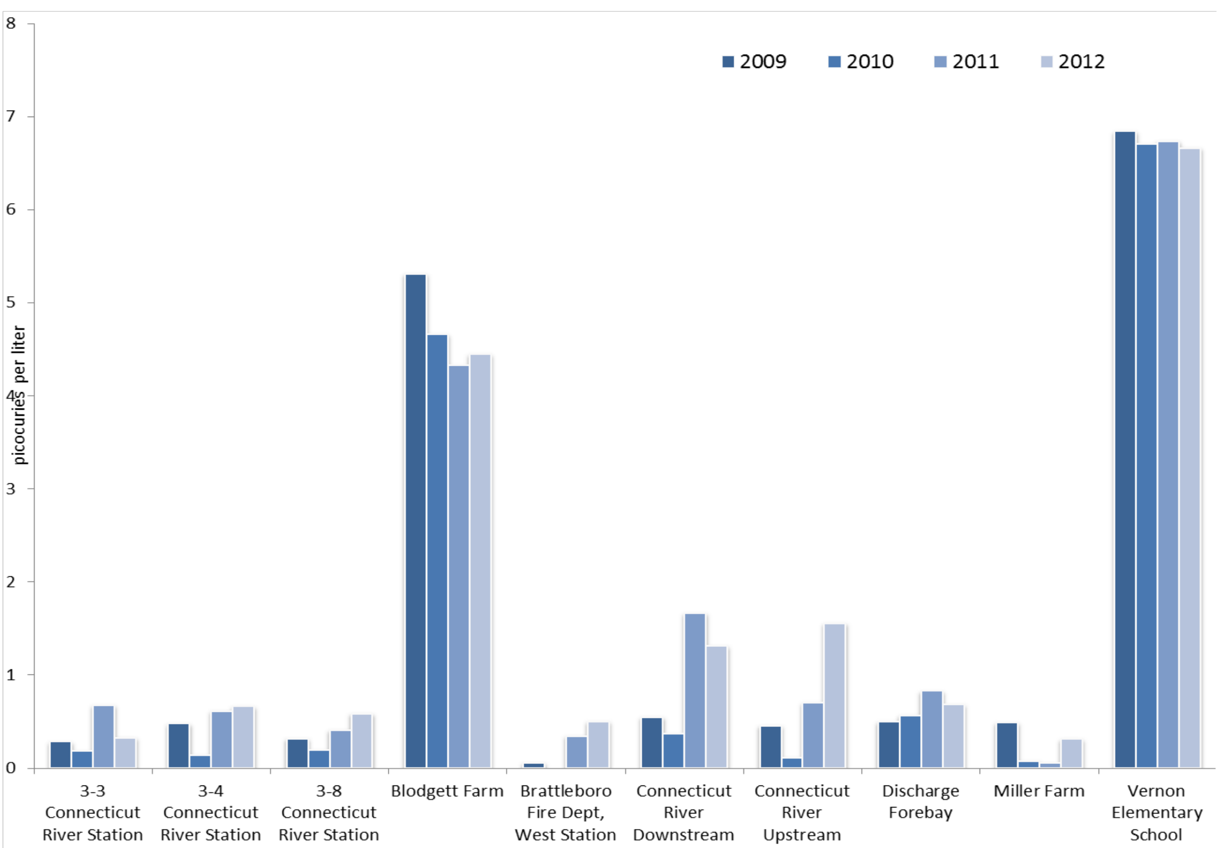
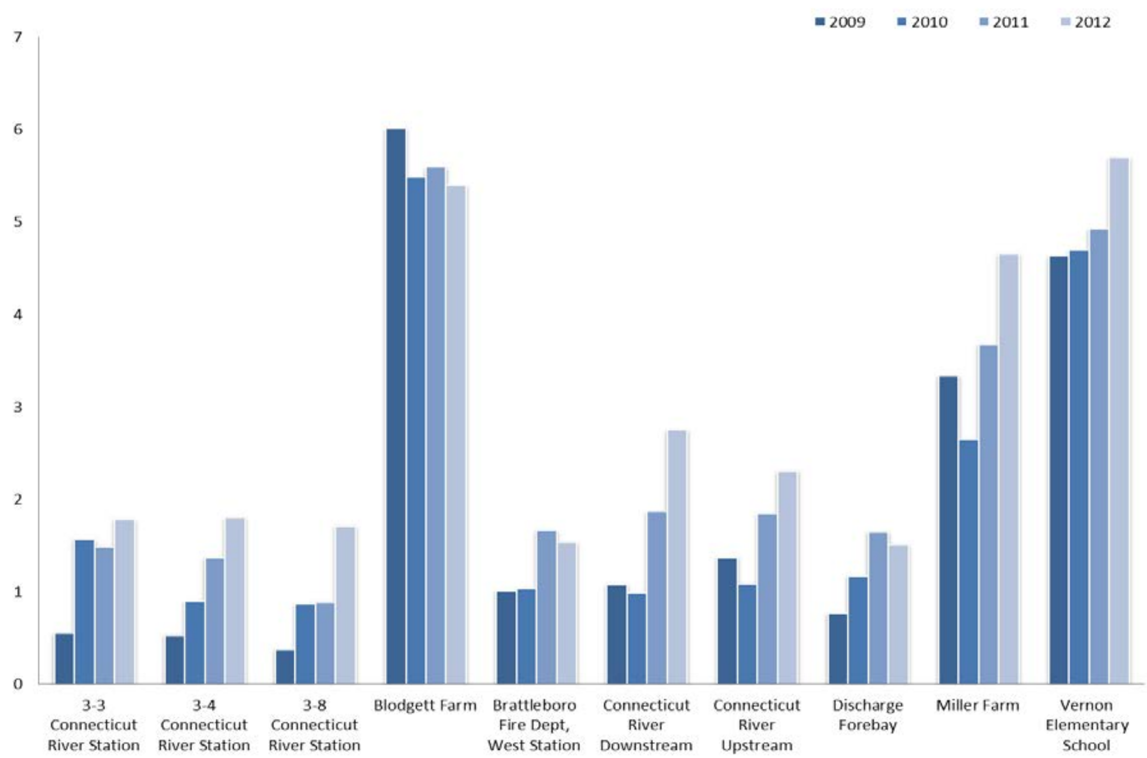


Figure 5. 2009-2012 Average Beta Radioactivity in Water



Water Gamma Spectroscopy Results

A total of 830 drinking, ground and surface (Connecticut River) water samples collected from both on and off-site locations in 2012 for gamma-emitting materials. No radioactive materials other than naturally-occurring were identified in any water sample collected in 2012. The Health Department calculated limits of detection for gamma-emitting materials are listed in Table 8. All results are presented in Appendix C.

Water Tritium Results

In 2012, the Health Department had 883 drinking, ground and surface (Connecticut River) water samples tested from both on and off-site locations for tritium. The maximum tritium concentration measured was 88,300 picocuries per liter (pCi/L) in well GZ-15 in July 2012. This well's tritium concentration declined to 72,800 pCi/L by December 2012.

Tritium concentrations over time, as measured by groundwater well results, generally decreased over the year. The highest concentration of tritium at the year's end was GZ-15.

No tritium was detected from any off-site water sample or any on-site active drinking water sample. In 2012, the Health Department detected tritium in one Connecticut River sample. This sample was collected at the interface of the soil and water. No measurable detections were observed in any downstream water samples. The Health Department Laboratory's lower limit of detection for tritium is 500 picocuries per liter.

A brief summary of tritium results by each sampling location is presented in Table 14. Graphs demonstrating the trends in tritium concentrations in groundwater monitoring wells are presented in Figures 6-10. All tritium data are presented in Appendix B.

Map 9

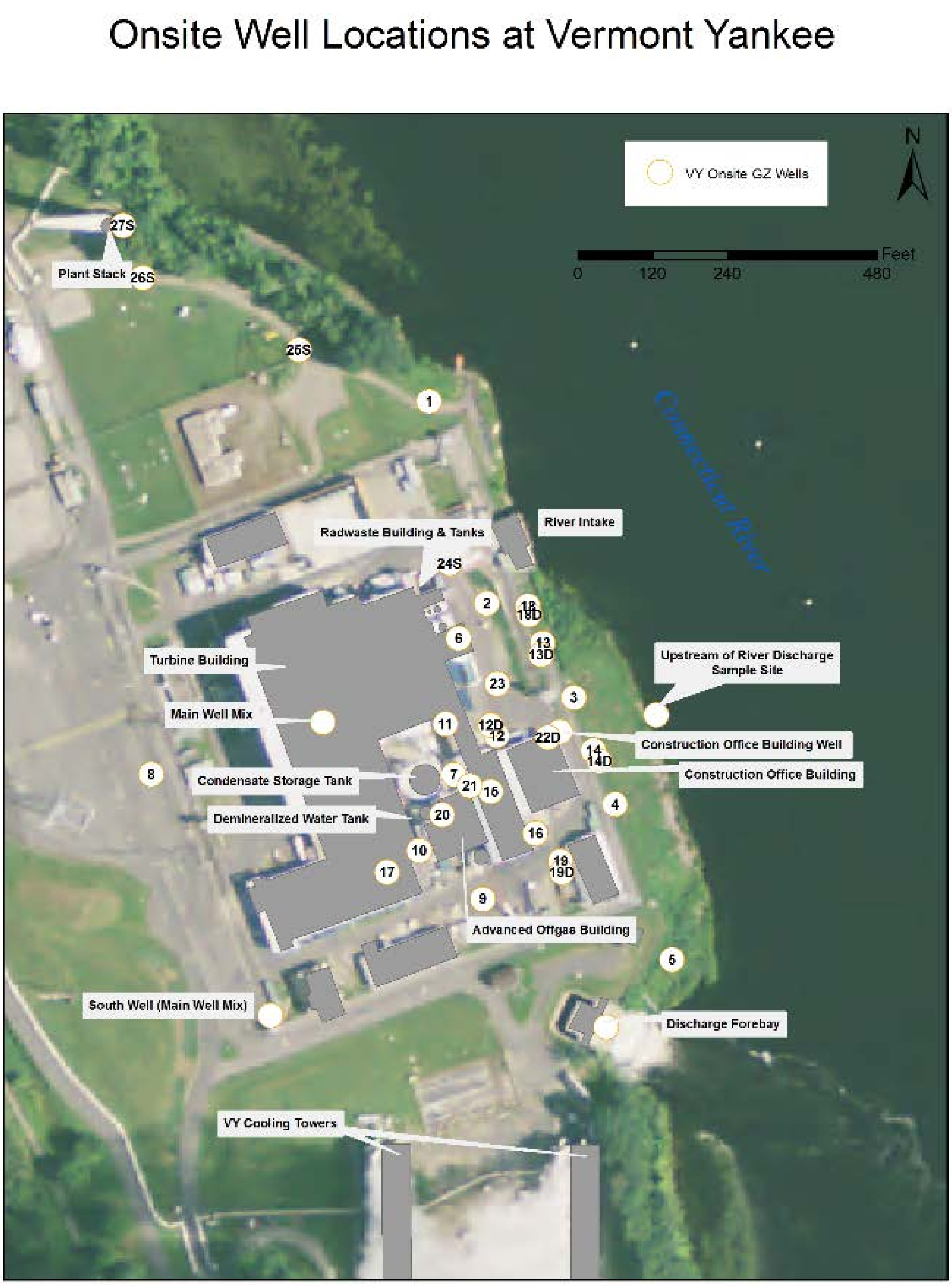

Onsite Well Locations at Vermont Yankee
VY Onsite GZ Wells
N
0 120 240 480 Feet
Connecticut River
27S
Plant Stack
26S
25S
1
River Intake
Radwaste Building & Tanks
24S
2
18
18D
6
13
13D
Turbine Building
Upstream of River Discharge Sample Site
23
3
Main Well Mix
11
12D
12
22D
Construction Office Building Well
14
14D
Construction Office Building
8
Condensate Storage Tank
7
21
15
4
Demineralized Water Tank
20
16
10
19
19D
17
9
Advanced Offgas Building
5
South Well (Main Well Mix)
Discharge Forebay
VY Cooling Towers

Table 14. 2012 Vermont Yankee Groundwater Wells, Tritium Detected

Monitoring Well	Range of tritium concentration in well (pCi/L) Jan-2012		Dec-2012	Trend of Tritium Concentration in 2012
GZ-03	896	to	591	relatively steady
GZ-04	4,020	to	< 500	decreased
GZ-06	707	to	<500	decreased
GZ-07	723	to	<500	decreased
GZ-11	<500	to	<500	relatively steady
GZ-12S	<500	to	1270	increased
GZ-12D	33,000	to	25,200	decreased
GZ-13D	964	to	879	relatively steady
GZ-14S	38,500	to	35,900	increased to 80,600 pCi/L and then decreased
GZ-14D	11,300	to	15,000	increased slightly
GZ-15	71,500	to	72,800	increased to 88,300 pCi/L and then decreased
GZ-18D	<500	to	609	relatively steady
GZ-21	6,410	to	1,840	decreased
GZ-22D	72,100	to	29,600	decreased
GZ-23S	<500	to	1,480	relatively steady

[a] Ranges presented are from tests performed at the Health Department Laboratory.
< LLD means less than the laboratory's lower limit of detection

Table 15. 2012 Water Sample Locations, Number of TritiumTests

Wells near Vermont Yankee		Connecticut River Sample Sites	
Blodgett Farm	24	Upstream of the VY River Discharge	44
Brattleboro Fire Department, West Station	24	3-3 Connecticut River Station	12
Miller Farm	24	3-4 Connecticut River Station	12
Residence - 1	23	3-8 Connecticut River Station	12
Vernon Elementary School	24	Discharge Forebay	12
Vernon Green Nursing Home	25	Connecticut River Upstream	23
White House	23	Connecticut River Downstream	26
Copeland Well	1		
On-site Wells			
GZ-01	6	GZ-18S	12
GZ-02	12	GZ-19D	5
GZ-03	28	GZ-19S	5
GZ-04	12	GZ-20	12
GZ-05	8	GZ-21	28
GZ-06	28	GZ-22D	28
GZ-07	28	GZ-23S	12
GZ-09	12	GZ-24S	28
GZ-10	12	GZ-25S	12
GZ-11	12	GZ-26S	11
GZ-12D	28	GZ-27S	12
GZ-12S	12	WVN0201	4
GZ-13D	12	WVN0202	4
GZ-13S	12	WVN0203	4
GZ-14D	28	WVN0204	4
GZ-14S	28	Main Well	25
GZ-15	25	Plant Support Building	24
GZ-16	12	Southwest Well	3
GZ-17	11	COB well (offline)	2
GZ-18D	12	**Total number of samples tested for tritium**	
* 1 sample tested from Mendon AOT as a part of training		**883**	

