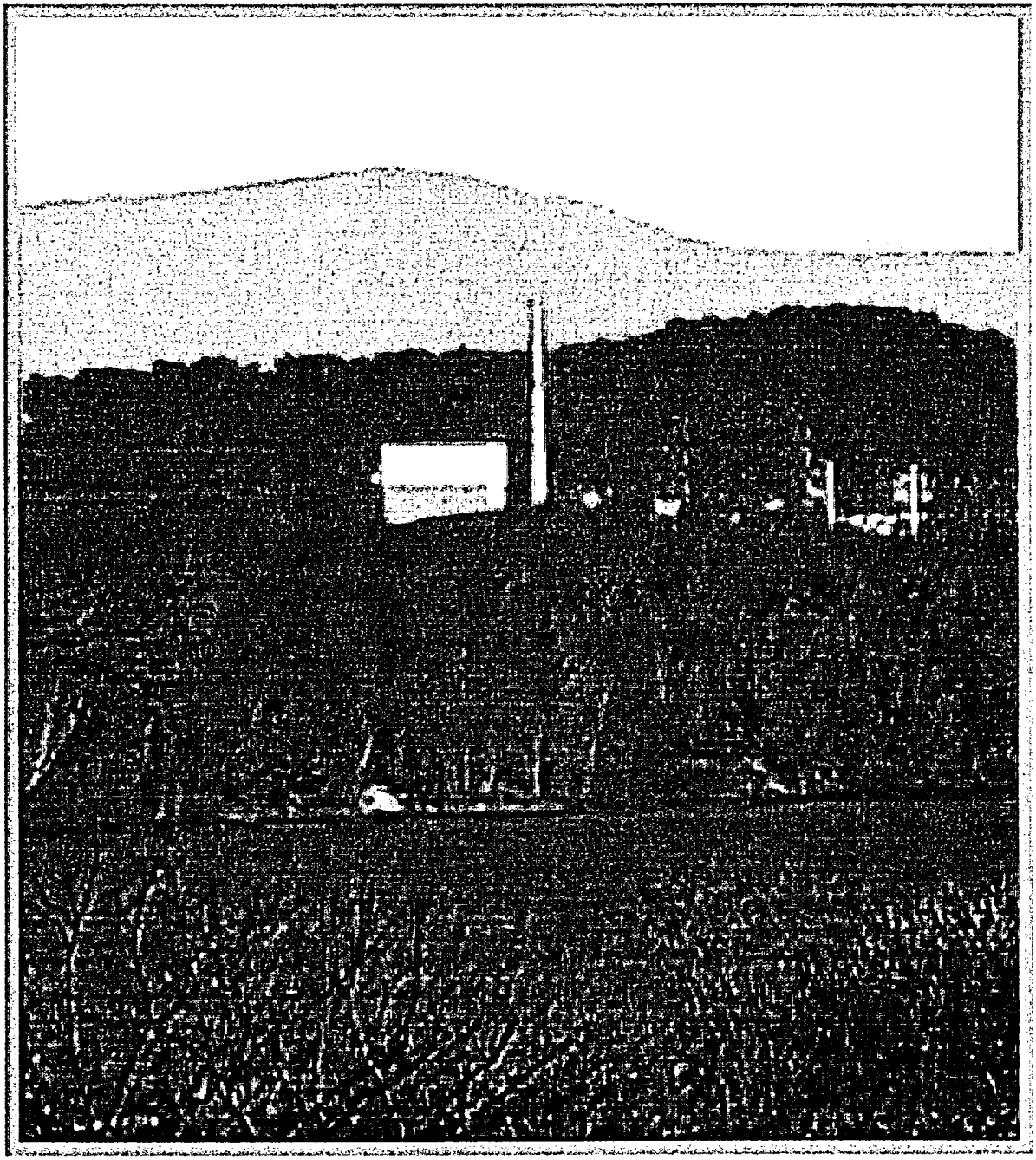
VERMONT YANKEE NUCLEAR POWER STATION



2002 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

ENTERGY NUCLEAR NORTHEAST - VERMONT YANKEE
Vermont Yankee Nuclear Power Station

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

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Prepared by:
Entergy Nuclear Northeast - Vermont Yankee
Chemistry Department Staff

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1. INTRODUCTION

This report summarizes the findings of the Radiological Environmental Monitoring Program (REMP) conducted by Vermont Yankee Nuclear Power Corporation in the vicinity of the Vermont Yankee Nuclear Power Station (VYNPS) in Vernon, Vermont during the calendar year 2002. It is submitted annually in compliance with plant Technical Specification 6.6.E. The remainder of this report is organized as follows:

Section 2: Provides an introductory explanation to the background radioactivity and radiation that is detected in the plant environs.

Section 3: Provides a brief description of the Vermont Yankee Nuclear Power Station site and its environs.

Section 4: Provides a description of the overall REMP program design. Included is a summary of the Vermont Yankee Nuclear Power Station (VYNPS) Off-Site Dose Calculation Manual (ODCM) requirements for REMP sampling, tables listing all locations sampled or monitored in 2002 with compass sectors and distances from the plant, and maps showing each REMP location. Tables listing Lower Limit of Detection requirements and Reporting Levels are also included.

Section 5: Consists of the summarized data as required by the VYNPS ODCM. The tables are in a format similar to that specified by the NRC Radiological Assessment Branch Technical Position on Environmental Monitoring (Reference 1). Also included is a summary of the 2002 environmental TLD measurements.

Section 6: Provides the results of the 2002 monitoring program. The performance of the program in meeting regulatory requirements as given in the ODCM is discussed, and the data acquired during the year are analyzed.

Section 7: Provides an overview of the Quality Assurance programs used at Teledyne Brown Engineering Laboratory. Included are the laboratory's results of the Analytics Intercomparison Program.

Section 8: Summarizes the requirements and the results of the 2002 Land Use Census.

Section 9: Gives a summary of the 2002 Radiological Environmental Monitoring Program.

2. BACKGROUND RADIOACTIVITY

Radiation or radioactivity potentially detected in the Vermont Yankee environment can be grouped into three categories. The first is "naturally-occurring' radiation and radioactivity. The second is "man-made" radioactivity from sources other than the Vermont Yankee plant. The third potential source of radioactivity is due to emissions from the Vermont Yankee plant. For the purposes of the Vermont Yankee REMP, the first two categories are classified as "background" radiation, and are the subject of discussion in this section of the report. The third category is the one that the REMP is designed to detect and evaluate.

2.1 Naturally Occurring Background Radioactivity

Natural radiation and radioactivity in the environment, which provide the major source of human radiation exposure, may be subdivided into three separate categories: "primordial radioactivity," "cosmogenic radioactivity" and "cosmic radiation." "Primordial radioactivity" is made up of those radionuclides that were created with the universe and that have a sufficiently long half-life to be still present on the earth. Included in this category are the radionuclides that these elements have decayed into. A few of the more important radionuclides in this category are Uranium-238 (U-238), Thorium-232 (Th-232), Rubidium-87 (Rb-87), Potassium-40 (K-40), Radium-226 (Ra-226), and Radon-222 (Rn-222). Uranium-238 and Thorium-232 are readily detected in soil and rock, whether through direct field measurements or through laboratory analysis of samples. Radium-226 in the earth can find its way from the soil into ground water, and is often detectable there. Radon-222 is one of the components of natural background in air, and its daughter products are detectable on air sampling filters. Potassium-40 comprises about 0.01 percent of all natural potassium in the earth, and is consequently detectable in most biological substances, including the human body. There are many more primordial radionuclides found in the environment in addition to the major ones discussed above (Reference 2).

The second sub-category of naturally-occurring radiation and radioactivity is "cosmogenic radioactivity." This is produced through the nuclear interaction of high energy cosmic radiation with elements in the earth's atmosphere, and to a much lesser degree, in the earth's crust. These radioactive elements are then incorporated into the entire geosphere and atmosphere, including the earth's soil, surface rock, biosphere, sediments, ocean floors, polar ice and atmosphere. The major radionuclides in this category are Carbon-14 (C-14), Hydrogen-3 (H-3 or Tritium), Sodium-22 (Na-22), and Beryllium-7 (Be-7). Beryllium-7 is the one most readily detected, and is found on air sampling filters and occasionally in biological media (Reference 2).

The third sub-category of naturally-occurring radiation and radioactivity is "cosmic radiation." This consists of high energy atomic and sub-atomic particles of extra-terrestrial origin and the secondary particles and radiation that are produced through their interaction in the earth's atmosphere. The majority of this radiation comes from outside of our solar system, and to a lesser degree from the sun. We are protected from most of this radiation by the earth's atmosphere, which absorbs the radiation. Consequently, one can see that with increasing elevation one would be exposed to more cosmic radiation as a direct result of a thinner layer of air for protection. This "direct radiation" is detected in the field with gamma spectroscopy equipment, high pressure ion chambers and thermoluminescent dosimeters (TLDs).

2.2 Man-Made Background Radioactivity

The second source of "background" radioactivity in the Vermont Yankee environment is from "man-made" sources not related to the power plant. The most recent contributor to this category was the fallout from the Chernobyl accident in April of 1986, which was detected in the Vermont Yankee environment and other parts of the world. A much greater contributor to this category, however, has been fallout from atmospheric nuclear weapons tests. Tests were conducted from 1945 through 1980 by the United States, the Soviet Union, the United Kingdom, China and France, with the large majority of testing occurring during the periods 1954-1958 and 1961-1962. (A test ban treaty was signed in 1963 by the United States, Soviet Union and United Kingdom, but not by France and China.) Atmospheric testing was conducted by the People's Republic of China as recently as October 1980. Much of the fallout detected today is due to this explosion and the last large scale one, done in November of 1976 (Reference 3).

The radioactivity produced by these detonations was deposited worldwide. The amount of fallout deposited in any given area is dependent on many factors, such as the explosive yield of the device, the latitude and altitude of the detonation, the season in which it occurred, and the timing of subsequent rainfall which washes fallout from the troposphere (Reference 4). Most of this fallout has decayed into stable elements, but the residual radioactivity is still readily detectable in environmental samples worldwide. The two predominant radionuclides are Cesium137 (Cs-137) and Strontium-90 (Sr-90). They are found in soil and in vegetation, and since cows and goats graze large areas of vegetation, these radionuclides are also readily detected in milk.

Other potential "man-made" sources of environmental "background" radioactivity include other nuclear power plants, coal-fired power plants, national defense installations, hospitals, research laboratories and industry. These collectively are insignificant on a global scale when compared to the sources discussed above (natural and fallout).

3. GENERAL PLANT AND SITE INFORMATION

The Vermont Yankee Nuclear Power Station is located in the town of Vernon, Vermont in Windham County. The 130-acre site is on the west shore of the Connecticut River, immediately upstream of the Vernon Hydroelectric Station. The plant site is bounded on the north, south and west by privately-owned land, and on the east by the Connecticut River. The surrounding area is generally rural and lightly populated, and the topography is flat or gently rolling on the valley floor.

Construction of the single 540 megawatt BWR (Boiling Water Reactor) plant began in 1967. The pre-operational Radiological Environmental Monitoring Program, designed to measure environmental radiation and radioactivity levels in the area prior to station operation, began in 1970. Commercial operation began on November 30, 1972.

4. PROGRAM DESIGN

The Radiological Environmental Monitoring Program (REMP) for the Vermont Yankee Nuclear Power Station (VYNPS) was designed with specific objectives in mind. These are:

- To provide an early indication of the appearance or accumulation of any radioactive material in the environment caused by the operation of the station.
- To provide assurance to regulatory agencies and the public that the station's environmental impact is known and within anticipated limits.
- To verify the adequacy and proper functioning of station effluent controls and monitoring systems.
- To provide standby monitoring capability for rapid assessment of risk to the general public in the event of unanticipated or accidental releases of radioactive material.

The program was initiated in 1970, approximately two years before the plant began commercial operation. It has been in operation continuously since that time, with improvements made periodically over those years.

The current program is designed to meet the intent of NRC Regulatory Guide 4.1, *Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants;* NRC Regulatory Guide 4.8, *Environmental Technical Specifications for Nuclear Power Plants;* the NRC Radiological Assessment Branch Technical Position of November 1979, *An Acceptable Radiological Environmental Monitoring Program;* and NRC NUREG-0473, *Radiological Effluent Technical Specifications for BWRs.* The environmental TLD program has been designed and tested around NRC Regulatory Guide 4.13, *Performance, Testing and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications.* The quality assurance program is designed around the guidance given in NRC Regulatory Guide *4.15, Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment.*

The sampling requirements of the REMP are given in the Off-Site Dose Calculation Manual Table 3.5.1. and are summarized in Table 4.1 of this report. The identification of the required sampling locations is given in the Off-Site Dose Calculation Manual (ODCM), Chapter 7. These sampling and monitoring locations are shown graphically on the maps in Figures 4.1 through 4.6 of this report.

The Vermont Yankee Chemistry Department conducts the radiological environmental monitoring program and collects all airborne, terrestrial and ground water samples. VYNPS maintains a contract with Normandeau Associates to collect all fish, river water and river sediment samples. In 2002, analytical measurements of environmental samples were performed at the Teledyne Brown Engineering Laboratory (TBE) in Knoxville, Tennessee. TLD badges are posted and retrieved by the Vermont Yankee Chemistry Department, and are analyzed by the Framatome ANP Environmental Laboratory in Westborough, Massachusetts.

4.1 Monitoring Zones

The REMP is designed to allow comparison of levels of radioactivity in samples from the area possibly influenced by the plant to levels found in areas not influenced by the plant. Monitoring locations within the first zone are called "indicators." Those within the second zone are called "controls." The distinction between the two zones, depending on the type of sample or sample pathway, is based on one or more of several factors, such as site meteorological history, meteorological dispersion calculations, relative direction from the plant, river flow, and distance. Analysis of survey data from the two zones aids in determining if there is a significant difference between the two areas. It can also help in differentiating between radioactivity and radiation due to plant releases and that due to other fluctuations in the environment, such as atmospheric nuclear weapons test fallout or seasonal variations in the natural background.

4.2 Pathways Monitored

Four pathway categories are monitored by the REMP. They are the airborne, waterborne, ingestion and direct radiation pathways. Each of these four categories is monitored by the collection of one or more sample media, which are listed below, and are described in more detail in this section:

Airborne Pathway
- Air Particulate Sampling
- Charcoal Cartridge (Radioiodine) Sampling

Waterborne Pathways
- River Water Sampling
- Ground Water Sampling
- Sediment Sampling

Ingestion Pathways
- Milk Sampling
- Silage Sampling
- Mixed Grass Sampling
- Fish Sampling

Direct Radiation Pathway
TLD Monitoring

4.3 Descriptions of Monitoring Programs

4.3.1 Air Sampling

Continuous air samplers are installed at seven locations. (Five are required by the VYNPS ODCM.) The sampling pumps at these locations operate continuously at a flow rate of approximately one cubic foot per minute. Airborne particulates are collected by passing air through a 50 mm glass-fiber filter. A dry gas meter is incorporated into the sampling stream to measure the total volume of air sampled in a given interval. The entire system is housed in a weatherproof structure. The filters were collected on a weekly frequency and to allow for the decay of radon daughter products, the analysis for gross beta radioactivity is delayed for more than 24 hours. The weekly filters were composited by location at the environmental laboratory for a quarterly gamma spectroscopy analysis.

If the gross-beta activity on an air particulate sample is greater than ten times the yearly mean of the control samples, ODCM Table 3.5.1, Note c, requires a gamma isotopic analysis on the sample. Whenever the main plant stack effluent release rate of I-131 is equal to or greater than 0.1 μCi/sec, weekly air particulate collection from the plant stack is required by ODCM Table 3.5.1, Note h.

4.3.2 Charcoal Cartridge (Radioiodine) Sampling

Continuous air samplers are installed at seven locations. (Five are required by the ODCM Table 3.5.1.) The sampling pumps at these locations operate continuously at a flow rate of approximately one cubic foot per minute. A 60 cc TEDA-impregnated charcoal cartridge is located downstream of the air particulate filter described in Section 4.3.1 above. A dry gas meter is incorporated into the sampling stream to measure the total volume of air sampled in a given interval. The entire system is housed in a weatherproof structure. These cartridges are collected and analyzed weekly for I-131.

Whenever the main plant stack effluent release rate of 1-131 is equal to or greater than 0.1 μCi/sec, weekly charcoal cartridge collection is required, pursuant to ODCM Table 3.5.1, Note h.

4.3.3 River Water Sampling

An automatic compositing sampler is maintained at the downstream sampling location by the Vermont Yankee Chemistry Department staff. Normandeau Associates personnel maintain the pump that delivers river water to the sampler. The sampler is controlled by a timer that collects a frequent aliquot of river water. An additional grab sample is collected monthly at the upstream control location. Each sample is

analyzed for gamma-emitting radionuclides. Although not required by the VYNPS ODCM, a gross-beta analysis is also performed on each sample. The monthly composite and grab samples are composited by location by the contracted environmental laboratory for a quarterly tritium (H-3) analysis.

4.3.4 Ground Water Sampling

Grab samples are collected quarterly from four indicator locations and one control location. Only one indicator and one control are required by the VYNPS ODCM. Each sample is analyzed for gamma-emitting radionuclides and H-3. Although not required by the VYNPS ODCM, a gross-beta analysis is also performed on each sample.

4.3.5 Sediment Sampling

River sediment grab samples are collected semiannually from the downriver location and at the North Storm Drain Outfall by Normandeau Associates. Each sample is analyzed at the contracted environmental laboratory for gamma-emitting radionuclides.

4.3.6 Milk Sampling

When milk animals are identified as being on pasture feed (May through October), milk samples are collected twice per month from that location. Throughout the rest of the year, and for the full year where animals are not on pasture, milk samples are collected on a monthly schedule. Three locations are chosen as a result of the annual Land Use Census, based on meteorological dispersion calculations. The fourth location is a control, which is located sufficiently far away from the plant to be outside any potential influence from it. Other samples may be collected from locations of interest.

Immediately after collection, each milk sample is refrigerated and then shipped to the contracted environmental laboratory. Each sample is analyzed for gamma-emitting radionuclides. A separate low-level I-131 analysis is performed to meet the Lower Limit of Detection requirements in the ODCM. Although not required by the ODCM, Sr-89 and Sr-90 analyses are also performed on quarterly composited samples.

4.3.7 Silage Sampling

Silage samples are collected at the milk sampling location at the time of harvest, if available. The silage from each location is shipped to the contracted environmental laboratory where it is analyzed for gamma-emitting radionuclides. Although not required by the ODCM, the silage samples are analyzed for low-level I-131.

4.3.8 Mixed Grass Sampling

At each air sampling station, a mixed grass sample is collected quarterly, when available. Enough grass is clipped to provide the minimal sample weight needed to achieve the required Lower Limit of Detection (LLD). The mixed grass samples are analyzed for gamma-emitting radionuclides. Although not required by the ODCM, the grass samples are analyzed for low-level I-131.

4.3.9 Fish Sampling

Fish samples are collected semiannually at two locations (upstream of the plant and in Vernon Pond) by Normandeau Associates. The samples are frozen and delivered to the environmental laboratory where the edible portions are analyzed for gamma-emitting radionuclides.

4.3.10 TLD Monitoring

Direct gamma radiation exposure is continuously monitored with the use of thermoluminescent dosimeters (TLDs). Specifically, Panasonic UD-801AS1 and UD-814AS1 calcium sulfate dosimeters are used, with a total of five elements in place at each monitoring location. Each pair of dosimeters is sealed in a plastic bag, which is in turn housed in a plastic screen cylinder. This cylinder is attached to an object such as a fence or utility pole.