Figure 6. 2012 Tritium in Groundwater Monitoring Wells: GZ-03, GZ-04, GZ-14S

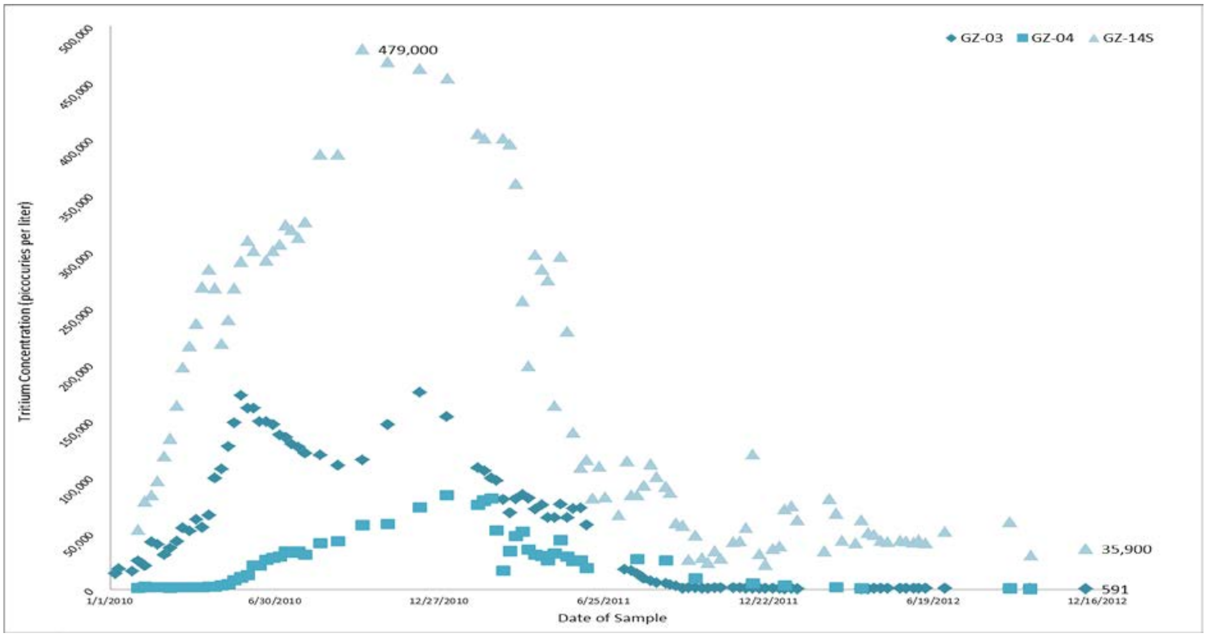


Figure 7. 2012 Tritium in Groundwater Monitoring Wells: GZ-07, GZ-15, GZ-21

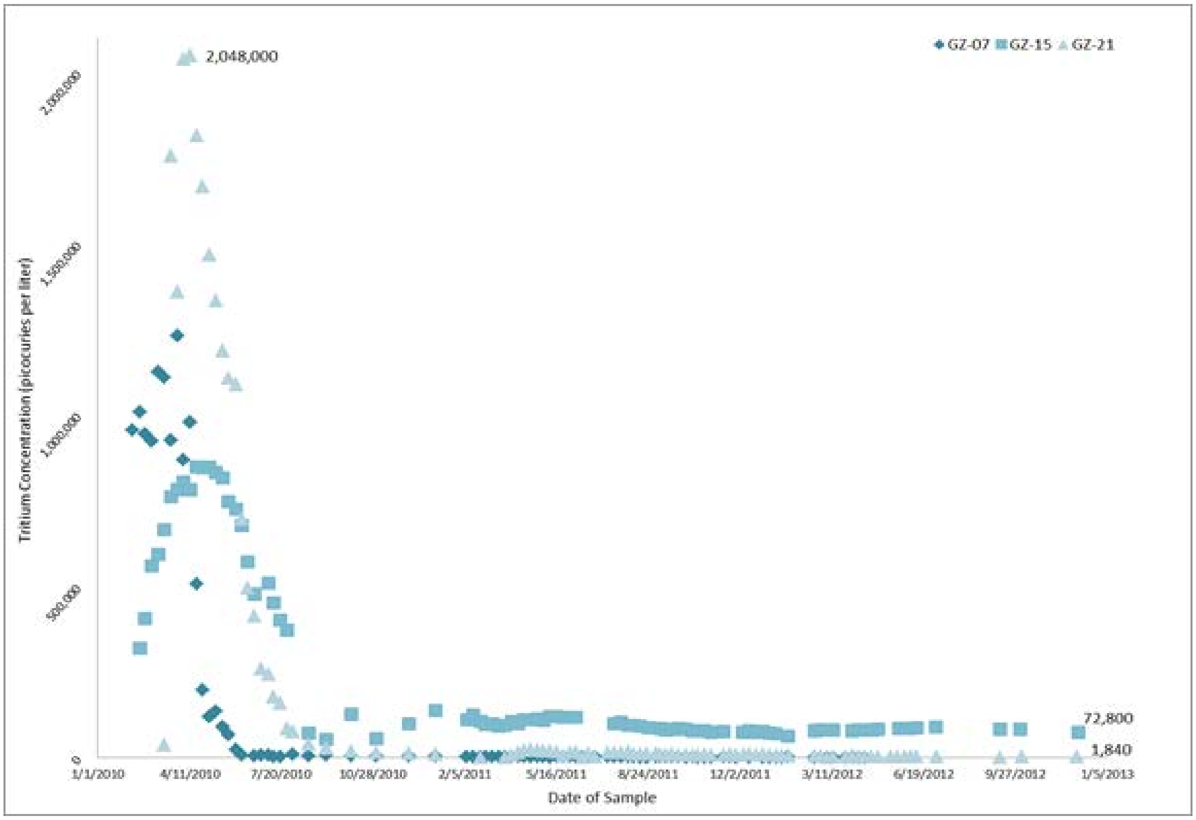


Figure 8. 2012 Tritium in Groundwater Monitoring Wells: GZ-12D, GZ-22D

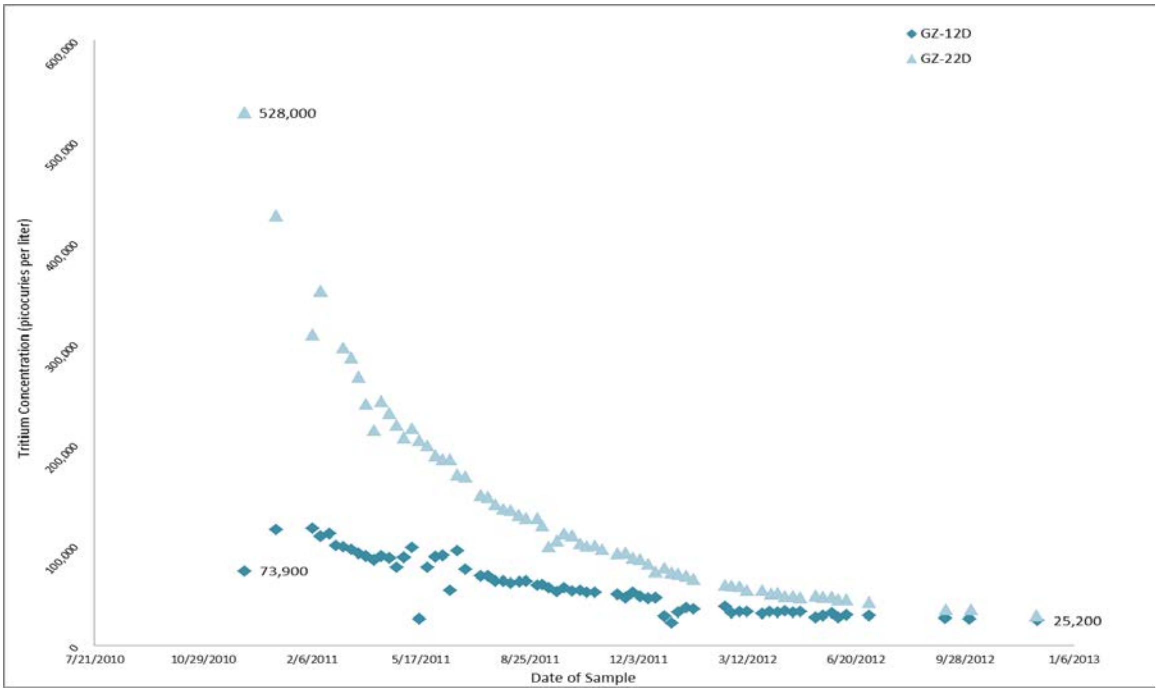


Figure 9. 2012 Tritium in Groundwater Monitoring Wells: GZ-12S, GZ-20

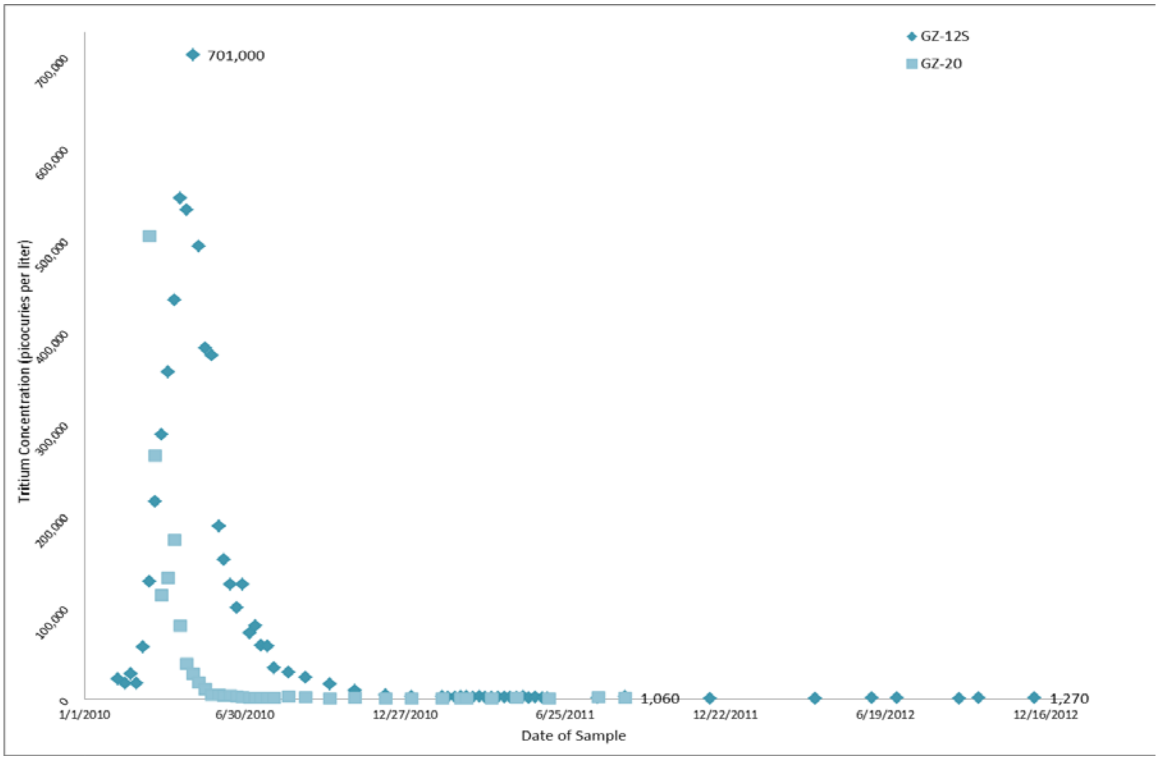
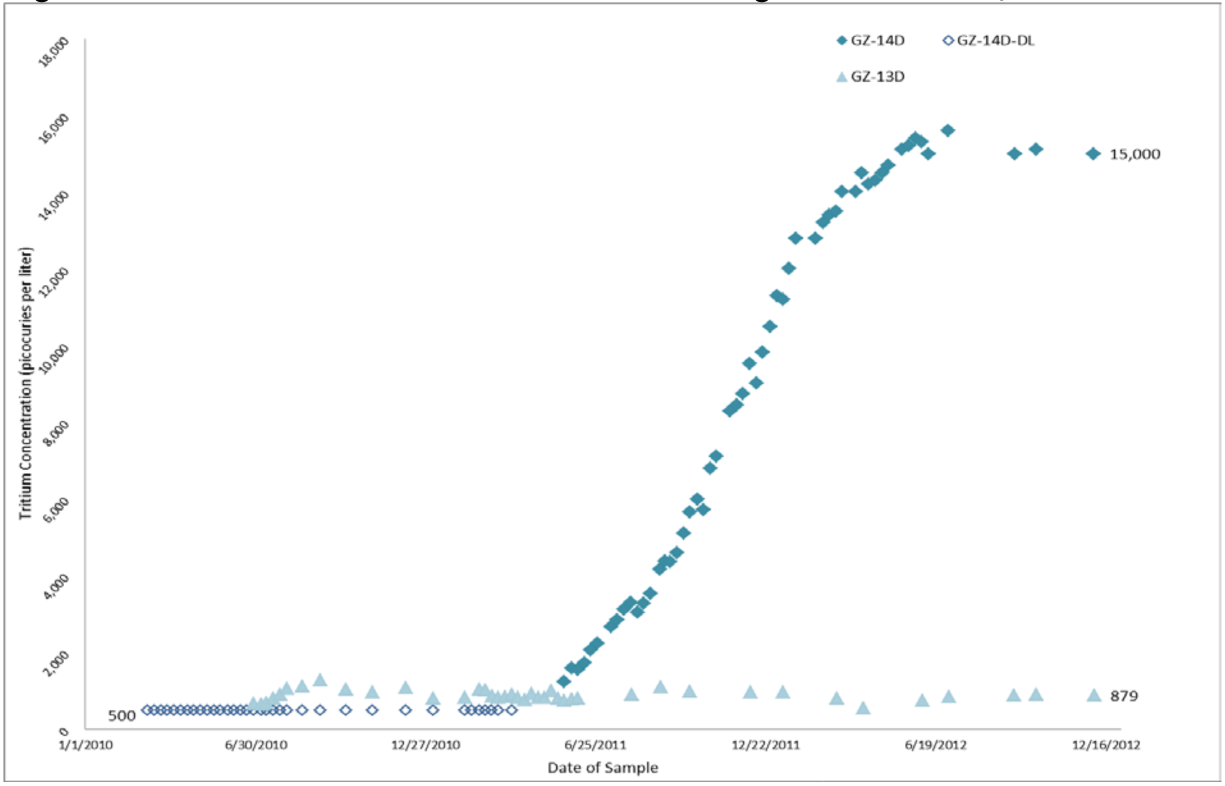


Figure 10. 2012 Tritium in Groundwater Monitoring Wells: GZ-13D, GZ-14D



Hard-to-Detect Results

This is the third year that tests for hard-to-detect metals, iron-55, nickel-63, strontium-89 and strontium-90, have been done by the Health Department. Quarterly water samples taken from each water sampling location were submitted to a contract laboratory for testing. Results for hard-to-detect samples are provided in Appendix D. Of the 209 water samples tested, no iron-55, nickel-63, strontium-89, or strontium-90 was detected

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In 2012, all off-site water sample locations showed no dose impact of operations at Vermont Yankee for total alpha, total beta, tritium, gamma spectroscopy, and hard-to-detect radioactive elements. In 2012, as in 2010, the one human-made radioactive element that has been measured in water samples is tritium from on-site water sources. The levels of tritium detected show a groundwater plume traveling from the source of the leaks to the Connecticut River. The dose associated with the tritium-contaminated plume in 2012 at Vermont Yankee did not measurably increase the dose from liquid effluents (discharges) to any member of the general public.

Food Chain Sampling Results

Monitoring the food chain involves direct monitoring of some foods such as milk, cultivated vegetation and fish. It also involves testing the soil and sediment that support land and aquatic species, and natural vegetation like grass, ferns and fungi. In 2012, a study to assess background levels of radioactivity in fish was done using fish collected in Rutland County.

For 2012:

- 20 milk samples were tested for iodine-131 and gamma-emitting materials.
- 36 Connecticut River sediment samples were tested for gamma-emitting materials.
- 5 environmental soil samples were tested for gamma-emitting materials.
- 9 vegetation samples were tested for gamma-emitting materials.
- 10 fish samples collected in the Connecticut River were tested for gamma-emitting materials, iron-55, nickel-63, strontium-89 and strontium-90.
- 47 fish samples collected in Rutland County were tested for strontium-90 and gamma-emitting materials.

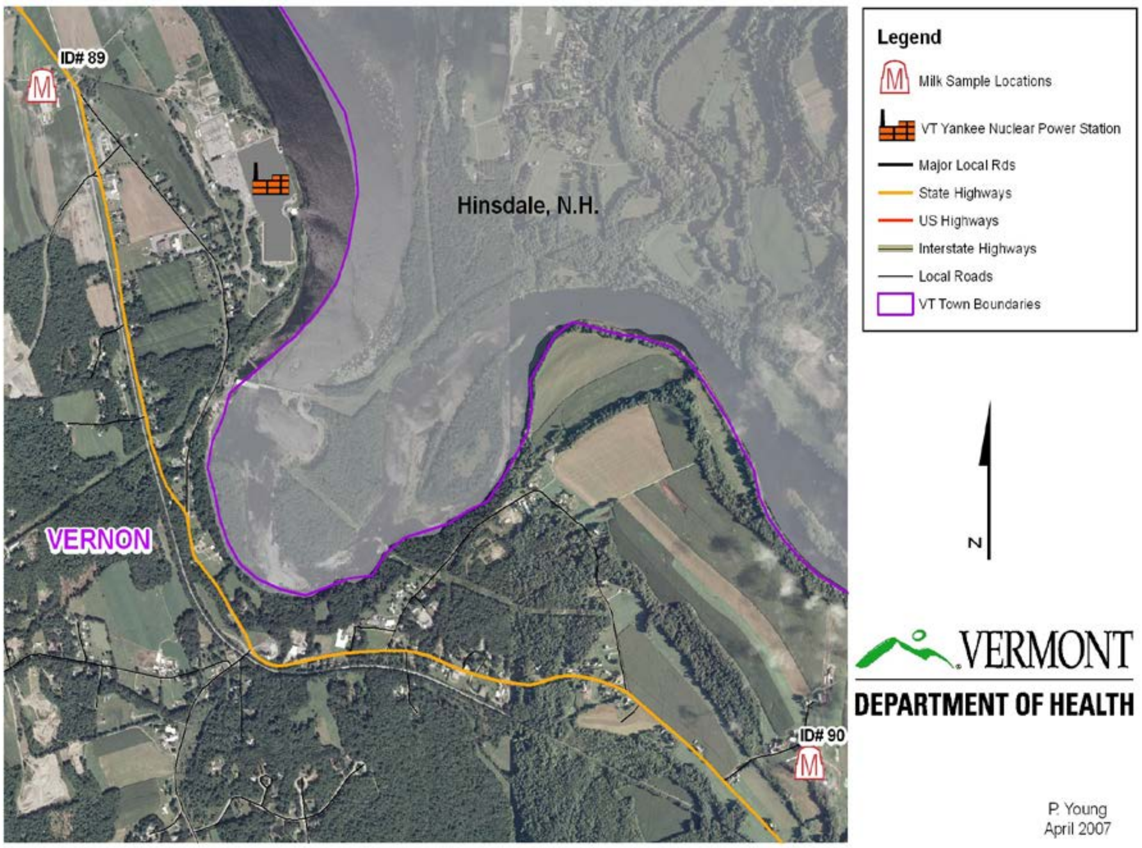
Milk Sample Results

Cows' raw milk is sampled monthly from two farms in Vernon. One farm is about one-half mile north of Vermont Yankee and the other is about three miles south of Vermont Yankee. Map 10 shows the location of these two dairy farms.

Potassium-40 (K-40) was the only radioactive material found in milk samples. Potassium-40 is a primordial radioactive material. Primordial radioactive materials are those created with the formation of the earth. Potassium-40 has a half-life of 1.28 billion years. In 2012 potassium-40 was detected in all milk samples. Results are shown in Table 16. The potassium-40 results for all milk samples ranged from 1,310 to 1,510 picocuries per liter (pCi/L), and fall within the historical range of 1,200 to 2,000 pCi/L. The average potassium-40 result in 2012 was 1,380 pCi/L. No iodine-131 was found in any milk sample in 2012.

Map 10

Environmental Radiation Surveillance Stations
Milk Sample Locations



Sample Location	Map ID
Miller Farm	89
Blodgett Farm	90

Table 16. 2012 Milk Iodine-131 and Gamma Spectroscopy Results

Sample Location	Date of Sample	Iodine-131 Result	Gamma Spectrometry Result	Potassium-40 Result +/- error (pCi/L)
Blodgett Farm	1/10/2012	< LLD	Natural	1400 +/- 240
Miller Farm	1/10/2012	< LLD	Natural	1400 +/- 240
Blodgett Farm	2/7/2012	< LLD	Natural	1410 +/- 240
Blodgett Farm	3/6/2012	< LLD	Natural	1350 +/- 230
Miller Farm	3/6/2012	< LLD	Natural	1320 +/- 230
Blodgett Farm	4/3/2012	< LLD	Natural	1430 +/- 250
Miller Farm	4/3/2012	< LLD	Natural	1380 +/- 240
Blodgett Farm	5/8/2012	< LLD	Natural	1320 +/- 230
Miller Farm	5/8/2012	< LLD	Natural	1380 +/- 240
Blodgett Farm	6/5/2012	< LLD	Natural	1370 +/- 240
Miller Farm	6/5/2012	< LLD	Natural	1360 +/- 240
Miller Farm	7/10/2012	< LLD	<LLD	1510 +/- 260
Miller Farm	8/7/2012	< LLD	Natural	1350 +/- 230
Blodgett Farm	9/11/2012	< LLD	Natural	1370 +/- 240
Miller Farm	9/11/2012	< LLD	Natural	1360 +/- 240
Blodgett Farm	10/8/2012	< LLD	Natural	1380 +/- 240
Miller Farm	10/8/2012	< LLD	Natural	1310 +/- 230
Miller Farm	11/6/2012	< LLD	Natural	1490 +/- 260
Blodgett Farm	12/4/2012	< LLD	Natural	1320 +/- 230
Miller Farm	12/4/2012	< LLD	Natural	1460 +/- 250

< LLD = Less than the laboratory's Lower Limit of Detection
Natural = gamma-emitting materials measured are not related to nuclear reactions

Vegetation and Soil Sample Results

Five soil samples were collected in the state. The results are shown in Table 17. The soil contained measurable amounts of potassium-40 and cesium-137. Potassium-40 is naturally-occurring. Cesium-137 is human-made. The amounts found are consistent with past years and attributable to above-ground weapons testing and other nuclear incidents. Naturally-occurring beryllium-7 was not found in 2012 soil samples.

Table 17. 2012 Soil Sample Results

Sample Location	Date of Sample	Beryllium-7 +/- error (pCi/kg)	Potassium-40 +/- error (pCi/kg)	Cesium-137 +/- error (pCi/kg)
Pittsford Fish Hatchery	5/22/2012	< LLD	18200 +/- 3400	194 +/- 32
Mendon AOT	5/22/2012	< LLD	13500 +/- 2500	< LLD
Clarendon AOT	5/22/2012	< LLD	17400 +/- 3200	67.1 +/- 20.5
Rutland City Fire Department	5/22/2012	< LLD	12700 +/- 2400	54.6 +/- 19.3
Brandon Fire Department	5/22/2012	< LLD	17900 +/- 3300	< LLD

< LLD = Less than the laboratory's Lower Limit of Detection

Vegetation samples were taken in May and October. Results are presented in Table 18. Potassium-40 and beryllium-7 were detected in the vegetation samples. Both are naturally-occurring. No other gamma-emitting materials or iodine -131 were detected.

Table 18. 2012 Vegetation Sample Results

Sample Location	Date of Sample	Sample type	Iodine-131 +/- error (pCi/kg)	Beryllium-7 +/- error (pCi/kg)	Potassium-40 +/- error (pCi/kg)
Brandon Fire Deparment	5/22/2012	Vegetation - Dry Grass	<LLD	3720 +/- 930	17600 +/- 3000
Clarendon AOT	5/22/2012	Vegetation - Green Grass	<LLD	<LLD	4740 +/- 870
Mendon AOT	5/22/2012	Vegetation - Dry Stems	<LLD	8880 +/- 1630	1520 +/- 610
Pittsford Fish Hatchery	5/22/2012	Vegetation - Green Grass	<LLD	<LLD	4820 +/- 880
Rutland City Fire Department	5/22/2012	Vegetation - Partially Dry Green Gra	<LLD	1240 +/- 740	15200 +/- 2700
Waterbury State Office Complex	10/25/2012	Vegetation - Partially Dry Grass	<LLD	6820 +/- 630	11500 +/- 2000
Waterbury State Office Complex	10/25/2012	Vegetation - Partially Dry Grass	<LLD	6400 +/- 600	5090 +/- 960
Waterbury State Office Complex	10/25/2012	Vegetation - Partially Dry Grass	<LLD	7560 +/- 660	10700 +/- 1900
Waterbury State Office Complex	10/25/2012	Vegetation - Dry Grass	<LLD	13300 +/- 1200	10300 +/- 1900

Sediment Sample Results

Sediment samples were collected from the bottom of the Connecticut River. The sediment samples were taken from four areas of the Connecticut River: Station 3-3 (south of Vernon Dam), Station 3-4 (near Vermont Yankee discharge), Station 3-8 (upstream near the Route 9 bridge) and the North Storm Drain area. In 1997, the North Storm Drain area was identified to have been contaminated with cobalt-60 from Vermont Yankee operations. The North Storm Drain area is sampled at 15 distinct locations: S-1, S-2, T-1,

T-2, T-3, U-1, U-2, U-3, U-4, V-3, V-4, V-5, W-4, W-5 and X-5. These sample locations are shown in Map 11. Cobalt-60 was last detected in a sediment sample obtained and tested in 2004.

All sediment locations are sampled each spring and fall. A sediment sample is taken with a mass ranging from 0.75 to 1.25 kilograms. Sediment samples are dried and tested by gamma spectroscopy. Tested sediments contained naturally-occurring potassium-40 (K-40) and beryllium-7 (Be-7), as well as fallout-related cesium-137 (Cs-137). The results are presented in Table 20. No cobalt-60 was detected in samples collected this year. Concentrations of potassium-40 and cesium-137 were detected generally within historical ranges for Vermont. In previous years naturally-occurring beryllium-7 has been found, none was detected in 2012 sediment samples. Comparisons to last year's data are presented in Figures 11 and 12.

Table 19. 2012 Sediment Gamma Spectroscopy Ranges as Compared to Historical Ranges

Radioactive Element	2012 Sediment Concentration Range (pCi/kg)	Historical Sediment Concentration Range (pCi/kg)
Beryllium-7	< LLD	< LLD-3,000
Potassium-40	9,850 - 28,700	6,000-30,400
Cesium-137	35.5 - 142	< LLD-500
< LLD means less the Laboratory's **L**ower **L**imit of **D**etection		

Map 11

Connecticut River Sediment Sample Locations-
North Storm Drain Area

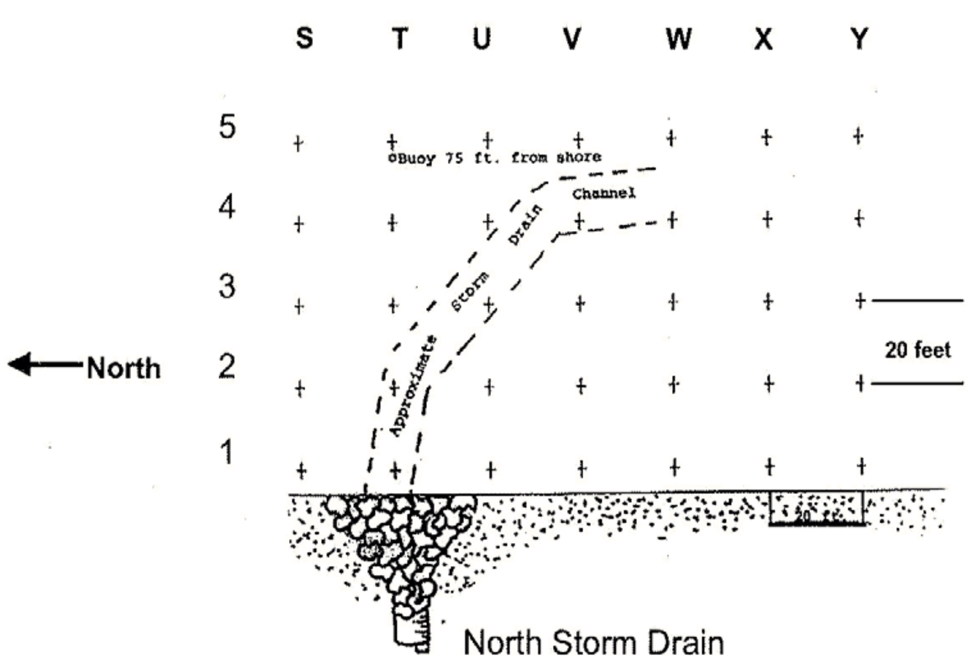


Table 20. 2012 Sediment Gamma Spectroscopy Results

Sample Location	Date of Sample	Beryllium-7 Result +/- error (pCi/L)	Potassium-40 Result +/- error (pCi/L)	Cesium-137 Result +/- error (pCi/L)
3-3	5/22/2012	< LLD	10900 +/- 2000	61 +/- 22.1
3-4	5/22/2012	< LLD	15800 +/- 3000	98.8 +/- 23.9
3-8	5/22/2012	< LLD	11300 +/- 2100	35.5 +/- 19.8
S-1	5/22/2012	< LLD	14200 +/- 2700	72.4 +/- 28.2
S-2	5/22/2012	< LLD	12700 +/- 2400	45.5 +/- 17.6
T-1	5/22/2012	< LLD	9850 +/- 1850	37.6 +/- 17.9
T-2	5/22/2012	< LLD	18400 +/- 3500	68.3 +/- 30.3
T-3	5/22/2012	< LLD	23100 +/- 4300	71.2 +/- 27.9
U-1	5/22/2012	< LLD	19400 +/- 3600	100 +/- 30
U-2	5/22/2012	< LLD	28000 +/- 5200	74.2 +/- 33.6
U-3	5/22/2012	< LLD	28300 +/- 5300	66.4 +/- 33.5
U-4	5/22/2012	< LLD	27200 +/- 5000	62.8 +/- 26.8
V-3	5/22/2012	< LLD	26500 +/- 4900	55.1 +/- 25.9
V-4	5/22/2012	< LLD	25300 +/- 4700	65.7 +/- 27.6
V-5	5/22/2012	< LLD	20600 +/- 3800	69.5 +/- 25.5
W-4	5/22/2012	< LLD	25900 +/- 4800	56 +/- 30.7
W-5	5/22/2012	< LLD	20400 +/- 3800	76.8 +/- 30.2
X-5	5/22/2012	< LLD	22900 +/- 4200	78.2 +/- 29.3
3-4	10/17/2012	< LLD	20200 +/- 3800	142 +/- 33
S-1	10/17/2012	< LLD	19400 +/- 3600	65.5 +/- 27.3
S-2	10/17/2012	< LLD	22900 +/- 4200	115 +/- 34
T-1	10/17/2012	< LLD	16000 +/- 3000	75.8 +/- 24.5
T-2	10/17/2012	< LLD	19600 +/- 3600	101 +/- 27
T-3	10/17/2012	< LLD	23000 +/- 4300	85.3 +/- 32.9
U-1	10/17/2012	< LLD	15600 +/- 2900	103 +/- 33
U-2	10/17/2012	< LLD	20200 +/- 3800	85.5 +/- 31.4
U-3	10/17/2012	< LLD	25700 +/- 4700	101 +/- 30
U-4	10/17/2012	< LLD	26900 +/- 5000	70.5 +/- 28.8
V-3	10/17/2012	< LLD	26200 +/- 4900	53.2 +/- 34.1
V-4	10/17/2012	< LLD	28700 +/- 5300	74 +/- 28.2
V-5	10/17/2012	< LLD	22800 +/- 4200	67.9 +/- 28.1
W-4	10/17/2012	< LLD	26400 +/- 4900	45.6 +/- 32.1
W-5	10/17/2012	< LLD	22700 +/- 4200	83.2 +/- 27.5
X-5	10/17/2012	< LLD	22000 +/- 4100	59.3 +/- 27.2
3-3	10/18/2012	< LLD	12100 +/- 2300	49.8 +/- 20.5
3-8	10/18/2012	< LLD	15900 +/- 3000	81.3 +/- 26.9

Figure 11. 2009-2012 Average Potassium-40 Levels in Sediment

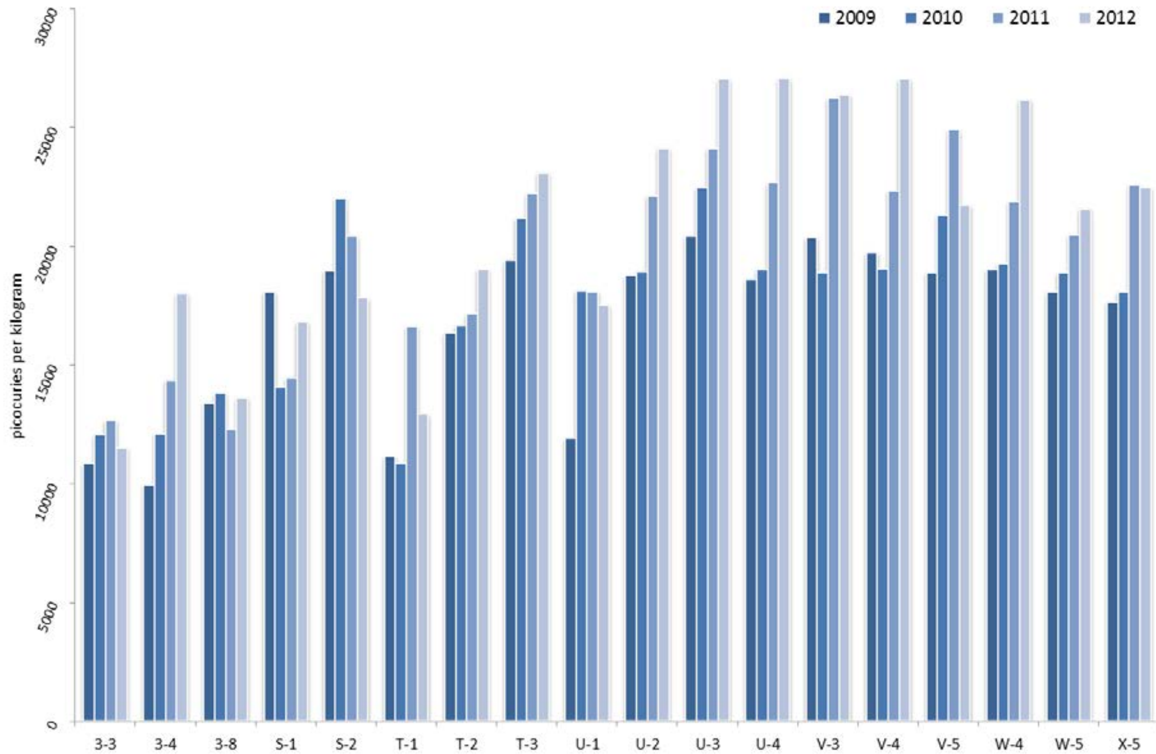
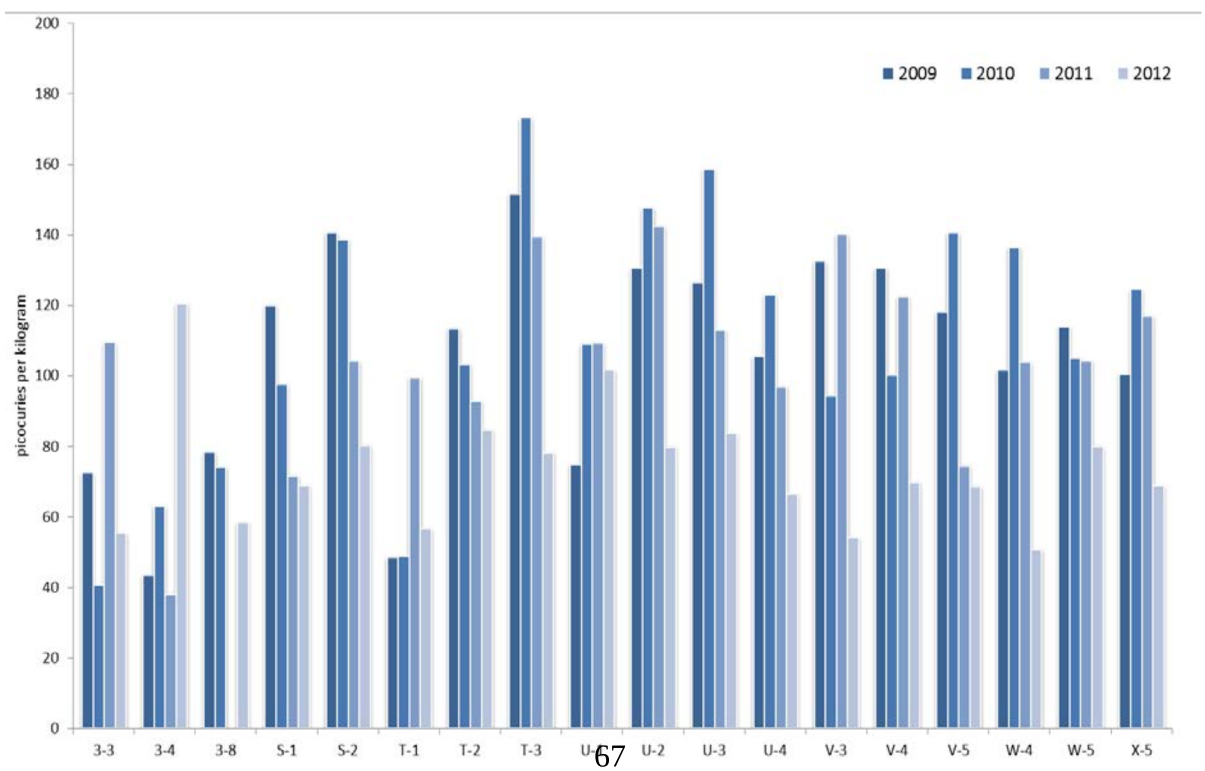