A total of 40 stations are required by the ODCM. Of these, 24 must be read out quarterly, while those from the remaining 16 incident response (outer ring) stations need only be de-dosed (annealed) quarterly, unless an ODCM gaseous release Control was exceeded during the period. Although not required by the ODCM, the TLDs from the 16 outer ring stations are read out quarterly along with the other stations' TLDs. In addition to the TLDs required by the ODCM, thirteen more are typically posted at or near the site boundary. The plant staff posts and retrieves all TLDs, while the contracted environmental laboratory (Framatome ANP) processes them.

TABLE 4.1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

(as required by ODCM Table 3.5.1)*

Exposure Pathway and/or Sample Media	Collection			Analysis	
	Number of Sample Locations	Routine Sampling Mode	Collection Frequency	Analysis Type	Analysis Frequency
1. Direct Radiation (TLDs)	40	Continuous	Quarterly	Gamma dose; Outer Ring - dc-dose only, unless gaseous release Control was exceeded	Each TLD
2. Airborne (Particulates and Radioiodine)	5	Continuous	Weekly	Particulate Sample: Gross Beta	Each Sample
				Gamma Isotopic	Quarterly Composite (by location)
				Radioiodine Canister: I-131	Each Sample
3. Waterborne					
a. Surface water	2	Downstream. Automatic composite	Monthly	Gamma Isotopic Tritium (H-3)	Each Sample Quarterly Composite
b. Ground water	2	Upstream: grab Grab	Quarterly	Gamma Isotopic Tritium (H-3)	Each Sample Each Sample
c. Shoreline Sediment	2	Downstream: grab N. Storm Drain Outfall: grab	Semiannually	Gamma Isotopic	Each Sample

- See ODCM Table 3.5.1 for complete footnotes.

TABLE 4.1, cont.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
(as required by ODCM Table 3.5.1)*

Exposure Pathway and/or Sample Media	Collection			Analysis	
	Nominal Number of Sample Locations	Routine Sampling Mode	Nominal Collection Frequency	Analysis Type	Analysis Frequency
4. Ingestion					
a. Milk	4	Grab	Monthly (Semimonthly when on pasture)	Gamma Isotopic 1-131	Each sample Each sample
b. Fish	2	Grab	Semiannually	Gamma Isotopic on edible portions	Each sample
c. Vegetation					
Grass sample	1 at each air sampling station	Grab	Quarterly when available	Gamma Isotopic	Each sample
Silage sample	1 at each milk sampling station	Grab	At harvest	Gamma Isotopic	Each sample

* See ODCM Table 3.5.1 for complete footnotes.

TABLE 4.2

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS (NON-TLD) IN 2002 VERMONT YANKEE NUCLEAR POWER STATION

Exposure Pathway	Station Code	Station Description	Zone[a]	Distance From Plant Stack (km)	Direction From Plant
I. Airborne					
	AP/CF-11	River Sta. No. 3.3	I	1.9	SSE
	AP/CF-12	N. Hinsdale, NH	I	3.6	NNW
	AP/CF-13	Hinsdale Substation	I	3.1	E
	AP/CF-14	Northfield, MA	I	11.6	SSE
	AP/CF-15	Tyler Hill Road	I	3.1	WNW
	AP/CF-21	Spofford Lake	C	16.4	NNE
	AP/CF-40	Gov. Hunt House	I	--	On-site
2. Waterborne					
a. Surface	WR-11	River Sta. No. 3.3	I	1.9	SSE
	WR-21	Rt.9 Bridge	C	11.8	NNW
b. Ground	WG-11	Plant Well	I	0.2	On-site
	WG-12	Vernon Nursing Well	I	2.1	SSE
	WG-13	COB Well	I	0.3	On-site
	WG-14	Plant Support Bldg (PSB) Well	I	0.3	On-site
	WT-14	Test Well 201	I	--	On-site
	WT-16	Test Well 202	I	--	On-site
	WT-17	Test Well 203	I	--	On-site
	WT-18	Test Well 204	I	--	On-site
	WG-22	Skibniowsky Well	C	13.7	N
c. Sediment	SE-11	Shoreline Downriver	I	0.6	SSE
	SE-12	North Storm Drain Outfall	I	0.1	E

TABLE 4.2, cont.

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS (NON-TLD) IN 2002
VERMONT YANKEE NUCLEAR POWER STATION

Exposure Pathway	Station Code	Station Description	Zone[a]	Distance From Plant Stack(km)	Direction From Plant Stack
3. Ingestion					
a. Milk	TM-11	Miller Farm	I	0.8	W
	TM-14	Brown Farm	I	2.2	S
	TM-18	Blodgett Farm	I	3.6	SE
	TM-22	Franklin Farm	I	9.7	WSW
	TM-24	County Farm	C	21.6	N
	TM-25	Downey-Spencer	I	6.9	W
	TM-26	Cheney Hill Farm	I	7.5	WNW
b. Fish	FH-11	Vernon Pond	I	0.6[b]	SSE
	FH-21	Rt.9 Bridge	C	11.8	NNW
c. Mixed Grass	TG-11	River Sta. No. 3.3	I	1.9	SSE
	TG-12	N. Hinsdale, NH	I	3.6	NNW
	TG-13	Hinsdale Substation	I	3.1	E
	TG-14	Northfield, MA	I	11.6	SSE
	TG-15	Tyler Hill Rd.	I	3.1	WNW
	TG-21	Spofford Lake	C	16.4	NNE
	TG-40	Gov. Hunt House	I	--	On-site
d. Silage	TC-11	Miller Farm	I	0.8	W
	TC-14	Brown Farm	I	2.2	S
	TC-18	Blodgett Farm	I	3.6	SE
	TC-22	Franklin Farm	I	9.7	WSW
	TC-24	County Farm	C	21.6	N
	TC-25	Downey-Spencer	I	6.9	W
	TC-26	Cheney Hill Farm	I	7.5	WNW

(a) I = Indicator Stations; C = Control Stations
(b) Fish samples are collected anywhere in Vernon Pond, which is adjacent to the plant (see Figure 4.1).

TABLE 4.3

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS (TLD) IN 2002
VERMONT YANKEE NUCLEAR POWER STATION

Station Code	Station Description	Zone[a]	Distance From Plant (km) [d]	Direction From Plant[d]
DR-1	River Sta. No. 3.3	I	1.6	SSE
DR-2	N. Hinsdale, NH	I	3.9	NNW
DR-3	Hinsdale Substation	I	3.0	E
DR-4	Northfield, MA	C	11.3	SSE
DR-5	Spofford Lake	C	16.5	NNE
DR-6	Vernon School	I	0.52	WSW
DR-7	Site Boundary[c]	SB	0.28	W
DR-8	Site Boundary	SB	0.25	SSW
DR-9	Inner Ring	I	1.7	N
DR-10	Outer Ring	O	4.5	N
DR-11	Inner Ring	I	1.6	NNE
DR-12	Outer Ring	O	3.6	NNE
DR-13	InnerRing	I	1.2	NE
DR-14	Outer Ring	O	3.9	NE
DR-15	Inner Ring	I	1.5	ENE
DR-16	Outer Ring	O	2.8	ENE
DR-17	Inner Ring	I	1.2	E
DR-18	Outer Ring	O	3.0	E
DR-19	Inner Ring	I	3.7	ESE
DR-20	Outer Ring	O	5.3	ESE
DR-21	Inner Ring	I	1.8	SE
DR-22	Outer Ring	O	3.3	SE
DR-23	Inner Ring	I	2.0	SSE
DR-24	Outer Ring	O	3.9	SSE
DR-25	Inner Ring	I	1.9	S
DR-26	Outer Ring	O	3.8	S
DR-27	Inner Ring	I	1.1	SSW
DR-28	Outer Ring	O	2.2	SSW
DR-29	Inner Ring	I	0.9	SW
DR-30	Outer Ring	O	2.4	SW

TABLE 4.3, cont.

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS (TLD) IN 2002
VERMONT YANKEE NUCLEAR POWER STATION

Station Code	Station Description	Zone[a]	Distance From Plant (km)[d]	Direction From Plant[d]
DR-31	Inner Ring	I	0.71	WSW
DR-32	Outer Ring	O	5.1	WSW
DR-33	Inner Ring	I	0.66	WNW
DR-34	Outer Ring	O	4.6	W
DR-35	Inner Ring	I	1.3	WNW
DR-36	Outer Ring	O	4.4	WNW
DR-37	Inner Ring	I	2.8	NW
DR-38	Outer Ring	O	7.3	NW
DR-39	Inner Ring	I	3.1	NNW
DR-40	Outer Ring	O	5.0	NNW
DR-41[b]	Site Boundary	SB	0.38	SSW
DR-42[b]	Site Boundary	SB	0.59	S
DR-43[b]	Site Boundary	SB	0.44	SSE
DR-44[b]	Site Boundary	SB	0.19	SE
DR-45[b]	Site Boundary	SB	0.12	NE
DR-46[b]	Site Boundary	SB	0.28	NNW
DR-47[b]	Site Boundary	SB	0.50	NNW
DR-48[b]	Site Boundary	SB	0.82	NW
DR-49[b]	Site Boundary	SB	0.55	WNW
DR-50[b]	Gov. Hunt House	I	0.35	SSW
DR-51[b]	Site Boundary	SB	0.26	W
DR-52[b]	Site Boundary	SB	0.24	SW
DR-53[b]	Site Boundary	SB	0.21	WSW

(a) I = Inner Ring TLD; O = Outer Ring Incident Response TLD; C = Control TLD; SB = Site Boundary TLD.

(b) This location is not considered a requirement of ODCM Table 3.5.1.

(c) DR-7 satisfies ODCM Table 3.5.1 for an inner ring direct radiation monitoring location. However, it is averaged as a Site Boundary TLD due to its close proximity to the plant.

(d) Distance and direction is relative to the center of the Turbine Building for direct radiation monitors.