Figure 12. 2009-2012 Average Cesium-137 Levels in Sediment



Fish Sample Results

Connecticut River Fish Samples

Each year, fish are collected monthly at two sites in the Connecticut River by an environmental contractor. One site is near the Vermont Yankee discharge and the other site is about nine miles upstream from Vermont Yankee, where the Route 9 bridge crosses the Connecticut River.

Fish samples were divided into edible and inedible portions and tested separately. The Health Department's contract laboratory tests for hard-to-detect radioactive metals and gamma-emitting materials. Fish types tested in 2012 included large and small mouth bass. Fish gamma spectroscopy results are presented in Table 21 and hard-to-detect metal results are in Table 22.

Potassium-40, cesium-137 and strontium-90 were measured in the Connecticut River fish in 2012. Potassium-40, a naturally-occurring radioactive material was detected in all fish. The cesium-137 results are within the historical range of less than the lower limit of detection to 100 picocuries per kilogram (pCi/kg). Strontium-90 was only found in the inedible portion of fish in 2012. The levels of strontium-90 measured in these fish did not pose a health risk. The levels of cesium-137 and strontium-90 measured may be attributed to the fallout from above-ground weapons testing and global nuclear incidents like Chernobyl.

Rutland County Fish Samples

In September 2012, 47 fish samples were collected from Lake Hortonia and Lake Bomoseen. Sampled fish were composited by species and lake for a minimum mass of 500 grams. Species collected included brown bullhead, large and small mouth bass, northern pike, bluegill, pumpkinseed, yellow perch and rock bass. Fish samples were divided into edible and inedible portions and tested separately. The contract laboratory tested for strontium-90 and gamma-emitting materials. Potassium-40, cesium-137 and strontium-90 were found, similar to the fish in the Connecticut River. An initial assessment of background levels of radioactivity was done. Additional sampling and testing is underway in New Hampshire and Massachusetts, with plans to compile all the data when completed. Summarized results are presented in Table 23. Sample specific data is presented in Appendix E.

In 2012, no radioactivity in food chain inputs was measured above historical and background ranges. Radioactivity measured in the food chain inputs can be attributed to natural sources or human-made sources released in above-ground weapons testing or global nuclear incidents.

Table 21. 2012 Connecticut River Fish Gamma Spectroscopy Results

2012 Connecticut River Fish Gamma Spectroscopy Results					
Month Sample Collected	Sample Location	Edible (flesh)		Inedible (bones, head, scales, guts)	
		Potassium-40 +/- error (pCi/kg)	Cesium-137 +/- error (pCi/kg)	Potassium-40 +/- error (pCi/kg)	Cesium-137 +/- error (pCi/kg)
April 2012	Near VY Discharge	3,210 ± 410	< LLD	2,000 ± 365	< LLD
	Upstream of VY	3,790 ± 452	24.2 ± 12	2,570 ± 363	< LLD
May 2012	Near VY Discharge	2,880 ± 512	< LLD	2,360 ± 309	13 ± 8
	Near VY Discharge	2,710 ± 482	< LLD	2,280 ± 308	< LLD
	Upstream of VY	2,910 ± 478	< LLD	2,140 ± 293	< LLD
	Upstream of VY	2,350 ± 442	< LLD	2,050 ± 328	< LLD
October 2012	Near VY Discharge	2,610 ± 522	< LLD	2,400 ± 338	< LLD
	Near VY Discharge	2,500 ± 486	< LLD	2,230 ± 334	< LLD
	Upstream of VY	2,560 ± 465	< LLD	1,860 ± 425	77.8 ± 31
	Upstream of VY	2,450 ± 575	78.3 ± 28	1,480 ± 394	< LLD
< LLD means less than the Laboratory's Lower Limit of Detection					

Table 22. 2012 Connecticut River Fish Hard-to-Detect Results

2012 Connecticut River Fish Hard-to-Detect Results									
Month Sample Collected	Sample Location	Edible (flesh)				Inedible (bones, head, scales, guts)			
		Iron-55 +/- error (pCi/kg)	Nickel-63 +/- error (pCi/kg)	Strontium-89 +/- error (pCi/kg)	Strontium-90 +/- error (pCi/kg)	Iron-55 +/- error (pCi/kg)	Nickel-63 +/- error (pCi/kg)	Strontium-89 +/- error (pCi/kg)	Strontium-90 +/- error (pCi/kg)
April 2012	Near VY Discharge	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
	Upstream of VY	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
May 2012	Near VY Discharge	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
	Near VY Discharge	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
	Upstream of VY	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	132 ± 45
	Upstream of VY	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	55.2 ± 32
October 2012	Near VY Discharge	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
	Near VY Discharge	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
	Upstream of VY	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	96.3 ± 38
	Upstream of VY	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	96.2 ± 38

< LLD means less than the Laboratory's Lower Limit of Detection

Table 23. 2012 Rutland County Fish Result Summary

	Edible (flesh)			Inedible (bones, head, scales, guts)		
	Cesium-137	Strontium-90	Potassium-40	Cesium-137	Strontium-90	Potassium-40
Average detection (pCi/kg)	36.8	< LLD	3,230	23.3	13.4	216
Range of detections (pCi/kg)	26.7 - 46.8	< LLD	2,100 - 4490	< LLD- 23.3	5.5 - 25.9	122 - 271
Number samples with detections	2/47	0/47	46/47	1/47	45/47	47/47

< LLD means less than the Laboratory's lower limit of detection

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Appendix A

2012 Air Filter Data for Total Alpha & Beta Radioactivity

- 2012 Air Filter Results for Total Alpha & Beta Radioactivity

- **2012 Air Filter Results for Total Alpha & Beta Radioactivity**

Sample Location	Date of Sample	Total Alpha Radioactivity +/- error (pCi/m^3)			Total Beta Radioactivity +/- error (pCi/m^3)		
108 Cherry St Burlington	1/10/2012	0.00203	+/-	0.0003	0.0186	+/-	0.0007
D & E Tree	1/10/2012	0.00103	+/-	0.00024	0.00847	+/-	0.00052
Dummerston IFO	1/10/2012	0.00112	+/-	0.00025	0.0112	+/-	0.0006
Guilford Town Garage	1/10/2012	0.00231	+/-	0.00035	0.024	+/-	0.00086
Power Line Crossing	1/10/2012	0.0025	+/-	0.00033	0.0208	+/-	0.0007
Renaud/Puffer	1/10/2012	0.00195	+/-	0.00032	0.0196	+/-	0.0008
Vermont Courthouse	1/10/2012	0.00175	+/-	0.0003	0.0192	+/-	0.0007
Vermont State Police	1/10/2012	0.000596	+/-	0.000202	0.00472	+/-	0.00043
Vernon Elementary School	1/10/2012	0.00212	+/-	0.00031	0.0198	+/-	0.0007
Wilmington State Highway Garage	1/10/2012	0.000933	+/-	0.000206	0.00706	+/-	0.00044
108 Cherry St Burlington	2/7/2012	0.0018	+/-	0.00031	0.0146	+/-	0.0007
D & E Tree	2/7/2012	0.0013	+/-	0.00028	0.00905	+/-	0.00059
Dummerston IFO	2/7/2012	0.00105	+/-	0.00026	0.011	+/-	0.0007
Guilford Town Garage	2/7/2012	0.00187	+/-	0.00035	0.0192	+/-	0.0009
Power Line Crossing	2/7/2012	0.00207	+/-	0.00033	0.017	+/-	0.0008
Renaud/Puffer	2/7/2012	0.00168	+/-	0.00034	0.0161	+/-	0.0008
Vermont Courthouse	2/7/2012	0.0014	+/-	0.0003	0.0151	+/-	0.0007
Vermont State Police	2/7/2012	0.000784	+/-	0.000245	0.00561	+/-	0.00053
Vernon Elementary School	2/7/2012	0.00197	+/-	0.00032	0.0165	+/-	0.0007
Wilmington State Highway Garage	2/7/2012	0.000748	+/-	0.000213	0.00767	+/-	0.00053
Dummerston IFO	3/5/2012	0.00132	+/-	0.00031	0.0114	+/-	0.0007
Vermont Courthouse	3/5/2012	0.00176	+/-	0.00035	0.0178	+/-	0.0008
Wilmington State Highway Garage	3/5/2012	0.00102	+/-	0.00025	0.00841	+/-	0.00053
D & E Tree	3/6/2012	0.00111	+/-	0.00029	0.00981	+/-	0.00062
Guilford Town Garage	3/6/2012	0.00205	+/-	0.00039	0.0204	+/-	0.0009
Power Line Crossing	3/6/2012	0.00202	+/-	0.00035	0.0186	+/-	0.0008
Renaud/Puffer	3/6/2012	0.00167	+/-	0.00036	0.0166	+/-	0.0008
Vermont State Police	3/6/2012	0.000838	+/-	0.000268	0.00576	+/-	0.00052
Vernon Elementary School	3/6/2012	0.00155	+/-	0.00031	0.0189	+/-	0.0008
108 Cherry St Burlington	3/7/2012	0.00154	+/-	0.0003	0.0173	+/-	0.0007
108 Cherry St Burlington	4/3/2012	0.00178	+/-	0.00034	0.0189	+/-	0.0008
D & E Tree	4/3/2012	0.00107	+/-	0.00028	0.00956	+/-	0.00061
Dummerston IFO	4/3/2012	0.00149	+/-	0.00032	0.0132	+/-	0.0007
Guilford Town Garage	4/3/2012	0.00277	+/-	0.00043	0.0217	+/-	0.0009
Power Line Crossing	4/3/2012	0.00205	+/-	0.00035	0.0181	+/-	0.0008
Renaud/Puffer	4/3/2012	0.00161	+/-	0.00036	0.0164	+/-	0.0008
Vermont Courthouse	4/3/2012	0.00183	+/-	0.00035	0.0177	+/-	0.0008
Vermont State Police	4/3/2012	0.000691	+/-	0.000255	0.00594	+/-	0.00055
Vernon Elementary School	4/3/2012	0.00233	+/-	0.00037	0.018	+/-	0.0008
Wilmington State Highway Garage	4/3/2012	0.000848	+/-	0.000235	0.00928	+/-	0.00056

Sample Location	Date of Sample	Total Alpha Radioactivity +/- error (pCi/m³)			Total Beta Radioactivity +/- error (pCi/m³)		
D & E Tree	5/8/2012	0.00111	+/-	0.00026	0.00696	+/-	0.00049
Dummerston IFO	5/8/2012	0.00194	+/-	0.00031	0.00959	+/-	0.00054
Guilford Town Garage	5/8/2012	0.00198	+/-	0.00033	0.0141	+/-	0.0007
Power Line Crossing	5/8/2012	0.00157	+/-	0.00028	0.012	+/-	0.0006
Renaud/Puffer	5/8/2012	0.00167	+/-	0.00031	0.0124	+/-	0.0006
Vermont Courthouse	5/8/2012	0.00182	+/-	0.00032	0.0129	+/-	0.0006
Vermont State Police	5/8/2012	0.000884	+/-	0.000271	0.00478	+/-	0.00049
Vernon Elementary School	5/8/2012	0.00153	+/-	0.00028	0.0124	+/-	0.0006
Wilmington State Highway Garage	5/8/2012	0.000914	+/-	0.000213	0.0075	+/-	0.00045
108 Cherry St Burlington	5/9/2012	0.0014	+/-	0.00026	0.0103	+/-	0.0005
108 Cherry St Burlington	6/5/2012	0.00129	+/-	0.0003	0.0127	+/-	0.0007
D & E Tree	6/5/2012	0.00065	+/-	0.00023	0.0061	+/-	0.00053
Dummerston IFO	6/5/2012	0.00128	+/-	0.0003	0.00982	+/-	0.00064
Guilford Town Garage	6/5/2012	0.00158	+/-	0.00033	0.0131	+/-	0.0007
Power Line Crossing	6/5/2012	0.00124	+/-	0.00029	0.00802	+/-	0.00058
Renaud/Puffer	6/5/2012	0.00127	+/-	0.0003	0.0116	+/-	0.0007
Vermont Courthouse	6/5/2012	0.00217	+/-	0.00053	0.0174	+/-	0.0012
Vermont State Police	6/5/2012	0.00098	+/-	0.0003	0.00429	+/-	0.00054
Vernon Elementary School	6/5/2012	0.00133	+/-	0.00029	0.0122	+/-	0.0007
Wilmington State Highway Garage	6/5/2012	0.000543	+/-	0.000207	0.0051	+/-	0.00047
108 Cherry St Burlington	7/10/2012	0.00131	+/-	0.00026	0.013	+/-	0.0006
D & E Tree	7/10/2012	0.000497	+/-	0.000195	0.00432	+/-	0.00041
Dummerston IFO	7/10/2012	0.000582	+/-	0.000205	0.00636	+/-	0.00048
Guilford Town Garage	7/10/2012	0.00132	+/-	0.00027	0.0138	+/-	0.0006
Power Line Crossing	7/10/2012	0.000652	+/-	0.000216	0.00601	+/-	0.00047
Renaud/Puffer	7/10/2012	0.00117	+/-	0.00026	0.0114	+/-	0.0006
Vermont Courthouse	7/10/2012	0.00146	+/-	0.00031	0.0159	+/-	0.0008
Vermont State Police	7/10/2012	*0.000178*	*+/-*	*0.000155*	*0.0032*	*+/-*	*0.00038*
Vernon Elementary School	7/10/2012	0.00143	+/-	0.00027	0.011	+/-	0.0006
Wilmington State Highway Garage	7/10/2012	0.000445	+/-	0.000172	0.00314	+/-	0.00034
108 Cherry St Burlington	8/7/2012	0.00155	+/-	0.00035	0.0184	+/-	0.0009
D & E Tree	8/7/2012	0.000703	+/-	0.000284	0.00648	+/-	0.00061
Dummerston IFO	8/7/2012	0.000973	+/-	0.000304	0.00742	+/-	0.00062
Guilford Town Garage	8/7/2012	*0.000296*	*+/-*	*0.000194*	*0.00332*	*+/-*	*0.00042*
Power Line Crossing	8/7/2012	0.00228	+/-	0.00038	0.0216	+/-	0.0009
Renaud/Puffer	8/7/2012	0.0014	+/-	0.00032	0.0121	+/-	0.0007
Vermont Courthouse	8/7/2012	0.00185	+/-	0.00037	0.0188	+/-	0.0009
Vermont State Police	8/7/2012	*0.00024*	*+/-*	*0.000303*	*0.00346*	*+/-*	*0.00065*
Vernon Elementary School	8/7/2012	0.00118	+/-	0.00029	0.0111	+/-	0.0006
Wilmington State Highway Garage	8/7/2012	0.000455	+/-	0.000205	0.00507	+/-	0.00047