TABLE 4.4
ENVIRONMENTAL LOWER LIMIT OF DETECTION (LLD) SENSITIVITY REQUIREMENTS

Analysis	Water (pCi/l)	Airborne Particulates or Gases (pCi/m^3)	Fish (pCi/Kg)	Milk (pCi/l)	Vegetation (pCi/Kg)	Sediment (pCi/Kg - dry)
Gross-Beta	4	0.01				
H-3	3000					
Mn-54	15		130			
Fe-59	30		260			
Co-58,60	15		130			
Zn-65	30		260			
Zr-Nb-95	15					
I-131		0.07		1	60	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-La-140	15			15		

See ODCM Table 4.5.1 for explanatory footnotes

TABLE 4.5

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Analysis	Water (pCi/l)	Airborne Particulates or Gases (pCi/m^3)	Fish (pCi/Kg)	Milk (pCi/l)	Food Product (pCi/Kg)	Sediment (pCi/Kg-dry)
H-3	20,000[(a)]					
Mn-54	1000		30,000			
Fe-59	400		10,000			
Co-58	1000		30,000			
Co-60	300		10,000			3000[(b)]
Zn-65	300		20,000			
Zr-Nb-95	400					
I-131		0.9		3	100	
Cs-134	30	10	1000	60	1000	
Cs-137	50	20	2000	70	2000	
Ba-La-140	200			300		

(a) Reporting Level for drinking water pathways. For non-drinking water, a value of 30,000 pCi/liter may be used.
(b) Reporting Level for grab samples taken at the North Storm Drain Outfall only.

See ODCM Table 3.5.2 for additional explanatory footnotes.