Sample Location	Date of Sample	Total Alpha Radioactivity +/- error (pCi/m^3)			Total Beta Radioactivity +/- error (pCi/m^3)		
108 Cherry St Burlington	9/4/2012	0.00191	+/-	0.00037	0.019	+/-	0.0008
D & E Tree	9/11/2012	0.000692	+/-	0.000285	0.00621	+/-	0.00056
Dummerston IFO	9/11/2012	0.000745	+/-	0.000246	0.00769	+/-	0.00053
Guilford Town Garage	9/11/2012	0.00213	+/-	0.00035	0.0196	+/-	0.0008
Power Line Crossing	9/11/2012	0.0008	+/-	0.000253	0.00964	+/-	0.00058
Renaud/Puffer	9/11/2012	0.00126	+/-	0.0003	0.0147	+/-	0.0007
Vermont Courthouse	9/11/2012	0.00201	+/-	0.00035	0.0197	+/-	0.0008
Vermont State Police	9/11/2012	0.00409	+/-	0.00044	0.0237	+/-	0.0008
Vernon Elementary School	9/11/2012	0.0005	+/-	0.000206	0.00599	+/-	0.00045
Wilmington State Highway Garage	9/11/2012	0.00291	+/-	0.00035	0.0173	+/-	0.0007
108 Cherry St Burlington	10/8/2012	0.00158	+/-	0.00029	0.0148	+/-	0.0007
D & E Tree	10/8/2012	0.000553	+/-	0.000293	0.00608	+/-	0.00067
Dummerston IFO	10/8/2012	0.00109	+/-	0.0003	0.00867	+/-	0.00063
Guilford Town Garage	10/8/2012	0.00141	+/-	0.00033	0.0173	+/-	0.0009
Power Line Crossing	10/8/2012	0.000382	+/-	0.00027	0.00557	+/-	0.00065
Renaud/Puffer	10/8/2012	0.00163	+/-	0.00036	0.0138	+/-	0.0008
Vermont Courthouse	10/8/2012	0.00168	+/-	0.00035	0.0166	+/-	0.0008
Vermont State Police	10/8/2012	*0.00825*	*+/-*	*0.00505*	*0.0793*	*+/-*	*0.011*
Vernon Elementary School	10/8/2012	0.000469	+/-	0.000216	0.0047	+/-	0.00049
Wilmington State Highway Garage	10/8/2012	0.00137	+/-	0.00028	0.0148	+/-	0.0007
108 Cherry St Burlington	11/6/2012	0.00198	+/-	0.00034	0.0138	+/-	0.0007
D & E Tree	11/6/2012	0.00026	+/-	0.000235	0.00355	+/-	0.00054
Dummerston IFO	11/6/2012	0.000774	+/-	0.000263	0.00651	+/-	0.00056
Guilford Town Garage	11/6/2012	0.00193	+/-	0.00037	0.0153	+/-	0.0008
Power Line Crossing	11/6/2012	0.00097	+/-	0.00031	0.0061	+/-	0.0006
Renaud/Puffer	11/6/2012	0.00148	+/-	0.00034	0.0115	+/-	0.0007
Vermont Courthouse	11/6/2012	0.00226	+/-	0.00039	0.0156	+/-	0.0008
Vernon Elementary School	11/6/2012	0.000531	+/-	0.000212	0.00393	+/-	0.00043
Wilmington State Highway Garage	11/6/2012	0.00162	+/-	0.00031	0.0117	+/-	0.0006
108 Cherry St Burlington	12/4/2012	0.00254	+/-	0.00038	0.023	+/-	0.0009
D & E Tree	12/4/2012	*0.000184*	*+/-*	*0.000264*	*0.00328*	*+/-*	*0.00061*
Dummerston IFO	12/4/2012	0.0018	+/-	0.00034	0.0158	+/-	0.0008
Guilford Town Garage	12/4/2012	0.00275	+/-	0.00044	0.0256	+/-	0.001
Power Line Crossing	12/4/2012	*0.000431*	*+/-*	*0.000321*	*0.00783*	*+/-*	*0.00082*
Renaud/Puffer	12/4/2012	0.00196	+/-	0.00038	0.0212	+/-	0.0009
Vermont Courthouse	12/4/2012	0.0026	+/-	0.00041	0.0257	+/-	0.001
Vermont State Police	12/4/2012	0.00435	+/-	0.00064	0.0289	+/-	0.0013
Vernon Elementary School	12/4/2012	0.000784	+/-	0.00024	0.00638	+/-	0.00051
Wilmington State Highway Garage	12/4/2012	0.00187	+/-	0.00032	0.0198	+/-	0.0008

pCi/m^3 is picocurie per cubic meter of air volume

Data in italics were qualified due to sampling issues.

Appendix B

2012 Tritium Water Data

Tritium results for all water samples tested by the Health Department in 2012 are provided in this appendix. Results are presented in order by sample location and by sampling date based on the following categories:

- Connecticut River samples
- On-site groundwater monitoring wells
- Off-site drinking water wells
- On-site drinking water wells

The Health Department's Lower Limit of Detection for tritium is 500 picocuries per liter (pCi/L).

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)
3-3 Connecticut River Station	1/13/2012	< 500
	2/16/2012	< 500
	3/15/2012	< 500
	4/13/2012	< 500
	5/15/2012	< 500
	6/13/2012	< 500
	7/16/2012	< 500
	8/15/2012	< 500
	9/13/2012	< 500
	10/16/2012	< 500
	11/15/2012	< 500
	12/13/2012	< 500
3-4 Connecticut River Station	1/13/2012	< 500
	2/16/2012	< 500
	3/15/2012	< 500
	4/13/2012	< 500
	5/15/2012	< 500
	6/13/2012	< 500
	7/16/2012	< 500
	8/15/2012	< 500
	9/13/2012	< 500
	10/16/2012	< 500
	11/15/2012	< 500
	12/13/2012	< 500
3-8 Connecticut River Station	1/13/2012	< 500
	2/16/2012	< 500
	3/15/2012	< 500
	4/13/2012	< 500
	5/15/2012	< 500
	6/13/2012	< 500
	7/16/2012	< 500
	8/15/2012	< 500
	9/13/2012	< 500

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)
3-8 Connecticut River Station continued	10/16/2012	< 500
	11/15/2012	< 500
	12/13/2012	< 500
Connecticut River, Downstream	1/10/2012	< 500
	1/24/2012	< 500
	2/7/2012	< 500
	2/21/2012	< 500
	3/6/2012	< 500
	3/20/2012	< 500
	4/3/2012	< 500
	4/16/2012	< 500
	5/8/2012	< 500
	5/22/2012	< 500
	6/5/2012	< 500
	6/19/2012	< 500
	7/10/2012	< 500
	7/24/2012	< 500
	8/7/2012	< 500
	8/21/2012	< 500
	9/11/2012	< 500
	9/24/2012	< 500
	10/8/2012	< 500
	10/22/2012	< 500
	11/6/2012	< 500
	11/20/2012	< 500
	12/4/2012	< 500
	12/17/2012	< 500

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)
Connecticut River, Upstream	1/10/2012	< 500
	1/24/2012	< 500
	2/7/2012	< 500
	2/21/2012	< 500
	3/6/2012	< 500
	3/20/2012	< 500
	4/3/2012	< 500
	4/16/2012	< 500
	5/8/2012	< 500
	5/22/2012	< 500
	6/5/2012	< 500
	6/19/2012	< 500
	7/10/2012	< 500
	7/24/2012	< 500
	8/7/2012	< 500
	8/21/2012	< 500
	9/11/2012	< 500
	9/24/2012	< 500
	10/8/2012	< 500
	10/22/2012	< 500
	11/6/2012	< 500
	12/4/2012	< 500
	12/17/2012	< 500
Discharge Forebay	1/13/2012	< 500
	2/16/2012	< 500
	3/15/2012	< 500
	4/13/2012	< 500
	5/15/2012	< 500
	6/13/2012	< 500
	7/16/2012	< 500
	8/15/2012	< 500
	9/13/2012	< 500
	10/16/2012	< 500
	11/15/2012	< 500
	12/13/2012	< 500

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)
Upstream of the VY River Discharge	1/3/2012	< 500
	1/5/2012	< 500
	1/9/2012	< 500
	1/12/2012	< 500
	1/16/2012	< 500
	1/19/2012	< 500
	1/23/2012	< 500
	1/26/2012	< 500
	2/13/2012	< 500
	2/16/2012	< 500
	2/21/2012	< 500
	2/23/2012	< 500
	2/27/2012	< 500
	2/29/2012	< 500
	3/5/2012	< 500
	3/8/2012	< 500
	3/12/2012	< 500
	3/15/2012	< 500
	3/26/2012	< 500
	3/29/2012	< 500
	4/2/2012	< 500
	4/5/2012	< 500
	4/9/2012	< 500
	4/12/2012	< 500
	4/16/2012	< 500
	4/19/2012	< 500
	4/23/2012	< 500
	4/25/2012	687 +/- 202
	4/30/2012	< 500
	5/3/2012	< 500
	5/10/2012	< 500
	5/14/2012	< 500
	5/17/2012	< 500
	5/21/2012	< 500
	5/24/2012	< 500
	5/29/2012	< 500
	5/31/2012	< 500
	6/4/2012	< 500
	6/7/2012	< 500
	6/11/2012	< 500

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)		
GZ-01	1/9/2012	< 500		
	6/5/2012	< 500		
GZ-02	1/9/2012	< 500		
	3/5/2012	< 500		
	4/2/2012	< 500		
	6/4/2012	< 500		
	7/2/2012	< 500		
	9/11/2012	< 500		
	10/2/2012	< 500		
	12/4/2012	< 500		
GZ-03	1/3/2012	896	+/-	207
	1/9/2012	703	+/-	210
	1/16/2012	935	+/-	212
	1/23/2012	648	+/-	209
	2/13/2012	< 500		
	2/21/2012	< 500		
	2/27/2012	< 500		
	3/5/2012	< 500		
	3/12/2012	< 500		
	3/26/2012	< 500		
	4/2/2012	559	+/-	199
	4/9/2012	518	+/-	201
	4/16/2012	847	+/-	201
	4/23/2012	877	+/-	201
	4/30/2012	979	+/-	205
	5/14/2012	1,060	+/-	210
	5/21/2012	1,090	+/-	210
	5/29/2012	1,340	+/-	210
	6/4/2012	1,160	+/-	210
	6/11/2012	1,180	+/-	210
	7/2/2012	1,270	+/-	210
	9/11/2012	1,130	+/-	150
	10/3/2012	900	+/-	140
	12/3/2012	591	+/-	138

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)		
GZ-04	1/9/2012	4,020	+/-	250
	3/5/2012	2,140	+/-	220
	4/2/2012	1,160	+/-	210
	6/4/2012	< 500		
	7/2/2012	< 500		
	9/11/2012	1,000	+/-	140
	10/3/2012	659	+/-	137
	12/3/2012	< 500		
GZ-05	1/9/2012	< 500		
	3/5/2012	< 500		
	4/2/2012	< 500		
	6/4/2012	< 500		
GZ-06	1/3/2012	707	+/-	210
	1/10/2012	< 500		
	1/17/2012	684	+/-	208
	1/24/2012	< 500		
	2/13/2012	< 500		
	2/21/2012	< 500		
	2/27/2012	< 500		
	3/5/2012	1,010	+/-	210
	3/12/2012	523	+/-	199
	3/26/2012	930	+/-	205
	4/2/2012	< 500		
	4/9/2012	595	+/-	202
	4/16/2012	511	+/-	198
	4/23/2012	700	+/-	198
	4/30/2012	636	+/-	200
	5/14/2012	752	+/-	202
	5/21/2012	513	+/-	198
	5/29/2012	574	+/-	197
	6/4/2012	< 500		
	6/11/2012	< 500		
	7/2/2012	< 500		
	9/11/2012	513	+/-	136
	10/4/2012	< 500		
	12/4/2012	< 500		

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)		
GZ-07	1/3/2012	723	+/-	210
	1/10/2012	605	+/-	202
	1/17/2012	929	+/-	211
	1/23/2012	1,220	+/-	210
	2/13/2012	1,180	+/-	210
	2/21/2012	934	+/-	210
	2/27/2012	741	+/-	206
	3/6/2012	632	+/-	202
	3/12/2012	538	+/-	199
	3/26/2012	584	+/-	199
	4/3/2012	885	+/-	204
	4/9/2012	697	+/-	204
	4/16/2012	514	+/-	198
	4/23/2012	< 500		
	4/30/2012	< 500		
	5/14/2012	< 500		
	5/21/2012	< 500		
	5/29/2012	< 500		
	6/4/2012	< 500		
	6/11/2012	< 500		
	7/3/2012	< 500		
	9/10/2012	< 500		
	10/2/2012	< 500		
	12/3/2012	< 500		
GZ-09	1/9/2012	< 500		
	3/5/2012	< 500		
	4/2/2012	< 500		
	6/5/2012	< 500		
	7/2/2012	< 500		
	9/11/2012	< 500		
	10/3/2012	< 500		
	12/3/2012	< 500		

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)		
GZ-10	1/9/2012	< 500		
	3/5/2012	< 500		
	4/2/2012	< 500		
	6/4/2012	< 500		
	7/2/2012	< 500		
	9/11/2012	< 500		
	10/3/2012	< 500		
	12/3/2012	< 500		
GZ-11	1/10/2012	< 500		
	3/6/2012	< 500		
	4/3/2012	< 500		
	6/4/2012	1,010	+/-	200
	7/3/2012	1,070	+/-	200
	9/11/2012	797	+/-	139
	10/2/2012	< 500		
	12/3/2012	< 500		
GZ-12D	1/3/2012	22,700	+/-	400
	1/9/2012	33,000	+/-	500
	1/16/2012	37,400	+/-	500
	1/23/2012	36,000	+/-	500
	2/13/2012	35,400	+/-	500
	2/21/2012	39,000	+/-	500
	2/27/2012	32,200	+/-	500
	3/5/2012	33,600	+/-	500
	3/12/2012	33,700	+/-	500
	3/26/2012	31,700	+/-	500
	4/2/2012	33,600	+/-	500
	4/9/2012	33,200	+/-	500
	4/16/2012	34,200	+/-	500
	4/23/2012	33,300	+/-	500
	4/30/2012	33,700	+/-	500
	5/14/2012	27,800	+/-	500
	5/21/2012	29,600	+/-	500
	5/29/2012	32,100	+/-	500

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)		
GZ-12D (continued)	6/4/2012	27,600	+/-	500
	6/11/2012	30,400	+/-	500
	7/2/2012	29,900	+/-	500
	9/10/2012	27,000	+/-	300
	10/2/2012	26,600	+/-	300
	12/4/2012	25,200	+/-	300
GZ-12S	1/9/2012	< 500		
	3/5/2012	< 500		
	4/2/2012	749	+/-	202
	6/4/2012	1,730	+/-	210
	7/2/2012	1,630	+/-	210
	9/10/2012	765	+/-	143
	10/2/2012	1,120	+/-	140
	12/4/2012	1,270	+/-	150
GZ-13D	1/9/2012	964	+/-	208
	3/6/2012	811	+/-	204
	4/3/2012	560	+/-	199
	6/5/2012	746	+/-	200
	7/3/2012	838	+/-	201
	9/10/2012	883	+/-	140
	10/3/2012	903	+/-	141
	12/4/2012	879	+/-	141
GZ-13S	1/9/2012	< 500		
	3/6/2012	< 500		
	4/3/2012	< 500		
	6/5/2012	< 500		
	7/3/2012	< 500		
	9/10/2012	< 500		
	10/3/2012	< 500		
	12/4/2012	< 500		

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)		
GZ-14D	1/3/2012	11,300	+/-	300
	1/9/2012	11,200	+/-	300
	1/16/2012	12,000	+/-	300
	1/23/2012	12,800	+/-	300
	2/13/2012	12,800	+/-	300
	2/21/2012	13,200	+/-	400
	2/27/2012	13,400	+/-	400
	3/5/2012	13,500	+/-	400
	3/12/2012	14,000	+/-	400
	3/26/2012	14,000	+/-	400
	4/2/2012	14,500	+/-	400
	4/9/2012	14,200	+/-	400
	4/16/2012	14,300	+/-	400
	4/23/2012	14,500	+/-	400
	4/30/2012	14,700	+/-	400
	5/14/2012	15,100	+/-	400
	5/21/2012	15,200	+/-	400
	5/29/2012	15,400	+/-	400
	6/4/2012	15,300	+/-	400
	6/11/2012	15,000	+/-	400
	7/2/2012	15,600	+/-	400
	9/11/2012	15,000	+/-	300
	10/3/2012	15,100	+/-	300
	12/3/2012	15,000	+/-	300
GZ-14S	1/3/2012	38,500	+/-	500
	1/9/2012	71,300	+/-	700
	1/16/2012	74,100	+/-	700
	1/23/2012	61,300	+/-	700
	2/13/2012	51,400	+/-	600
	2/21/2012	34,000	+/-	500
	2/27/2012	80,600	+/-	700
	3/5/2012	67,600	+/-	700
	3/12/2012	43,100	+/-	600
	3/26/2012	41,200	+/-	600
	4/2/2012	61,500	+/-	700
	4/9/2012	50,000	+/-	600
	4/16/2012	48,600	+/-	600