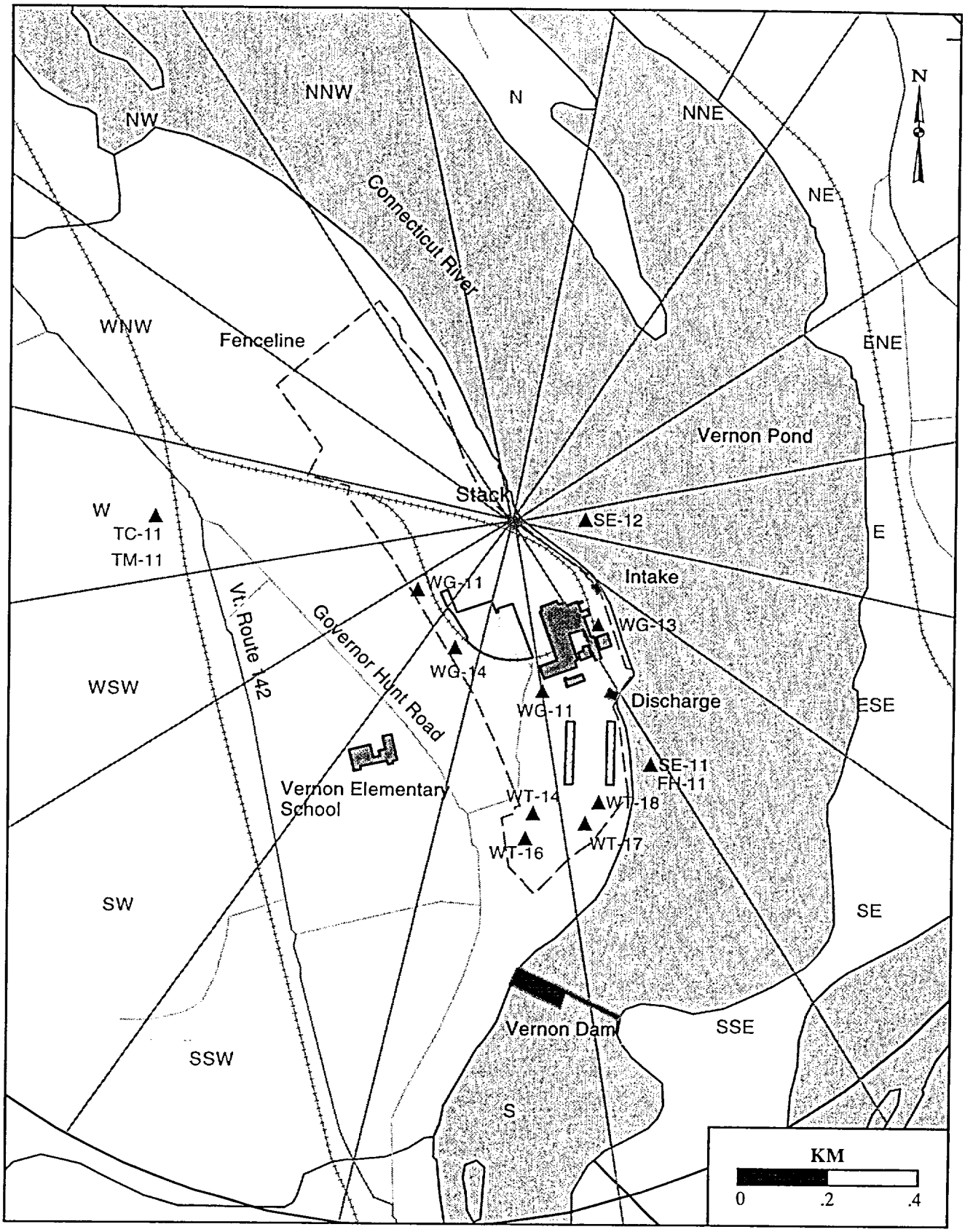

Figure 4-1 Environmental Sampling Locations in Close Proximity to the Plant

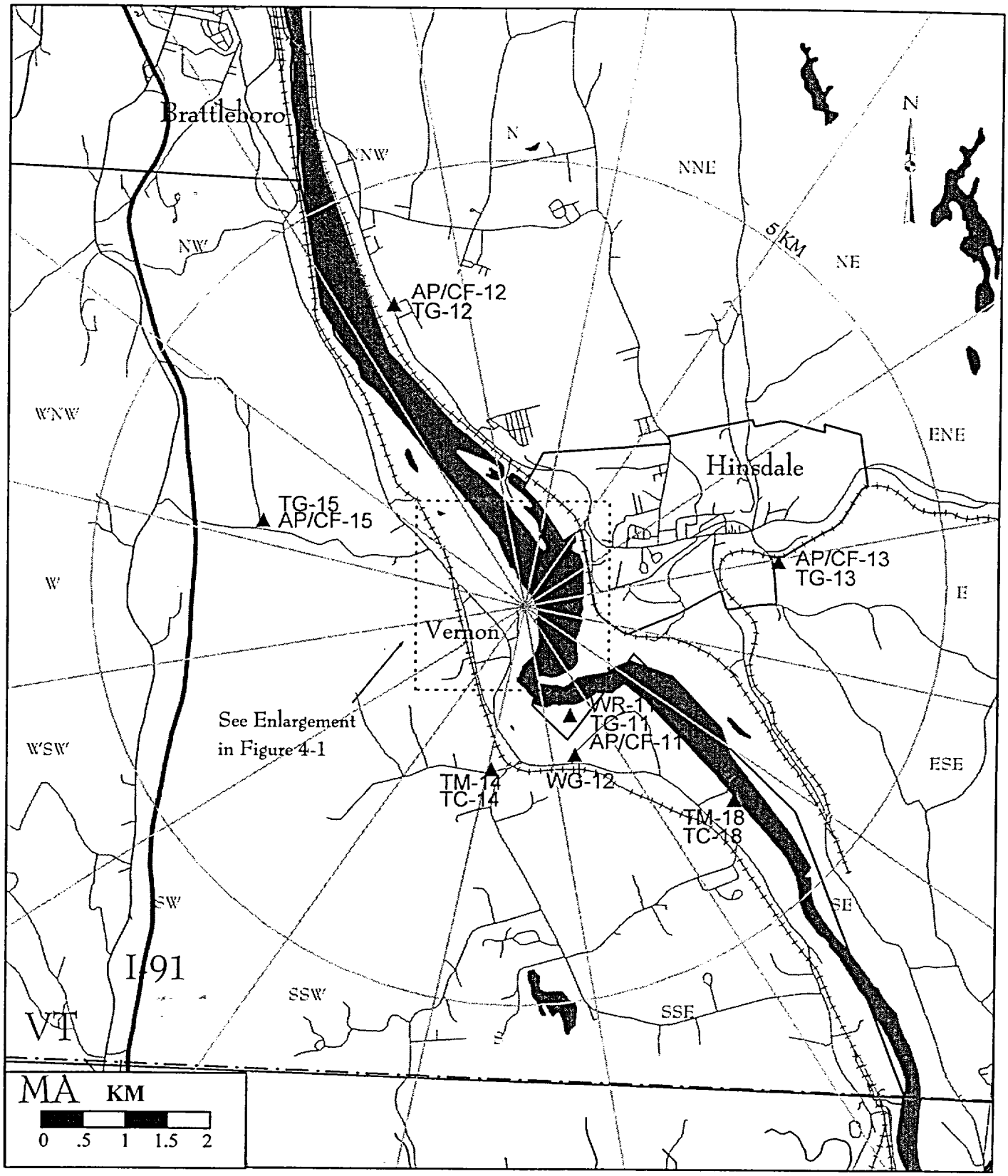

Figure 4-2 Environmental Sampling Locations

Within 5 Km of Plant

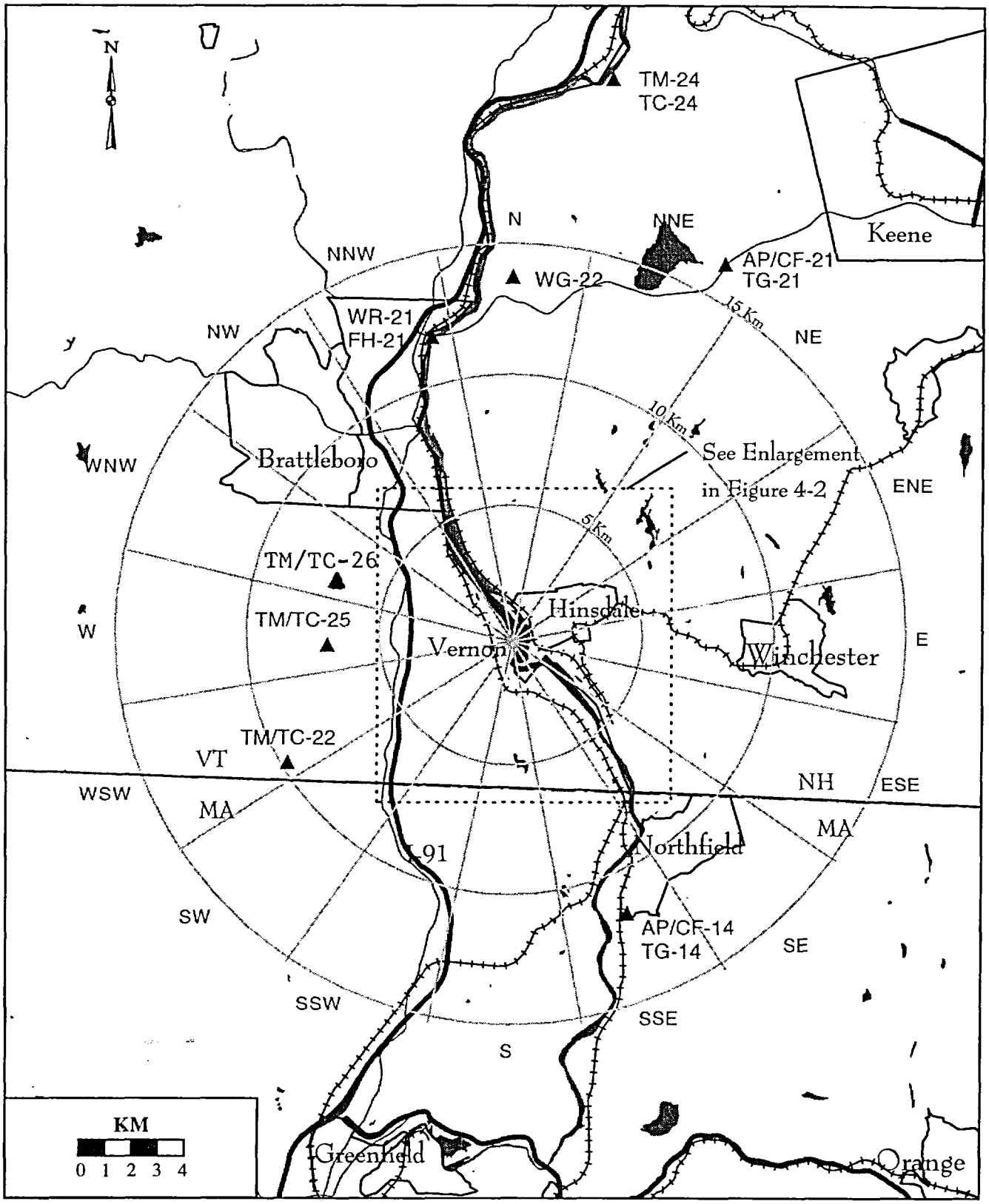

Figure 4-3 Environmental Sampling Locations

Greater than 5 Km from Plant

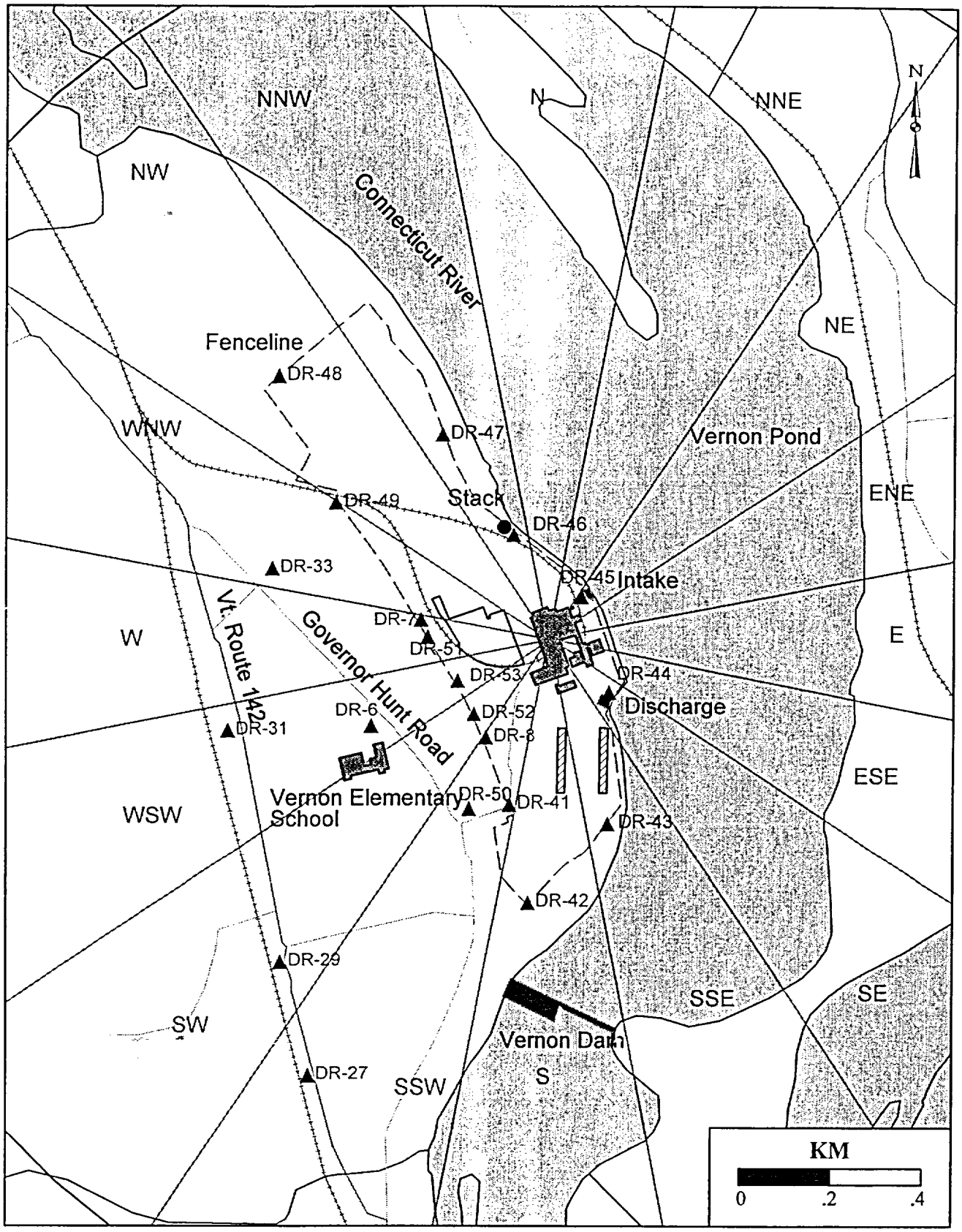

Figure 4-4 TLD Locations in Close Proximity to Plant

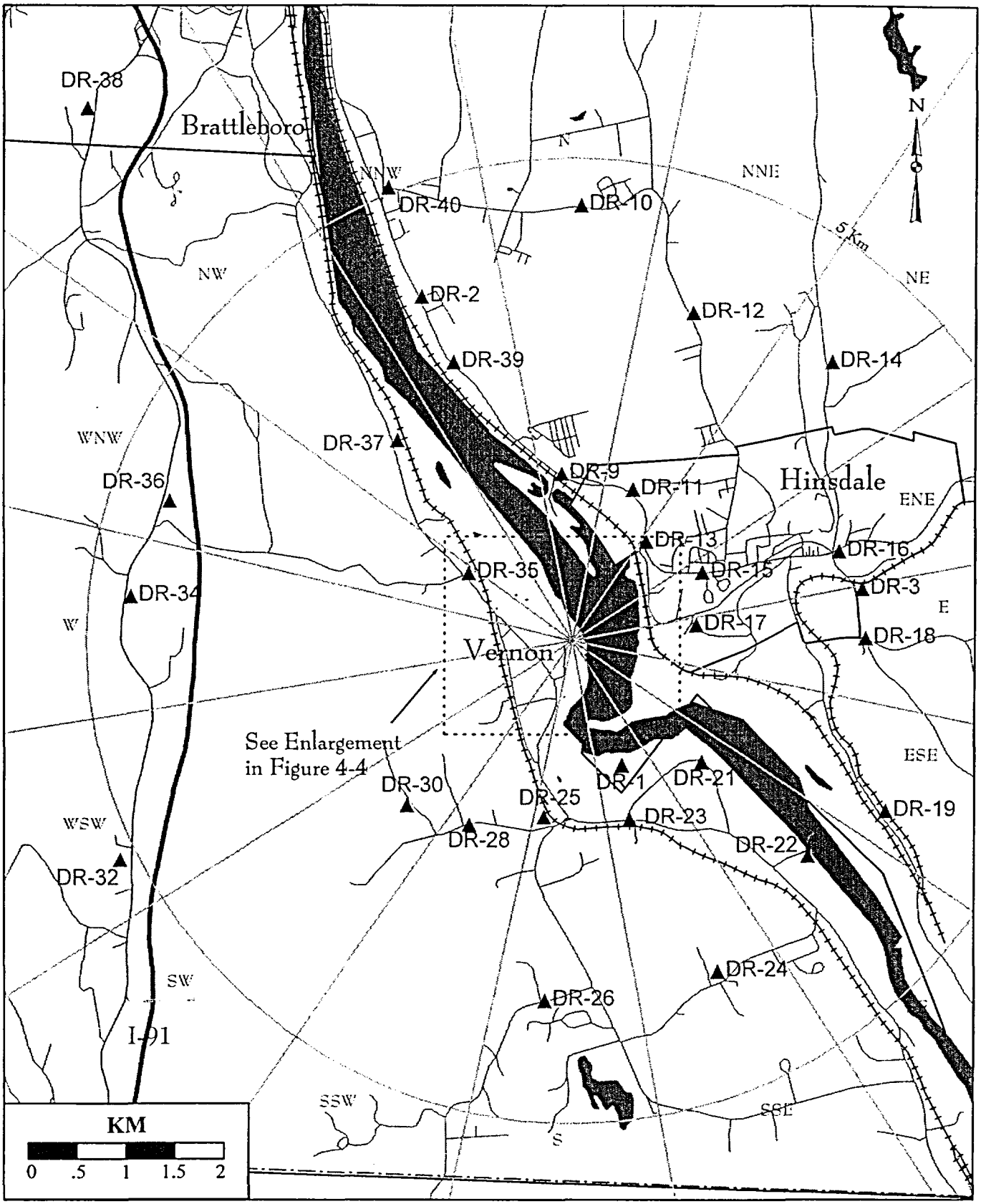

Figure 4-5 TLD Locations Within 5 Km of Plant

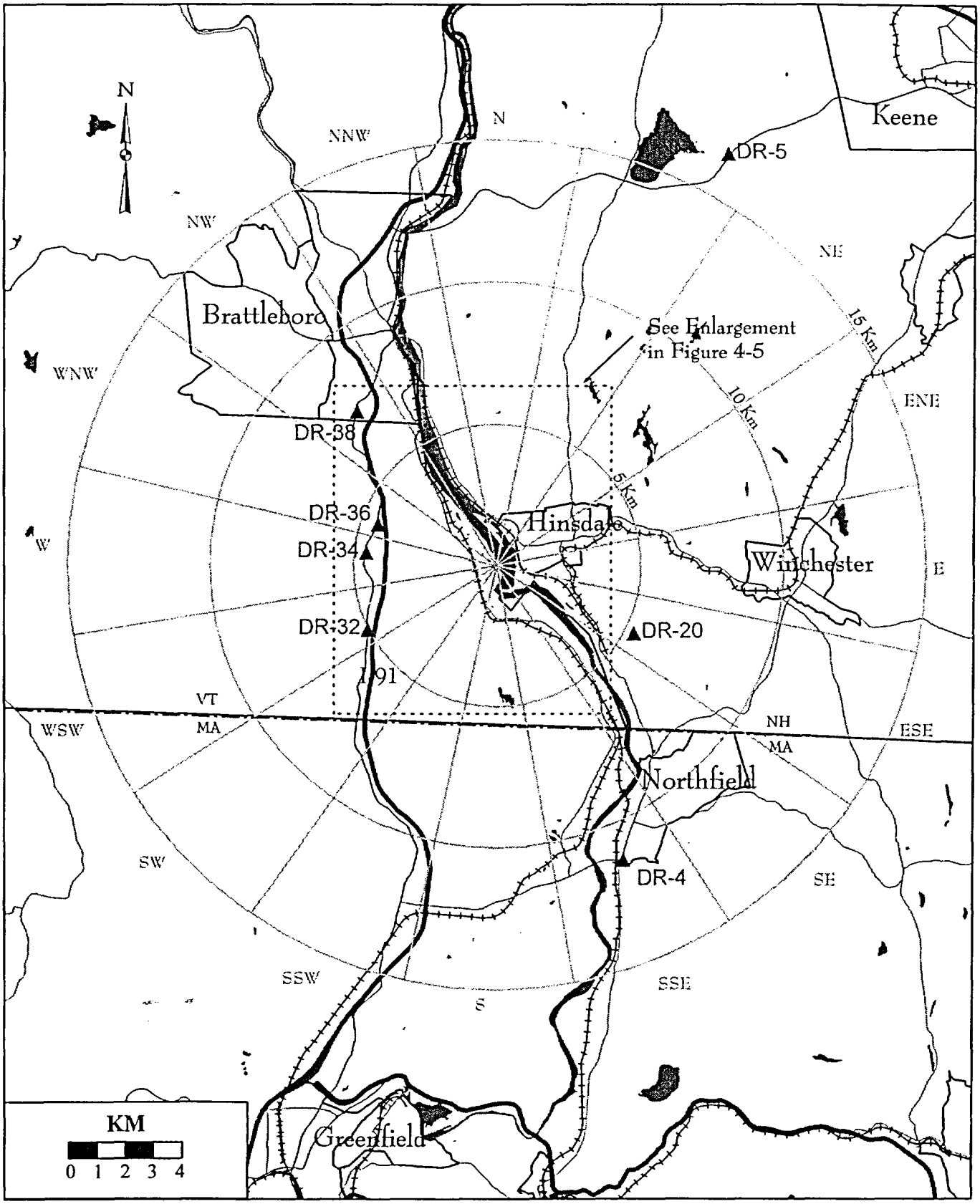

Figure 4-6 TLD Locations Greater Than 5 Km from Plant

5. RADIOLOGICAL DATA SUMMARY TABLES

This section summarizes the analytical results of the environmental samples that were collected during 2002. These results, shown in Table 5.1, are presented in a format similar to that prescribed in the NRC's Radiological Assessment Branch Technical Position on Environmental Monitoring (Reference 1). The results are ordered by sample media type and then by radionuclide. The units for each media type are also given.

In 2002, Vermont Yankee contracted with one laboratory for primary analyses of the environmental samples. A second laboratory was used to cross-check the first laboratory for selected samples.

The left-most column of Table 5.1 contains the radionuclide of interest, the total number of analyses for that radionuclide in 2002, and the number of measurements which exceeded the Reporting Levels found in Table 3.5.2 of the VYNPS Off-site Dose Calculation Manual. The latter are classified as "Non-routine" measurements. The second column lists the required Lower Limit of Detection (LLD) for those radionuclides that have detection capability requirements as specified in the ODCM Table 4.5.1. The absence of a value in this column indicates that no LLD is specified in the ODCM for that radionuclide in that media. The target LLD for any analysis is typically 50 percent of the most restrictive required LLD. Occasionally the required LLD may not be met. This may be due to malfunctions in sampling equipment or lack of sufficient sample quantity which would then result in low sample volume. Delays in analysis at the laboratory could also be a factor. Such cases, if and when they should occur, would be addressed in Section 6.2.

For each radionuclide and media type, the remaining three columns summarize the data for the following categories of monitoring locations: (1) the Indicator stations, which are within the range of influence of the plant and which could be affected by its operation; (2) the station which had the highest mean concentration during 2002 for that radionuclide; and (3) the Control stations, which are beyond the influence of the plant. Direct radiation monitoring stations (using TLDs) are grouped into Inner Ring, Outer ring, Site Boundary and Control.

In each of these columns, for each radionuclide, the following statistical values are given:

- The mean value of all concentrations, including those results that are less than the *a posteriori* LLD for that analysis.
- The minimum and maximum concentration, including those results that are less than the *a posteriori* LLD. In previous years, data less than the *a posteriori* LLD were converted to zero for purposes of reporting the means and ranges.
- The "Number Detected" is the number of positive measurements. A measurement is considered positive when the concentration is greater than three times the standard deviation in the concentration and greater than or equal to the *a posteriori* LLD (Minimum Detectable Concentration or MDC).

- The "Total Analyzed" for each column is also given.

Each single radioactivity measurement datum in this report is based on a single measurement of a sample. Any concentration below the *a posteriori* LLD for its analysis is averaged with those values above the *a posteriori* LLD to determine the average of the results. Likewise, the values are reported in ranges even though they are below the *a posteriori* LLD. To be consistent with normal data review practices used by Vermont Yankee, a "positive measurement" is considered to be one whose concentration is greater than three times its associated standard deviation, is greater than or equal to the *a posteriori* LLD and satisfies the analytical laboratory's criteria for identification.

The radionuclides reported in this section represent those that: 1) had an LLD requirement in Table 4.5.1 of the ODCM, or a Reporting Level listed in Table 3.5.2 of the ODCM, or 2) had a positive measurement of radioactivity, whether it was naturally-occurring or man-made; or 3) were of special interest for any other reason. The radionuclides that were routinely analyzed and reported by the environmental laboratory (in a gamma spectroscopy analysis) were: Th-232, Ag-110m, Ba/La-140, Be-7, Ce-141, Ce-144, Co-57, Co-58, Co-60, Cr-51, Cs-134, Cs-137, Fe-59, I-131, I-133, K-40, Mn-54, Mo-99, Np-239, Ru-103, Ru-106, Sb-124, Se-75, TeI-132, U-238, Zn-65 and Zr-95.

Data from direct radiation measurements made by TLDs are provided in Table 5.2. The complete listing of quarterly TLD data is provided in Table 5.3.