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)		
GZ-14S (continued)	4/23/2012	43,200	+/-	600
	4/30/2012	42,100	+/-	600
	5/14/2012	43,200	+/-	600
	5/21/2012	42,800	+/-	600
	5/29/2012	41,800	+/-	600
	6/4/2012	43,900	+/-	600
	6/11/2012	40,900	+/-	500
	7/2/2012	51,400	+/-	600
	9/11/2012	60,100	+/-	500
	10/4/2012	30,100	+/-	300
	12/3/2012	35,900	+/-	400
GZ-15	1/3/2012	71,500	+/-	700
	1/9/2012	67,700	+/-	700
	1/23/2012	62,600	+/-	700
	2/13/2012	75,700	+/-	700
	2/21/2012	77,300	+/-	700
	2/27/2012	79,700	+/-	700
	3/5/2012	80,500	+/-	700
	3/12/2012	80,200	+/-	700
	4/2/2012	78,300	+/-	700
	4/9/2012	79,500	+/-	700
	4/16/2012	80,700	+/-	700
	4/24/2012	79,800	+/-	700
	4/30/2012	81,400	+/-	700
	5/23/2012	84,800	+/-	800
	5/29/2012	85,000	+/-	800
	6/4/2012	85,500	+/-	800
	6/11/2012	87,000	+/-	800
	7/2/2012	88,300	+/-	800
	9/10/2012	81,700	+/-	500
	10/2/2012	81,300	+/-	500
	12/4/2012	72,800	+/-	500

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)		
GZ-16	1/9/2012	< 500		
	3/5/2012	< 500		
	4/2/2012	< 500		
	6/4/2012	< 500		
	7/2/2012	< 500		
	9/10/2012	< 500		
	10/3/2012	< 500		
	12/3/2012	< 500		
GZ-17	1/10/2012	< 500		
	3/5/2012	< 500		
	4/2/2012	< 500		
	6/4/2012	< 500		
	7/2/2012	< 500		
	9/11/2012	< 500		
	10/4/2012	< 500		
GZ-18D	1/9/2012	< 500		
	3/6/2012	< 500		
	4/3/2012	< 500		
	6/5/2012	< 500		
	7/3/2012	520	+/-	195
	9/10/2012	557	+/-	136
	10/3/2012	630	+/-	135
	12/4/2012	609	+/-	138
GZ-18S	1/9/2012	< 500		
	3/6/2012	< 500		
	4/3/2012	< 500		
	6/5/2012	< 500		
	7/3/2012	< 500		
	9/11/2012	< 500		
	10/3/2012	< 500		
	12/4/2012	< 500		

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)		
GZ-19D	12/21/2012	< 500		
GZ-19S	12/21/2012	< 500		
GZ-20	1/10/2012	< 500		
	3/6/2012	< 500		
	4/3/2012	< 500		
	6/4/2012	< 500		
	7/3/2012	< 500		
	9/10/2012	< 500		
	10/2/2012	< 500		
	12/3/2012	< 500		
GZ-21	1/3/2012	6,410	+/-	280
	1/10/2012	7,740	+/-	300
	1/17/2012	4,740	+/-	260
	1/24/2012	4,320	+/-	260
	2/13/2012	6,220	+/-	280
	2/21/2012	4,710	+/-	260
	2/27/2012	3,700	+/-	250
	3/6/2012	609	+/-	201
	3/12/2012	2,780	+/-	230
	3/26/2012	2,750	+/-	230
	4/2/2012	3,460	+/-	240
	4/9/2012	3,170	+/-	240
	4/16/2012	2,140	+/-	220
	4/23/2012	1,940	+/-	220
	4/30/2012	1,940	+/-	220
	5/14/2012	1,810	+/-	220
	5/21/2012	1,780	+/-	220
	5/29/2012	1,530	+/-	210
	6/5/2012	1,460	+/-	210
	6/11/2012	1,320	+/-	210
	7/3/2012	1,700	+/-	210
	9/10/2012	763	+/-	143
	10/4/2012	1,420	+/-	140
	12/3/2012	1,840	+/-	150

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)		
GZ-22D	1/3/2012	72,100	+/-	700
	1/9/2012	70,700	+/-	700
	1/16/2012	68,800	+/-	700
	1/23/2012	65,800	+/-	700
	2/13/2012	61,100	+/-	700
	2/21/2012	59,700	+/-	700
	2/27/2012	59,300	+/-	700
	3/5/2012	58,800	+/-	600
	3/12/2012	54,900	+/-	600
	3/26/2012	54,600	+/-	600
	4/3/2012	51,400	+/-	600
	4/9/2012	51,700	+/-	600
	4/16/2012	48,400	+/-	600
	4/23/2012	48,600	+/-	600
	4/30/2012	47,100	+/-	600
	5/14/2012	49,500	+/-	600
	5/21/2012	47,900	+/-	600
	5/29/2012	48,000	+/-	600
	6/4/2012	45,200	+/-	600
	6/11/2012	45,500	+/-	600
	7/2/2012	42,800	+/-	600
	9/11/2012	35,600	+/-	400
	10/4/2012	35,500	+/-	400
	12/3/2012	29,600	+/-	300
GZ-23S	1/9/2012	< 500		
	3/5/2012	636	+/-	203
	4/2/2012	732	+/-	202
	6/4/2012	580	+/-	201
	7/2/2012	655	+/-	197
	9/10/2012	536	+/-	140
	10/2/2012	887	+/-	138
	12/4/2012	1,480	+/-	150

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)
GZ-24S	1/3/2012	< 500
	1/10/2012	< 500
	1/17/2012	< 500
	1/26/2012	< 500
	2/13/2012	< 500
	2/21/2012	< 500
	2/27/2012	< 500
	3/5/2012	< 500
	3/12/2012	< 500
	3/26/2012	< 500
	4/2/2012	< 500
	4/9/2012	< 500
	4/16/2012	< 500
	4/24/2012	< 500
	4/30/2012	< 500
	5/14/2012	< 500
	5/21/2012	< 500
	5/29/2012	< 500
	6/4/2012	< 500
	6/11/2012	< 500
	7/2/2012	< 500
	9/10/2012	< 500
	10/2/2012	< 500
	12/4/2012	< 500
GZ-25S	1/9/2012	< 500
	3/5/2012	< 500
	4/2/2012	< 500
	6/5/2012	< 500
	7/2/2012	< 500
	9/11/2012	< 500
	10/4/2012	< 500
	12/3/2012	< 500

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)
GZ-26S	1/9/2012	< 500
	3/5/2012	< 500
	4/2/2012	< 500
	6/5/2012	< 500
	7/2/2012	< 500
	9/11/2012	< 500
	12/3/2012	< 500
GZ-27S	1/9/2012	< 500
	3/5/2012	< 500
	4/2/2012	< 500
	6/5/2012	< 500
	7/2/2012	< 500
	9/11/2012	< 500
	10/4/2012	< 500
	12/3/2012	< 500
WVN0201	2/7/2012	< 500
	5/9/2012	< 500
	8/8/2012	< 500
	11/7/2012	< 500
WVN0202	2/7/2012	< 500
	5/9/2012	< 500
	8/8/2012	< 500
	11/7/2012	< 500
WVN0203	2/7/2012	< 500
	5/9/2012	< 500
	8/8/2012	< 500
	11/7/2012	< 500
WVN0204	2/7/2012	< 500
	5/9/2012	< 500
	8/8/2012	< 500
	11/7/2012	< 500

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)
Blodgett Farm	1/10/2012	< 500
	1/24/2012	< 500
	2/7/2012	< 500
	2/21/2012	< 500
	3/6/2012	< 500
	3/20/2012	< 500
	4/3/2012	< 500
	4/16/2012	< 500
	5/8/2012	< 500
	5/22/2012	< 500
	6/5/2012	< 500
	6/19/2012	< 500
	7/10/2012	< 500
	7/24/2012	< 500
	8/7/2012	< 500
	8/21/2012	< 500
	9/11/2012	< 500
	9/24/2012	< 500
	10/8/2012	< 500
	10/22/2012	< 500
	11/6/2012	< 500
	11/20/2012	< 500
	12/4/2012	< 500
	12/17/2012	< 500
Brattleboro Fire Dept, West Station	1/10/2012	< 500
	1/24/2012	< 500
	2/7/2012	< 500
	2/21/2012	< 500
	3/6/2012	< 500
	3/20/2012	< 500
	4/3/2012	< 500
	4/16/2012	< 500
	5/8/2012	< 500

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)
Brattleboro Fire Dept, West Station (continued)	5/22/2012	< 500
	6/5/2012	< 500
	6/19/2012	< 500
	7/10/2012	< 500
	7/24/2012	< 500
	8/7/2012	< 500
	8/21/2012	< 500
	9/11/2012	< 500
	9/24/2012	< 500
	10/8/2012	< 500
	10/22/2012	< 500
	11/6/2012	< 500
	11/20/2012	< 500
	12/4/2012	< 500
	12/17/2012	< 500
Mendon AOT	5/22/2012	< 500
Miller Farm	1/10/2012	< 500
	1/24/2012	< 500
	2/7/2012	< 500
	2/21/2012	< 500
	3/6/2012	< 500
	3/20/2012	< 500
	4/3/2012	< 500
	4/16/2012	< 500
	5/8/2012	< 500
	5/22/2012	< 500
	6/5/2012	< 500
	6/19/2012	< 500
	7/10/2012	< 500
	7/24/2012	< 500
	8/7/2012	< 500
	8/21/2012	< 500
	9/11/2012	< 500
	9/24/2012	< 500
	10/8/2012	< 500
	10/22/2012	< 500
	11/6/2012	< 500
	11/20/2012	< 500
	12/4/2012	< 500
	12/17/2012	< 500

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)
Residence - 1	1/10/2012	< 500
	1/24/2012	< 500
	2/7/2012	< 500
	2/21/2012	< 500
	3/6/2012	< 500
	3/20/2012	< 500
	4/3/2012	< 500
	4/16/2012	< 500
	5/8/2012	< 500
	5/22/2012	< 500
	6/5/2012	< 500
	6/19/2012	< 500
	7/10/2012	< 500
	7/24/2012	< 500
	8/7/2012	< 500
	8/21/2012	< 500
	9/11/2012	< 500
	9/24/2012	< 500
	10/8/2012	< 500
	10/22/2012	< 500
	11/20/2012	< 500
	12/4/2012	< 500
	12/17/2012	< 500
Vernon Elementary School	1/10/2012	< 500
	1/24/2012	< 500
	2/7/2012	< 500
	2/21/2012	< 500
	3/6/2012	< 500
	3/20/2012	< 500
	4/3/2012	< 500
	4/16/2012	< 500
	5/8/2012	< 500
	5/22/2012	< 500

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)
Vernon Elementary School (continued)	6/5/2012	< 500
	6/19/2012	< 500
	7/10/2012	< 500
	7/24/2012	< 500
	8/7/2012	< 500
	8/21/2012	< 500
	9/11/2012	< 500
	9/24/2012	< 500
	10/8/2012	< 500
	10/22/2012	< 500
	11/6/2012	< 500
	11/20/2012	< 500
	12/4/2012	< 500
	12/17/2012	< 500
Vernon Green Nursing Home	1/10/2012	< 500
	1/24/2012	< 500
	2/7/2012	< 500
	2/21/2012	< 500
	3/6/2012	< 500
	3/20/2012	< 500
	4/3/2012	< 500
	4/16/2012	< 500
	5/8/2012	< 500
	5/22/2012	< 500
	6/5/2012	< 500
	6/19/2012	< 500
	7/10/2012	< 500
	7/24/2012	< 500
	8/7/2012	< 500
	8/21/2012	< 500

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)
Vernon Green Nursing Home (continued)	9/11/2012	< 500
	9/24/2012	< 500
	10/8/2012	< 500
	10/22/2012	< 500
	11/6/2012	< 500
	11/20/2012	< 500
	12/4/2012	< 500
	12/17/2012	< 500
White House	1/10/2012	< 500
	1/17/2012	< 500
	2/14/2012	< 500
	2/28/2012	< 500
	3/6/2012	< 500
	3/26/2012	< 500
	4/2/2012	< 500
	4/11/2012	< 500
	4/17/2012	< 500
	4/24/2012	< 500
	5/2/2012	< 500
	5/15/2012	< 500
	5/22/2012	< 500
	5/29/2012	< 500
	6/4/2012	< 500
	6/14/2012	< 500
	7/10/2012	< 500
	9/11/2012	< 500
	10/16/2012	< 500
	12/19/2012	< 500

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)
COB Well *(offline)*	9/17/2012	< 500
Main Well	1/11/2012	< 500
	1/18/2012	< 500
	2/14/2012	< 500
	2/23/2012	< 500
	2/28/2012	< 500
	3/6/2012	< 500
	3/27/2012	< 500
	4/2/2012	< 500
	4/11/2012	< 500
	4/17/2012	< 500
	4/24/2012	< 500
	4/30/2012	< 500
	5/17/2012	< 500
	5/23/2012	< 500
	5/30/2012	< 500
	6/4/2012	< 500
	6/14/2012	< 500
	7/12/2012	< 500
	9/13/2012	< 500
	10/1/2012	< 500
	12/19/2012	< 500
PSB Well	1/10/2012	< 500
	1/17/2012	< 500
	2/14/2012	< 500
	2/23/2012	< 500
	2/28/2012	< 500
	3/6/2012	< 500
	3/26/2012	< 500
	4/2/2012	< 500
	4/11/2012	< 500
	4/17/2012	< 500
	4/24/2012	< 500

Sample Location	Date of Sample	Tritium Result +/- error (pCi/L)
PSB Well (continued)	5/2/2012	< 500
	5/15/2012	< 500
	5/22/2012	< 500
	5/29/2012	< 500
	6/4/2012	< 500
	6/14/2012	< 500
	7/10/2012	< 500
	9/11/2012	< 500
	10/1/2012	< 500
	12/19/2012	< 500
Southwest Well	5/29/2012	< 500
	10/2/2012	< 500
pCi/L = picocuries per liter		

Appendix C

2012 Gamma Spectroscopy Water Data

Gamma spectroscopy data for all water samples tested by the Health Department in 2012 are provided in this appendix. Results are presented in order by sample location and by sampling date based on the following categories:

- Connecticut River samples
- On-site groundwater monitoring wells
- Off-site drinking water wells
- On-site drinking water wells

Natural means that gamma-emitting materials detected are not related to nuclear power stations or above-grounds weapons testing.

< LLD means less than the Laboratory's Lower Limit if Detection.