Radiological Environmental Program Summary

2002 Radiological Environmental Operating Report
Vermont Yankee

Table 5.1:

Sample Medium:	Air Particulate (AP)
Sample Medium:	Charcoal Cartridge (CF)
Sample Medium:	River Water (WR)
Sample Medium:	Ground Water (WG)
Sample Medium:	Sediment (SE)
Sample Medium:	Test Well (WT)
Sample Medium:	Milk (TM)
Sample Medium:	Silage (TC)
Sample Medium:	Mixed Grass (TG)
Sample Medium:	Fish (FH)

AP

Table 5.1
Radiological Environmental Program Summary
Vermont Yankee Nuclear Power Plant, Vernon, VT
(January - December 2002)

Medium: Air Particulate (AP) UNITS: pCi/cubic meter

AP *Radionuclides**	*Required LLD*	*Indicator Station*	*Station with Highest Mean*	*Control Station*
Be-7	None Required		*Station*	
Number of Analyses	28		40	
*Non-Routine***	0			
Range — *Mean*		0.1202	0.1248	0.1195
Range — *Maximum*		0.2000	0.1990	0.1870
Range — *Minimum*		0.0683	0.0784	0.0690
*Number Detected****		24	4	4
Total Analyzed		24	4	4
Cs-134	0.05		*Station*	
Number of Analyses	28		12	
*Non-Routine***	0			
Range — *Mean*		-0.0003	0.0000	-0.0007
Range — *Maximum*		0.0002	0.0000	-0.0002
Range — *Minimum*		-0.0021	-0.0001	-0.0016
*Number Detected****		0	0	0
Total Analyzed		24	4	4
Cs-137	0.06		*Station*	
Number of Analyses	28		11	
*Non-Routine***	0			
Range — *Mean*		0.0000	0.0001	0.0002
Range — *Maximum*		0.0002	0.0002	0.0007
Range — *Minimum*		-0.0003	-0.0001	-0.0001
*Number Detected****		0	0	1
Total Analyzed		24	4	4
GR-B	0.01		*Station*	
Number of Analyses	364		15	
*Non-Routine***	0			
Range — *Mean*		0.0175	0.0181	0.0173
Range — *Maximum*		0.0505	0.0505	0.0302
Range — *Minimum*		0.0077	0.0092	0.0102
*Number Detected****		312	52	52
Total Analyzed		312	52	52

AP

Radionuclides*		Required LLD	Indicator Station	Station with Highest Mean	Control Station
K-40		None Required		Station	
Number of Analyses		28		15	
Non-Routine**		0			
Range	Mean		0.0040	0.0065	0.0025
	Maximum		0.0084	0.0084	0.0067
	Minimum		-0.0013	0.0037	-0.0078
Number Detected***			2	1	1
Total Analyzed			24	4	4
Ra-226		None Required		Station	
Number of Analyses		28		15	
Non-Routine**		0			
Range	Mean		0.0006	0.0026	-0.0026
	Maximum		0.0088	0.0088	0.0025
	Minimum		-0.0033	-0.0033	-0.0110
Number Detected***			0	1	0
Total Analyzed			24	4	4
Th-232		None Required		Station	
Number of Analyses		28		14	
Non-Routine**		0			
Range	Mean		0.0002	0.0007	0.0004
	Maximum		0.0025	0.0015	0.0009
	Minimum		-0.0007	0.0000	-0.0004
Number Detected***			0	1	0
Total Analyzed			24	4	4

The only radionuclides reported in this table are those with LLD requirements and those for which positive radioactivity was detected. See Section 5 of this report for a discussion of other radionucides that were analyzed.

***Non-Routine refers to those radionuclides that exceeded the Reporting Lveles in Technical Specification Table 3.9.4.*

****The fraction of sampling analyses yielding detectable measurements (i.e. >3 standard deviations). Note, this does not include measurements that were less than the Minimum Detectable Concentration.*

CF

Table 5.1

Radiological Environmental Program Summary

Vermont Yankee Nuclear Power Plant, Vernon, VT

(January - December 2002)

Medium: Charcoal Cartridge (CF) UNITS: pCi/cubic meter

CF					
*Radionuclides**		*Required LLD*	*Indicator Station*	*Station with Highest Mean*	*Control Station*
I-131		0.07		*Station*	
Number of Analyses	364			14	
*Non-Routine***	0				
Range	*Mean*		0.0001	0.0012	-0.0013
	Maximum		0.0242	0.0202	0.0301
	Minimum		-0.0324	-0.0187	-0.0318
	*Number Detected****		0	0	0
	Total Analyzed		312	52	52

**The only radionuclides reported in this table are those with LLD requirements and those for which positive radioactivity was detected. See Section 5 of this report for a discussion of other radionucides that were analyzed.*

***Non-Routine refers to those radionuclides that exceeded the Reporting Lveles in Technical Specification Table 3.9.4.*

****The fraction of sampling analyses yielding detectable measurements (i.e. >3 standard deviations).*

WR

Table 5.1

Radiological Environmental Program Summary

Vermont Yankee Nuclear Power Plant, Vernon, VT

(January - December 2002)

Medium: River Water (WR) UNITS: pCi/L

WR Radionuclides*	Required LLD	Indicator Station	Station with Highest Mean	Control Station
Ba-La-140	15	Station		
Number of Analyses	24	21		
Non-Routine**	0			
Range Mean		0.4915	1.1588	1.1588
Range Maximum		8.3300	3.8400	3.8400
Range Minimum		-4.7900	-0.3480	-0.3480
Number Detected***		0	0	0
Total Analyzed		12	12	12
Co-58	15	Station		
Number of Analyses	24	11		
Non-Routine**	0			
Range Mean		-0.0874	-0.0874	-0.4529
Range Maximum		0.5569	0.5569	0.1350
Range Minimum		-0.7250	-0.7250	-1.7500
Number Detected***		0	0	0
Total Analyzed		12	12	12
Co-60	15	Station		
Number of Analyses	24	11		
Non-Routine**	0			
Range Mean		0.2864	0.2864	0.2626
Range Maximum		0.7580	0.7580	1.7500
Range Minimum		-0.2683	-0.2683	-1.0200
Number Detected***		0	0	0
Total Analyzed		12	12	12
Cs-134	15	Station		
Number of Analyses	24	21		
Non-Routine**	0			
Range Mean		-0.7890	-0.0720	-0.0720
Range Maximum		0.8110	3.3000	3.3000
Range Minimum		-7.0100	-1.9890	-1.9890
Number Detected***		0	0	0
Total Analyzed		12	12	12

WR

Radionuclides*	Required LLD	Indicator Station	Station with Highest Mean	Control Station
Cs-137	18	Station		
Number of Analyses	24		11	
Non-Routine**	0			
Range Mean		0.3192	0.3192	0.1973
Range Maximum		1.4700	1.4700	1.2000
Range Minimum		-0.2320	-0.2320	-0.4660
Number Detected***		0	0	0
Total Analyzed		12	12	12
Fe-59	30	Station		
Number of Analyses	24		11	
Non-Routine**	0			
Range Mean		1.4048	1.4049	0.4807
Range Maximum		4.2500	4.2500	4.4300
Range Minimum		-0.8240	-0.8240	-3.1100
Number Detected***		0	0	0
Total Analyzed		12	12	12
GR-B	4	Station		
Number of Analyses	24		11	
Non-Routine**	0			
Range Mean		1.4388	1.4388	1.7253
Range Maximum		2.4400	2.4400	2.7400
Range Minimum		0.5800	0.5800	0.4730
Number Detected***		7	7	10
Total Analyzed		12	12	12
H-3	3000	Station		
Number of Analyses	8		11	
Non-Routine**	0			
Range Mean		58.4250	58.4250	76.6750
Range Maximum		110.0000	110.0000	184.0000
Range Minimum		15.3000	15.3000	25.2000
Number Detected***		0	0	0
Total Analyzed		4	4	4
I-131	None Required	Station		
Number of Analyses	28		21	
Non-Routine**	0			
Range Mean		-0.4720	-0.3620	-0.3620
Range Maximum		6.9300	2.2100	2.2100
Range Minimum		-7.8200	-2.5800	-2.5800
Number Detected***		0	0	0
Total Analyzed		14	14	14

WR

Radionuclides*		Required LLD	Indicator Station	Station with Highest Mean	Control Station
Mn-54		15	Station		
Number of Analyses	24		11		
Non-Routine**	0				
Range	Mean		0.1222	0.1222	0.1125
	Maximum		1.0200	1.0200	1.2200
	Minimum		-0.4700	-0.4700	-1.7300
	Number Detected***		0	0	0
	Total Analyzed		12	12	12
RA-226		None Required	Station		
Number of Analyses	24		21		
Non-Routine**	0				
Range	Mean		-4.8696	3.6517	3.6517
	Maximum		13.3700	70.0000	70.0000
	Minimum		-71.8000	-43.0000	-43.0000
	Number Detected***		0	1	1
	Total Analyzed		12	12	12
TH-232		None Required	Station		
Number of Analyses	24		21		
Non-Routine**	0				
Range	Mean		-0.0247	2.9324	2.9324
	Maximum		3.8500	11.6000	11.6000
	Minimum		-3.8770	-3.1200	-3.1200
	Number Detected***		1	1	1
	Total Analyzed		12	12	12
Zn-65		30	Station		
Number of Analyses	24		21		
Non-Routine**	0				
Range	Mean		-1.2737	-1.5356	-1.5356
	Maximum		0.5959	1.7100	1.7100
	Minimum		-2.4500	-6.1200	-6.1200
	Number Detected***		0	0	0
	Total Analyzed		12	12	12
Zr-95		15	Station		
Number of Analyses	24		21		
Non-Routine**	0				
Range	Mean		-0.3854	0.1313	0.1313
	Maximum		1.1800	1.6500	1.6500
	Minimum		-1.4800	-1.7400	-1.7400
	Number Detected***		0	0	0
	Total Analyzed		12	12	12

WR

*Radionuclides**	*Required LLD*	*Indicator Station*	*Station with Highest Mean*	*Control Station*

**The only radionuclides reported in this table are those with LLD requirements and those for which positive radioactivity was detected. See Section 5 of this report for a discussion of other radionucides that were analyzed.*

***Non-Routine refers to those radionuclides that exceeded the Reporting Lveles in Technical Specification Table 3.9.4.*

****The fractionof sampling analyses yielding detectable measurements (i.e. >3 standard deviations).*

WG

Table 5.1

Radiological Environmental Program Summary

Vermont Yankee Nuclear Power Plant, Vernon, VT

(January - December 2002)