Sample Location	Date of Sample	Gamma Spectroscopy Result
3-3 Connecticut River Station	1/13/2012	< LLD
	2/16/2012	< LLD
	3/15/2012	< LLD
	4/13/2012	< LLD
	5/15/2012	< LLD
	6/13/2012	< LLD
	7/16/2012	< LLD
	8/15/2012	< LLD
	9/13/2012	< LLD
	10/16/2012	< LLD
	11/15/2012	< LLD
	12/13/2012	< LLD
3-4 Connecticut River Station	1/13/2012	< LLD
	2/16/2012	< LLD
	3/15/2012	< LLD
	4/13/2012	< LLD
	5/15/2012	< LLD
	6/13/2012	< LLD
	7/16/2012	< LLD
	8/15/2012	< LLD
	9/13/2012	< LLD
	10/16/2012	< LLD
	11/15/2012	< LLD
	12/13/2012	< LLD
3-8 Connecticut River Station	1/13/2012	< LLD
	2/16/2012	< LLD
	3/15/2012	< LLD
	4/13/2012	< LLD
	5/15/2012	< LLD
	6/13/2012	< LLD
	7/16/2012	< LLD
	8/15/2012	< LLD
	9/13/2012	< LLD
	10/16/2012	< LLD
	11/15/2012	< LLD
	12/13/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
Connecticut River Downstream	1/10/2012	< LLD
	1/24/2012	< LLD
	2/7/2012	< LLD
	2/21/2012	< LLD
	3/6/2012	< LLD
	3/20/2012	< LLD
	4/3/2012	< LLD
	4/16/2012	< LLD
	5/8/2012	< LLD
	5/22/2012	< LLD
	6/5/2012	< LLD
	6/19/2012	< LLD
	7/10/2012	< LLD
	7/24/2012	< LLD
	8/7/2012	< LLD
	8/21/2012	Natural
	9/11/2012	< LLD
	9/24/2012	< LLD
	10/8/2012	< LLD
	10/22/2012	< LLD
	11/6/2012	< LLD
	11/20/2012	< LLD
	12/4/2012	< LLD
	12/17/2012	< LLD
Connecticut River Upstream	1/10/2012	< LLD
	1/24/2012	< LLD
	2/7/2012	< LLD
	2/21/2012	< LLD
	3/6/2012	< LLD
	3/20/2012	< LLD
	4/3/2012	< LLD
	4/16/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
Connecticut River, Upstream (continued)	5/8/2012	< LLD
	5/22/2012	< LLD
	6/5/2012	< LLD
	6/19/2012	< LLD
	7/10/2012	< LLD
	7/24/2012	< LLD
	8/7/2012	< LLD
	8/21/2012	< LLD
	9/11/2012	< LLD
	9/24/2012	< LLD
	10/8/2012	< LLD
	10/22/2012	< LLD
	11/6/2012	< LLD
	12/4/2012	< LLD
	12/17/2012	< LLD
Discharge Forebay	1/13/2012	< LLD
	2/16/2012	< LLD
	3/15/2012	< LLD
	4/13/2012	< LLD
	5/15/2012	< LLD
	6/13/2012	< LLD
	7/16/2012	< LLD
	8/15/2012	< LLD
	9/13/2012	< LLD
	10/16/2012	< LLD
	11/15/2012	< LLD
	12/13/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
Upstream of the VY River Discharge	1/3/2012	< LLD
	1/5/2012	< LLD
	1/9/2012	< LLD
	1/12/2012	< LLD
	1/16/2012	< LLD
	1/19/2012	< LLD
	1/23/2012	< LLD
	1/26/2012	< LLD
	2/13/2012	< LLD
	2/16/2012	< LLD
	2/21/2012	< LLD
	2/23/2012	< LLD
	2/27/2012	< LLD
	2/29/2012	< LLD
	3/5/2012	< LLD
	3/8/2012	Natural
	3/12/2012	< LLD
	3/15/2012	< LLD
	3/26/2012	< LLD
	3/29/2012	< LLD
	4/2/2012	< LLD
	4/5/2012	< LLD
	4/9/2012	< LLD
	4/12/2012	< LLD
	4/16/2012	< LLD
	4/19/2012	< LLD
	4/23/2012	< LLD
	4/25/2012	< LLD
	4/30/2012	< LLD
	5/3/2012	< LLD
	5/10/2012	< LLD
	5/14/2012	< LLD
	5/17/2012	< LLD
	5/21/2012	< LLD
	5/31/2012	< LLD
	6/4/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
GZ-01	1/9/2012	< LLD
	6/5/2012	< LLD
GZ-02	1/9/2012	< LLD
	3/5/2012	< LLD
	4/2/2012	< LLD
	6/4/2012	< LLD
	7/2/2012	< LLD
	9/11/2012	Natural
	10/2/2012	< LLD
	12/4/2012	< LLD
GZ-03	1/3/2012	< LLD
	1/9/2012	< LLD
	1/16/2012	< LLD
	1/23/2012	< LLD
	2/13/2012	< LLD
	2/21/2012	< LLD
	2/27/2012	< LLD
	3/5/2012	< LLD
	3/12/2012	< LLD
	3/26/2012	< LLD
	4/2/2012	< LLD
	4/9/2012	< LLD
	4/16/2012	< LLD
	4/23/2012	< LLD
	5/14/2012	< LLD
	5/21/2012	< LLD
	5/29/2012	< LLD
	6/4/2012	< LLD
	6/11/2012	< LLD
	7/2/2012	< LLD
	9/11/2012	< LLD
	10/3/2012	< LLD
	12/3/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
GZ-04	1/9/2012	< LLD
	3/5/2012	< LLD
	4/2/2012	< LLD
	6/4/2012	< LLD
	7/2/2012	< LLD
	9/11/2012	< LLD
	10/3/2012	< LLD
	12/3/2012	< LLD
GZ-05	1/9/2012	< LLD
	3/5/2012	< LLD
	4/2/2012	< LLD
	6/4/2012	< LLD
GZ-06	1/3/2012	< LLD
	1/10/2012	< LLD
	1/17/2012	< LLD
	1/24/2012	< LLD
	2/13/2012	< LLD
	2/21/2012	< LLD
	2/27/2012	< LLD
	3/5/2012	< LLD
	3/12/2012	< LLD
	3/26/2012	< LLD
	4/2/2012	< LLD
	4/9/2012	< LLD
	4/16/2012	< LLD
	4/23/2012	< LLD
	5/14/2012	< LLD
	5/21/2012	< LLD
	5/29/2012	< LLD
	6/4/2012	< LLD
	6/11/2012	< LLD
	7/2/2012	< LLD
	9/11/2012	< LLD
	10/4/2012	< LLD
	12/4/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
GZ-07	1/3/2012	< LLD
	1/10/2012	< LLD
	1/17/2012	< LLD
	1/23/2012	< LLD
	2/13/2012	< LLD
	2/27/2012	< LLD
	3/6/2012	< LLD
	3/12/2012	< LLD
	3/26/2012	< LLD
	4/3/2012	< LLD
	4/9/2012	< LLD
	4/16/2012	< LLD
	4/23/2012	< LLD
	4/30/2012	< LLD
	5/14/2012	< LLD
	5/21/2012	< LLD
	5/29/2012	< LLD
	6/4/2012	< LLD
	7/3/2012	< LLD
	9/10/2012	< LLD
	10/2/2012	< LLD
	12/3/2012	< LLD
GZ-09	1/9/2012	< LLD
	3/5/2012	< LLD
	4/2/2012	< LLD
	6/5/2012	< LLD
	7/2/2012	< LLD
	9/11/2012	< LLD
	10/3/2012	< LLD
	12/3/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
GZ-10	1/9/2012	< LLD
	3/5/2012	< LLD
	4/2/2012	< LLD
	6/4/2012	< LLD
	7/2/2012	< LLD
	9/11/2012	< LLD
	10/3/2012	Natural
	12/3/2012	< LLD
GZ-11	1/10/2012	< LLD
	3/6/2012	< LLD
	4/3/2012	< LLD
	6/4/2012	< LLD
	7/3/2012	< LLD
	9/11/2012	< LLD
	10/2/2012	< LLD
	12/3/2012	< LLD
GZ-12D	1/3/2012	< LLD
	1/16/2012	< LLD
	2/13/2012	< LLD
	2/27/2012	< LLD
	3/5/2012	< LLD
	3/26/2012	< LLD
	4/9/2012	< LLD
	4/23/2012	< LLD
	5/14/2012	< LLD
	5/21/2012	< LLD
	5/29/2012	< LLD
	6/4/2012	< LLD
	6/11/2012	< LLD
	7/2/2012	< LLD
	9/10/2012	< LLD
	10/2/2012	< LLD
	12/4/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
GZ-12S	1/9/2012	< LLD
	3/5/2012	< LLD
	4/2/2012	< LLD
	6/4/2012	< LLD
	7/2/2012	< LLD
	9/10/2012	< LLD
	10/2/2012	< LLD
	12/4/2012	< LLD
GZ-13D	1/9/2012	< LLD
	3/6/2012	< LLD
	4/3/2012	< LLD
	6/5/2012	< LLD
	7/3/2012	< LLD
	9/10/2012	< LLD
	10/3/2012	< LLD
	12/4/2012	< LLD
GZ-13S	1/9/2012	< LLD
	3/6/2012	< LLD
	4/3/2012	< LLD
	6/5/2012	< LLD
	7/3/2012	< LLD
	9/10/2012	< LLD
	10/3/2012	< LLD
	12/4/2012	< LLD
GZ-14D	1/3/2012	< LLD
	1/16/2012	< LLD
	2/13/2012	< LLD
	2/27/2012	< LLD
	3/5/2012	< LLD
	3/26/2012	< LLD
	4/9/2012	< LLD
	4/23/2012	< LLD
	5/14/2012	< LLD
	5/21/2012	< LLD
	5/29/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
GZ-14D (continued)	6/4/2012	< LLD
	6/11/2012	< LLD
	7/2/2012	< LLD
	9/11/2012	< LLD
	10/3/2012	< LLD
	12/3/2012	< LLD
GZ-14S	1/3/2012	< LLD
	1/16/2012	< LLD
	2/13/2012	< LLD
	2/27/2012	< LLD
	3/5/2012	< LLD
	3/26/2012	< LLD
	4/9/2012	< LLD
	4/23/2012	< LLD
	5/14/2012	< LLD
	5/21/2012	< LLD
	5/29/2012	< LLD
	6/4/2012	< LLD
	6/11/2012	< LLD
	7/2/2012	< LLD
	9/11/2012	< LLD
	10/4/2012	< LLD
	12/3/2012	< LLD
GZ-15	1/3/2012	< LLD
	1/9/2012	< LLD
	1/23/2012	< LLD
	2/13/2012	< LLD
	2/27/2012	< LLD
	3/5/2012	< LLD
	4/2/2012	< LLD
	4/9/2012	< LLD
	4/24/2012	< LLD
	5/23/2012	< LLD
	5/29/2012	< LLD
	6/4/2012	< LLD
	6/11/2012	< LLD
	7/2/2012	< LLD
	9/10/2012	< LLD
	10/2/2012	< LLD
	12/4/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
GZ-16	1/9/2012	< LLD
	3/5/2012	< LLD
	4/2/2012	< LLD
	6/4/2012	< LLD
	7/2/2012	< LLD
	9/10/2012	< LLD
	10/3/2012	< LLD
	12/3/2012	< LLD
GZ-17	1/10/2012	< LLD
	3/5/2012	< LLD
	4/2/2012	< LLD
	6/4/2012	< LLD
	7/2/2012	< LLD
	9/11/2012	< LLD
	10/4/2012	< LLD
GZ-18D	1/9/2012	< LLD
	3/6/2012	< LLD
	4/3/2012	< LLD
	6/5/2012	< LLD
	7/3/2012	< LLD
	9/10/2012	< LLD
	10/3/2012	< LLD
	12/4/2012	< LLD
GZ-18S	1/9/2012	< LLD
	3/6/2012	< LLD
	4/3/2012	< LLD
	6/5/2012	< LLD
	7/3/2012	< LLD
	9/11/2012	< LLD
	10/3/2012	< LLD
	12/4/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
GZ-19D	12/21/2012	< LLD
GZ-19S	12/21/2012	< LLD
GZ-20	1/10/2012	< LLD
	3/6/2012	< LLD
	4/3/2012	< LLD
	6/4/2012	< LLD
	7/3/2012	< LLD
	9/10/2012	< LLD
	10/2/2012	< LLD
	12/3/2012	< LLD
GZ-21	1/3/2012	< LLD
	1/17/2012	< LLD
	2/13/2012	< LLD
	2/27/2012	< LLD
	3/6/2012	< LLD
	3/26/2012	< LLD
	4/9/2012	< LLD
	4/23/2012	< LLD
	5/14/2012	< LLD
	5/21/2012	< LLD
	5/29/2012	< LLD
	6/5/2012	< LLD
	6/11/2012	< LLD
	7/3/2012	< LLD
	9/10/2012	< LLD
	10/4/2012	< LLD
	12/3/2012	< LLD
GZ-22D	1/3/2012	< LLD
	1/16/2012	< LLD
	2/13/2012	< LLD
	2/27/2012	< LLD
	3/5/2012	< LLD
	3/26/2012	< LLD
	4/9/2012	< LLD
	4/23/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
GZ-22D (continued)	5/14/2012	< LLD
	5/21/2012	< LLD
	5/29/2012	< LLD
	6/4/2012	< LLD
	6/11/2012	< LLD
	7/2/2012	< LLD
	9/11/2012	Natural
	10/4/2012	< LLD
	12/3/2012	< LLD
GZ-23S	1/9/2012	< LLD
	3/5/2012	< LLD
	4/2/2012	< LLD
	6/4/2012	< LLD
	7/2/2012	< LLD
	9/10/2012	< LLD
	10/2/2012	< LLD
	12/4/2012	< LLD
GZ-24S	1/3/2012	< LLD
	1/10/2012	< LLD
	1/17/2012	< LLD
	1/26/2012	< LLD
	2/13/2012	< LLD
	2/21/2012	< LLD
	2/27/2012	< LLD
	3/5/2012	< LLD
	3/12/2012	< LLD
	3/26/2012	< LLD
	4/2/2012	< LLD
	4/9/2012	< LLD
	4/16/2012	< LLD
	4/24/2012	< LLD
	4/30/2012	< LLD
	5/14/2012	< LLD
	5/21/2012	< LLD
	6/4/2012	< LLD
	7/2/2012	< LLD
	9/10/2012	< LLD
	10/2/2012	< LLD
	12/4/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
GZ-25S	1/9/2012	< LLD
	3/5/2012	< LLD
	4/2/2012	< LLD
	6/5/2012	< LLD
	7/2/2012	< LLD
	9/11/2012	< LLD
	10/4/2012	< LLD
	12/3/2012	< LLD
GZ-26S	1/9/2012	< LLD
	3/5/2012	< LLD
	4/2/2012	< LLD
	6/5/2012	< LLD
	7/2/2012	< LLD
	9/11/2012	< LLD
	12/3/2012	< LLD
GZ-27S	1/9/2012	Natural
	3/5/2012	< LLD
	4/2/2012	< LLD
	6/5/2012	< LLD
	7/2/2012	< LLD
	9/11/2012	< LLD
	10/4/2012	< LLD
	12/3/2012	< LLD
WVN0201	2/7/2012	< LLD
	5/9/2012	< LLD
	8/8/2012	< LLD
	11/7/2012	< LLD
WVN0202	2/7/2012	< LLD
	5/9/2012	< LLD
	8/8/2012	< LLD
	11/7/2012	< LLD
WVN0203	2/7/2012	< LLD
	5/9/2012	< LLD
	8/8/2012	< LLD
	11/7/2012	< LLD
WVN0204	2/7/2012	Natural
	5/9/2012	< LLD
	8/8/2012	< LLD
	11/7/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
Blodgett Farm	1/10/2012	Natural
	1/24/2012	Natural
	2/7/2012	Natural
	2/21/2012	< LLD
	3/6/2012	Natural
	3/20/2012	Natural
	4/3/2012	Natural
	4/16/2012	< LLD
	5/8/2012	Natural
	5/22/2012	< LLD
	6/5/2012	Natural
	6/19/2012	< LLD
	7/10/2012	Natural
	7/24/2012	Natural
	8/7/2012	Natural
	8/21/2012	Natural
	9/11/2012	Natural
	9/24/2012	Natural
	10/8/2012	Natural
	10/22/2012	Natural
	11/6/2012	Natural
	11/20/2012	Natural
	12/4/2012	Natural
	12/17/2012	Natural
Brattleboro Fire Dept, West Station	1/10/2012	Natural
	1/24/2012	< LLD
	2/7/2012	< LLD
	2/21/2012	< LLD
	3/6/2012	< LLD
	3/20/2012	< LLD
	4/3/2012	< LLD
	4/16/2012	< LLD
	5/8/2012	< LLD
	5/22/2012	< LLD
	6/5/2012	< LLD
	6/19/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
Brattleboro Fire Dept, West Station (continued)	7/10/2012	< LLD
	7/24/2012	< LLD
	8/7/2012	< LLD
	8/21/2012	< LLD
	9/11/2012	< LLD
	9/24/2012	< LLD
	10/8/2012	< LLD
	10/22/2012	< LLD
	11/6/2012	< LLD
	11/20/2012	< LLD
	12/4/2012	< LLD
	12/17/2012	< LLD
Mendon AOT	5/22/2012	< LLD
Miller Farm	1/10/2012	Natural
	1/24/2012	Natural
	2/7/2012	Natural
	2/21/2012	< LLD
	3/6/2012	< LLD
	3/20/2012	< LLD
	4/3/2012	Natural
	4/16/2012	< LLD
	5/8/2012	Natural
	5/22/2012	< LLD
	6/5/2012	Natural
	6/19/2012	< LLD
	7/10/2012	Natural
	7/24/2012	Natural
	8/7/2012	Natural
	8/21/2012	Natural
	9/11/2012	Natural
	9/24/2012	< LLD
	10/8/2012	Natural
	10/22/2012	Natural
	11/6/2012	Natural
	11/20/2012	Natural
	12/4/2012	< LLD
	12/17/2012	Natural

Sample Location	Date of Sample	Gamma Spectroscopy Result
Residence - 1	1/10/2012	< LLD
	1/24/2012	Natural
	2/7/2012	< LLD
	2/21/2012	< LLD
	3/6/2012	< LLD
	3/20/2012	< LLD
	4/3/2012	< LLD
	4/16/2012	< LLD
	5/8/2012	Natural
	5/22/2012	< LLD
	6/5/2012	< LLD
	6/19/2012	< LLD
	7/10/2012	< LLD
	7/24/2012	< LLD
	8/7/2012	Natural
	8/21/2012	Natural
	9/11/2012	Natural
	9/24/2012	< LLD
	10/8/2012	Natural
	10/22/2012	Natural
	11/20/2012	Natural
	12/4/2012	< LLD
	12/17/2012	Natural
Vernon Elementary School	1/10/2012	< LLD
	1/24/2012	Natural
	2/7/2012	Natural
	2/21/2012	< LLD
	3/6/2012	< LLD
	3/20/2012	< LLD
	4/3/2012	Natural
	4/16/2012	< LLD
	5/8/2012	Natural
	5/22/2012	< LLD
	6/5/2012	Natural
	6/19/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
	7/24/2012	< LLD
	8/7/2012	Natural
	8/21/2012	< LLD
	9/11/2012	Natural
	9/24/2012	Natural
	10/8/2012	Natural
	10/22/2012	Natural
	11/6/2012	Natural
	11/20/2012	Natural
	12/4/2012	< LLD
	12/17/2012	Natural
Vernon Green Nursing Home	1/10/2012	Natural
	1/24/2012	Natural
	2/7/2012	< LLD
	2/21/2012	< LLD
	3/6/2012	< LLD
	3/20/2012	< LLD
	4/3/2012	Natural
	4/16/2012	< LLD
	5/8/2012	Natural
	5/22/2012	< LLD
	6/5/2012	< LLD
	6/19/2012	< LLD
	7/10/2012	Natural
	7/24/2012	< LLD
	8/7/2012	Natural
	8/21/2012	Natural
	9/11/2012	Natural
	9/24/2012	Natural
	10/8/2012	Natural
	10/22/2012	Natural
	11/6/2012	< LLD
	11/20/2012	Natural
	12/4/2012	< LLD
	12/17/2012	Natural

Sample Location	Date of Sample	Gamma Spectroscopy Result
White House	1/10/2012	< LLD
	1/17/2012	< LLD
	2/14/2012	< LLD
	2/28/2012	< LLD
	3/6/2012	< LLD
	3/26/2012	< LLD
	4/2/2012	< LLD
	4/11/2012	< LLD
	4/17/2012	< LLD
	4/24/2012	< LLD
	5/2/2012	Natural
	5/15/2012	< LLD
	5/22/2012	< LLD
	6/4/2012	< LLD
	7/10/2012	< LLD
	9/11/2012	< LLD
	10/16/2012	< LLD
	12/19/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
COB Well (ofline)	9/17/2012	< LLD
Main Well	1/11/2012	< LLD
	1/18/2012	< LLD
	2/14/2012	< LLD
	2/23/2012	< LLD
	2/28/2012	< LLD
	3/6/2012	< LLD
	3/27/2012	< LLD
	4/2/2012	< LLD
	4/11/2012	< LLD
	4/17/2012	< LLD
	4/24/2012	Natural
	4/30/2012	Natural
	5/17/2012	< LLD
	5/23/2012	< LLD
	6/4/2012	< LLD
	7/12/2012	< LLD
	9/13/2012	< LLD
	10/1/2012	Natural
	12/19/2012	< LLD
PSB Well	1/10/2012	< LLD
	1/17/2012	< LLD
	2/14/2012	< LLD
	2/23/2012	< LLD
	2/28/2012	< LLD
	3/6/2012	< LLD
	3/26/2012	< LLD
	4/2/2012	< LLD
	4/11/2012	< LLD
	4/17/2012	< LLD
	4/24/2012	< LLD
	5/2/2012	Natural
	5/15/2012	< LLD
	5/22/2012	< LLD
	6/4/2012	< LLD
	7/10/2012	< LLD

Sample Location	Date of Sample	Gamma Spectroscopy Result
PSB Well (continued)	9/11/2012	< LLD
	10/1/2012	Natural
	12/19/2012	< LLD
Southwest Well	5/29/2012	< LLD
	10/2/2012	Natural
< LLD means less than the Laboratory's Lower Limit of Detection		

Appendix D

2012 Hard-to-Detect Water Results

Hard-to-detect metal results for all water samples tested by the Health Department in 2012 are provided in this appendix. Results are presented in alphabetical order by sample location and by sampling date based on the following categories:

- Connecticut River samples
- On-site groundwater monitoring wells
- Off-site drinking water wells
- On-site drinking water wells

Lower limit of detections (LLDs) for water samples:

Iron-55: 50 pCi/L

Nickel-63: 5.0 pCi/L

Strontium-90[1]: 2.0 pCi/L

[1] Strontium-89 lower limit of detection varied due to shorter half-life.

Sample Location	Sample Date	Hard-to Detect Results	Sample Date	Hard-to Detect Results
3-3 Connecticut River Station	2/16/2012	< LLD	5/15/2012	< LLD
	8/15/2012	< LLD	11/15/2012	< LLD
3-4 Connecticut River Station	2/16/2012	< LLD	5/15/2012	< LLD
	8/15/2012	< LLD	11/15/2012	< LLD
3-8 Connecticut River Station	2/16/2012	< LLD	5/15/2012	< LLD
	8/15/2012	< LLD	11/15/2012	< LLD
Connecticut River Downstream	2/7/2012	< LLD	5/8/2012	< LLD
	8/7/2012	< LLD	11/6/2012	< LLD
Connecticut River Upstream	2/6/2012	< LLD	2/7/2012	< LLD
	5/7/2013	< LLD	5/8/2013	< LLD
	8/7/2012	< LLD	11/6/2012	< LLD
Discharge Forebay	2/16/2012	< LLD	5/15/2012	< LLD
	8/15/2012	< LLD	11/15/2012	< LLD
Upstream of the River Discharge	2/6/2012	< LLD	2/9/2012	< LLD
	4/25/2012	< LLD	5/7/2012	< LLD
GZ-01	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/7/2012	< LLD
GZ-02	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/7/2012	< LLD
GZ-03	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/7/2012	< LLD
GZ-04	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/7/2012	< LLD
GZ-05	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/7/2012	< LLD
GZ-06	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/5/2012	< LLD
GZ-07	2/7/2012	< LLD	5/7/2012	< LLD
	8/7/2012	< LLD	11/5/2012	< LLD
GZ-09	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/5/2012	< LLD
GZ-10	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/5/2012	< LLD
GZ-11	2/7/2012	< LLD	5/7/2012	< LLD
	8/7/2012	< LLD	11/5/2012	< LLD

Sample Location	Sample Date	Hard-to Detect Results	Sample Date	Hard-to Detect Results
GZ-12D	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/5/2012	< LLD
GZ-12S	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/5/2012	< LLD
GZ-13D	2/7/2012	< LLD	5/8/2012	< LLD
	8/7/2012	< LLD	11/6/2012	< LLD
GZ-13S	2/7/2012	< LLD	5/8/2012	< LLD
	8/7/2012	< LLD	11/6/2012	< LLD
GZ-14D	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/7/2012	< LLD
GZ-14S	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/7/2012	< LLD
GZ-15	2/6/2012	< LLD	5/8/2012	< LLD
	8/6/2012	< LLD	11/5/2012	< LLD
GZ-16	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/6/2012	< LLD
GZ-17	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/5/2012	< LLD
GZ-18D	2/7/2012	< LLD	5/8/2012	< LLD
	8/7/2012	< LLD	11/6/2012	< LLD
GZ-18S	2/7/2012	< LLD	5/8/2012	< LLD
	8/7/2012	< LLD	11/6/2012	< LLD
GZ-19D	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/6/2012	< LLD
GZ-19S	2/7/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/6/2012	< LLD
GZ-20	2/7/2012	< LLD	5/7/2012	< LLD
	8/7/2012	< LLD	11/5/2012	< LLD
GZ-21	2/7/2012	< LLD	5/7/2012	< LLD
	8/7/2012	< LLD	11/5/2012	< LLD
GZ-22D	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/7/2012	< LLD
GZ-23S	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/5/2012	< LLD
GZ-24S	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/5/2012	< LLD

Sample Location	Sample Date	Hard-to Detect Results	Sample Date	Hard-to Detect Results
GZ-25S	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/5/2012	< LLD
GZ-26S	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/5/2012	< LLD
GZ-27S	2/6/2012	< LLD	5/7/2012	< LLD
	8/6/2012	< LLD	11/5/2012	< LLD
WVN0201	2/7/2012	< LLD	5/9/2012	< LLD
	8/8/2012	< LLD	11/07/2012	< LLD
WVN0202	2/7/2012	< LLD	5/9/2012	< LLD
	8/8/2012	< LLD	11/07/2012	< LLD
WVN0203	2/7/2012	< LLD	5/9/2012	< LLD
	8/8/2012	< LLD	11/07/2012	< LLD
WVN0204	2/7/2012	< LLD	5/9/2012	< LLD
	8/8/2012	< LLD	11/07/2012	< LLD
Blodgett Farm	2/7/2012	< LLD	5/8/2012	< LLD
	8/7/2012	< LLD	11/06/2012	< LLD
Brattleboro Fire Department, West Station	2/7/2012	< LLD	5/8/2012	< LLD
	8/7/2012	< LLD	11/06/2012	< LLD
Miller Farm	2/7/2012	< LLD	5/8/2012	< LLD
	8/7/2012	< LLD	11/06/2012	< LLD
Residence-1	2/7/2012	< LLD	5/8/2012	< LLD
	8/7/2012	< LLD	10/22/2012	< LLD
Vernon Elementary School	2/7/2012	< LLD	5/8/2012	< LLD
	8/7/2012	< LLD	11/06/2012	< LLD
Vernon Green Nursing Home	2/7/2012	< LLD	5/8/2012	< LLD
	7/17/2012	< LLD	8/7/2012	< LLD
	11/5/2012	< LLD		
Main well	2/9/2012	< LLD	5/8/2012	< LLD
	07/17/2012	< LLD	08/16/2012	< LLD
PSB Well	5/8/2012	< LLD	07/17/2012	< LLD
	08/15/2012	< LLD		
Southwest Well	5/29/2012	< LLD	07/23/2012	< LLD
	10/02/2012	< LLD		
White House	2/7/2012	< LLD	5/8/2012	< LLD
	08/13/2012	< LLD		
Cob Well	09/17/2012	< LLD		
COB Composite-Sample B	09/17/2012	< LLD		
Copeland Well	7/17/2012	< LLD		

Appendix E

2012 Rutland County Fish Results

			EDIBLE PORTION			INEDIBLE PORTION		
Fish species	Location	Mass (g)	Cesium-137 ± error (pCi/kg)	Strontium-90 ± error (pCi/kg)	Potassium-40 ± error (pCi/kg)	Cesium-137 ± error (pCi/kg)	Strontium-90 ± error (pCi/kg)	Potassium-40 ± error (pCi/kg)
Bluegill	Bomoseen	533	< LLD	< LLD	3,610 ± 752	< LLD	20.6 ± 7.0	2,070 ± 577
	Bomoseen	546	< LLD	< LLD	3,330 ± 746	< LLD	7.2 ± 4.0	2,080 ± 489
	Hortonia	500	< LLD	< LLD	2,910 ± 661	< LLD	14.5 ± 5.4	2,000 ± 436
	Hortonia	538	< LLD	< LLD	2,740 ± 724	< LLD	10.6 ± 4.6	2,220 ± 462
	Hortonia	525	< LLD	< LLD	3,050 ± 1210	< LLD	11.5 ± 4.8	2,220 ± 347
	Hortonia	505	< LLD	< LLD	3,370 ± 840	< LLD	14.4 ± 5.4	2,400 ± 556
Brown Bullhead	Bomoseen	550	< LLD	< LLD	3,490 ± 831	< LLD	14.8 ± 5.7	1,930 ± 598
	Bomoseen	595	< LLD	< LLD	2,900 ± 843	< LLD	18.4 ± 5.9	2,550 ± 568
	Bomoseen	535	< LLD	< LLD	3,510 ± 681	< LLD	9.9 ± 4.1	2,450 ± 502
	Bomoseen	653	< LLD	< LLD	3,670 ± 806	< LLD	7.1 ± 3.8	2,190 ± 451
	Hortonia	654	< LLD	< LLD	3,840 ± 1,190	< LLD	< LLD	2,370 ± 405
	Hortonia	529	< LLD	< LLD	< LLD	< LLD	16.4 ± 5.5	2,340 ± 466
	Hortonia	504	< LLD	< LLD	3,350 ± 1,160	< LLD	10.5 ± 4.3	2,370 ± 512
	Hortonia	504	< LLD	< LLD	3,150 ± 1,130	< LLD	< LLD	2,480 ± 644
	Hortonia	538	< LLD	< LLD	3,210 ± 988	< LLD	6.5 ± 3.7	2,090 ± 453
	Hortonia	529	< LLD	< LLD	3,010 ± 716	< LLD	5.7 ± 3.6	2,180 ± 476
Crappie	Hortonia/Bomoseen	500 *(est)*	< LLD	< LLD	3,050 ± 743	< LLD	14.8 ± 5.8	1,480 ± 571
Largemouth Bass	Bomoseen	564	< LLD	< LLD	3,800 ± 806	< LLD	18.9 ± 6.5	2,590 ± 503
	Bomoseen	565	< LLD	< LLD	2,920 ± 788	< LLD	6.3 ± 3.5	2,710 ± 653
	Bomoseen	598	< LLD	< LLD	4,310 ± 866	< LLD	13.0 ± 5.0	2,560 ± 542
	Bomoseen	638	< LLD	< LLD	2,580 ± 629	< LLD	12.9 ± 4.9	2,570 ± 523
	Bomoseen	678	< LLD	< LLD	3,770 ± 805	< LLD	18.9 ± 6.4	1,220 ± 494
	Hortonia	902	< LLD	< LLD	3,140 ± 440	< LLD	11.3 ± 4.8	2,630 ± 648
	Hortonia	594	< LLD	< LLD	3,910 ± 802	< LLD	11.3 ± 4.8	1,870 ± 412
	Hortonia	701	< LLD	< LLD	2,680 ± 810	< LLD	13.0 ± 5.0	2,120 ± 385

			EDIBLE PORTION			INEDIBLE PORTION		
Fish species	Location	Mass (g)	Cesium-137 ± error (pCi/kg)	Strontium-90 ± error (pCi/kg)	Potassium-40 ± error (pCi/kg)	Cesium-137 ± error (pCi/kg)	Strontium-90 ± error (pCi/kg)	Potassium-40 ± error (pCi/kg)
Northern Pike	Bomoseen	1,584	46.8 ± 15	< LLD	3,230 ± 405	< LLD	6.5 ± 3.7	2,210 ± 428
	Hortonia	512	< LLD	< LLD	3,540 ± 756	< LLD	5.5 ± 3.2	1,880 ± 593
	Hortonia	1,385	26.7 ± 9	< LLD	2,960 ± 359	< LLD	9.6 ± 4.3	2,390 ± 510
Pumpkinseed	Bomoseen	520	< LLD	< LLD	3,030 ± 771	< LLD	11.5 ± 4.7	1,770 ± 402
	Bomoseen	680	< LLD	< LLD	3,440 ± 855	< LLD	19.2 ± 6.7	1,910 ± 490
	Hortonia	559	< LLD	< LLD	3,140 ± 695	< LLD	5.5 ± 3.6	2,370 ± 327
	Hortonia	547	< LLD	< LLD	2,980 ± 726	< LLD	11.1 ± 4.6	1,920 ± 613
	Hortonia	515	< LLD	< LLD	2,800 ± 789	< LLD	10.8 ± 4.6	2,220 ± 336
	Hortonia	500	< LLD	< LLD	2,100 ± 842	< LLD	8.0 ± 4.0	2,020 ± 685
Rock Bass	Bomoseen	460	< LLD	< LLD	2,430 ± 880	< LLD	22.6 ± 7.1	1,480 ± 429
	Bomoseen	502	< LLD	< LLD	3,420 ± 1,270	< LLD	18.6 ± 6.1	2,300 ± 452
	Bomoseen	510	< LLD	< LLD	4,490 ± 1,230	23.3 ± 14	11.8 ± 4.8	2,320 ± 328
	Bomoseen	595	< LLD	< LLD	3,370 ± 728	< LLD	21.1 ± 6.8	2,230 ± 457
	Hortonia	534	< LLD	< LLD	2,650 ± 820	< LLD	11.7 ± 4.9	2,230 ± 482
Smallmouth Bass	Bomoseen	527	< LLD	< LLD	3,280 ± 832	< LLD	23.0 ± 7.3	2,210 ± 522
	Bomoseen	514	< LLD	< LLD	2,890 ± 943	< LLD	24.7 ± 7.7	2,020 ± 537
Yellow Perch	Bomoseen	536	< LLD	< LLD	3,160 ± 736	< LLD	16.0 ± 5.8	2,120 ± 493
	Bomoseen	515	< LLD	< LLD	3,240 ± 879	< LLD	25.8 ± 8.1	1,750 ± 578
	Bomoseen	545	< LLD	< LLD	3,450 ± 706	< LLD	12.5 ± 5.2	1,890 ± 450
	Bomoseen	645	< LLD	< LLD	3,230 ± 711	< LLD	17.6 ± 6.1	2,120 ± 504
	Hortonia	503	< LLD	< LLD	2,960 ± 796	< LLD	7.4 ± 3.9	2,210 ± 490
	Hortonia	546	< LLD	< LLD	3,380 ± 809	< LLD	12.4 ± 4.9	2,030 ± 405