Medium: Ground Water (WG) UNITS: pCi/L

WG Radionuclides*		Required LLD	Indicator Station	Station with Highest Mean	Control Station
Ba-La-140		15	Station		
Number of Analyses		29		12	
Non-Routine**		0			
Range	Mean		0.4159	2.3803	2.0620
	Maximum		8.2300	8.2300	11.3000
	Minimum		-6.3100	-0.6280	-1.9300
Number Detected***			0	0	0
Total Analyzed			23	6	6
Co-58		15	Station		
Number of Analyses		25		13	
Non-Routine**		0			
Range	Mean		-0.8229	-0.3707	-1.3032
	Maximum		3.6690	0.7795	0.2810
	Minimum		-3.4900	-1.5300	-2.3890
Number Detected***			0	0	0
Total Analyzed			20	5	5
Co-60		15	Station		
Number of Analyses		25		12	
Non-Routine**		0			
Range	Mean		-0.1622	0.6041	0.2804
	Maximum		1.5500	1.5500	1.4700
	Minimum		-1.7100	-1.0700	-1.2110
Number Detected***			0	0	0
Total Analyzed			20	5	5
Cs-134		15	Station		
Number of Analyses		25		11	
Non-Routine**		0			
Range	Mean		-0.5865	0.1235	-1.2343
	Maximum		2.5170	1.8600	-0.2367
	Minimum		-11.6000	-0.7106	-1.9300
Number Detected***			0	0	0
Total Analyzed			20	5	5

WG

Radionuclides*		Required LLD	Indicator Station	Station with Highest Mean	Control Station
Cs-137		18		Station	
Number of Analyses		25		14	
Non-Routine**		0			
Range	Mean		0.2266	0.4488	-0.0022
	Maximum		3.3400	3.3400	4.3000
	Minimum		-3.9400	-3.9400	-2.2750
Number Detected***			0	0	0
Total Analyzed			20	5	5
Fe-59		30		Station	
Number of Analyses		25		12	
Non-Routine**		0			
Range	Mean		1.9992	4.3811	1.1826
	Maximum		10.3400	10.3400	4.6400
	Minimum		-6.0590	-0.0947	-2.1750
Number Detected***			0	0	0
Total Analyzed			20	5	5
GR-B		4		Station	
Number of Analyses		25		11	
Non-Routine**		0			
Range	Mean		4.6030	8.0566	-2.9884
	Maximum		14.9418	14.9418	3.3000
	Minimum		-9.7000	3.2000	-26.0000
Number Detected***			12	5	2
Total Analyzed			20	5	5
H-3		3000		Station	
Number of Analyses		25		22	
Non-Routine**		0			
Range	Mean		42.5638	128.8362	128.8362
	Maximum		307.0388	338.1003	338.1003
	Minimum		-85.0000	4.8000	4.8000
Number Detected***			0	0	0
Total Analyzed			20	5	5

WG

Radionuclides*		Required LLD	Indicator Station	Station with Highest Mean	Control Station
I-131		None Required		Station	
Number of Analyses		25		12	
Non-Routine**		0			
Range	Mean		0.5608	4.3350	2.3909
	Maximum		12.7000	12.7000	8.5200
	Minimum		-12.8000	0.1840	-1.8980
Number Detected***			0	0	0
Total Analyzed			20	5	5
Mn-54		15		Station	
Number of Analyses		25		13	
Non-Routine**		0			
Range	Mean		0.0467	0.1593	-1.0412
	Maximum		2.1700	0.9190	0.9780
	Minimum		-1.5000	-0.4800	-3.3100
Number Detected***			0	0	0
Total Analyzed			20	5	5
Nb-95		None Required		Station	
Number of Analyses		25		13	
Non-Routine**		0			
Range	Mean		0.3073	1.8086	0.9698
	Maximum		6.2000	6.2000	4.5300
	Minimum		-3.9520	-2.5320	-1.1980
Number Detected***			1	1	1
Total Analyzed			20	5	5
Ra-226		None Required		Station	
Number of Analyses		25		13	
Non-Routine**		0			
Range	Mean		11.9948	36.1152	11.6180
	Maximum		83.6200	80.8000	57.6000
	Minimum		-74.1000	-1.4440	-42.7000
Number Detected***			0	0	0
Total Analyzed			20	5	5

WG

Radionuclides*		Required LLD	Indicator Station	Station with Highest Mean	Control Station
Th-232		None Required	Station		
Number of Analyses		15		14	
Non-Routine**		0			
Range	Mean		8.3566	13.2800	-4.2437
	Maximum		33.2000	33.2000	-0.5710
	Minimum		-7.9400	-2.2500	-6.1100
Number Detected***			2	1	0
Total Analyzed			12	3	3
Zn-65		30	Station		
Number of Analyses		25		13	
Non-Routine**		0			
Range	Mean		0.1753	1.8606	-3.2348
	Maximum		6.9430	6.0500	1.3620
	Minimum		-7.3500	-2.8830	-10.4300
Number Detected***			0	0	0
Total Analyzed			20	5	5
Zr-95		15	Station		
Number of Analyses		25		22	
Non-Routine**		0			
Range	Mean		-0.7564	0.4611	0.4611
	Maximum		2.9700	4.1100	4.1100
	Minimum		-2.9980	-1.2800	-1.2800
Number Detected***			0	0	0
Total Analyzed			20	5	5

The only radionuclides reported in this table are those with LLD requirements and those for which positive radioactivity was detected. See Section 5 of this report for a discussion of other radionucides that were analyzed.

***Non-Routine refers to those radionuclides that exceeded the Reporting Lveles in Technical Specification Table 3.9.4.*

****The fraction of sampling analyses yielding detectable measurements (i.e. >3 standard deviations). Note, this does not include measurements that were less than the Minimum Detectable Concentration.*

SE

Table 5.1
Radiological Environmental Program Summary
Vermont Yankee Nuclear Power Plant, Vernon, VT
(January - December 2002)
Medium: Sediment (SE) UNITS: pCi/Kg

SE

Radionuclides*		Required LLD	Indicator Station	Station with Highest Mean	Control Station
Ac-228		None Required		Station	
Number of Analyses		15		31	
Non-Routine**		0			
Range	Mean		1442.0667	2040.0000	No Data
	Maximum		2040.0000	2040.0000	No Data
	Minimum		736.8000	2040.0000	No Data
Number Detected***			15	1	0
Total Analyzed			15	1	0
Ba-La-140		None Required		Station	
Number of Analyses		56		35	
Non-Routine**		0			
Range	Mean		0.5451	93.4000	No Data
	Maximum		363.8000	363.8000	No Data
	Minimum		-187.0000	-92.3000	No Data
Number Detected***			1	0	0
Total Analyzed			56	3	0
Be-7		None Required		Station	
Number of Analyses		42		17	
Non-Routine**		0			
Range	Mean		278.0202	791.5000	No Data
	Maximum		1387.0000	1387.0000	No Data
	Minimum		-148.0000	196.0000	No Data
Number Detected***			16	1	0
Total Analyzed			42	2	0
Co-60		None Required		Station	
Number of Analyses		42		18	
Non-Routine**		0			
Range	Mean		8.7383	43.8100	No Data
	Maximum		71.1000	71.1000	No Data
	Minimum		-29.8000	16.5200	No Data
Number Detected***			6	2	0
Total Analyzed			42	2	0

SE

Radionuclides*		Required LLD	Indicator Station	Station with Highest Mean	Control Station
Cs-134		150	Station		
Number of Analyses		42	30		
Non-Routine**		0			
Range	Mean		1.2788	15.0000	No Data
	Maximum		20.1900	19.8000	No Data
	Minimum		-24.3000	10.2000	No Data
	Number Detected***		0	0	0
	Total Analyzed		42	2	0
Cs-137		180	Station		
Number of Analyses		42	28		
Non-Routine**		0			
Range	Mean		151.5290	206.0000	No Data
	Maximum		226.0000	206.0000	No Data
	Minimum		46.7600	206.0000	No Data
	Number Detected***		42	1	0
	Total Analyzed		42	1	0
K-40		None Required	Station		
Number of Analyses		42	13		
Non-Routine**		0			
Range	Mean		17417.857	21695.0000	No Data
	Maximum		22100.000	22100.0000	No Data
	Minimum		9350.0000	21290.0000	No Data
	Number Detected***		42	2	0
	Total Analyzed		42	2	0
Mn-54		None Required	Station		
Number of Analyses		42	29		
Non-Routine**		0			
Range	Mean		11.4708	54.0000	No Data
	Maximum		54.0000	54.0000	No Data
	Minimum		-17.3000	54.0000	No Data
	Number Detected***		7	1	0
	Total Analyzed		42	1	0
Nb-95		None Required	Station		
Number of Analyses		42	29		
Non-Routine**		0			
Range	Mean		18.4972	55.9000	No Data
	Maximum		59.1500	55.9000	No Data
	Minimum		-26.6000	55.9000	No Data
	Number Detected***		12	1	0
	Total Analyzed		42	1	0

SE

Radionuclides*		Required LLD	Indicator Station	Station with Highest Mean	Control Station
Ra-226		None Required		Station	
Number of Analyses	42			34	
Non-Routine**	0				
Range	Mean		1824.9333	3050.0000	No Data
	Maximum		3050.0000	3050.0000	No Data
	Minimum		495.9000	3050.0000	No Data
	Number Detected***		41	1	0
	Total Analyzed		42	1	0
Th-228		None Required		Station	
Number of Analyses	42			28	
Non-Routine**	0				
Range	Mean		1210.1857	1750.0000	No Data
	Maximum		1750.0000	1750.0000	No Data
	Minimum		570.1000	1750.0000	No Data
	Number Detected***		42	1	0
	Total Analyzed		42	1	0
Th-232		None Required		Station	
Number of Analyses	42			46	
Non-Routine**	0				
Range	Mean		1283.3286	1530.0000	No Data
	Maximum		1592.0000	1530.0000	No Data
	Minimum		435.0000	1530.0000	No Data
	Number Detected***		42	1	0
	Total Analyzed		42	1	0
U-238		None Required		Station	
Number of Analyses	15			35	
Non-Routine**	0				
Range	Mean		1208.8933	2853.0000	No Data
	Maximum		2853.0000	2853.0000	No Data
	Minimum		159.0000	2853.0000	No Data
	Number Detected***		4	0	0
	Total Analyzed		15	1	0

*The only radionuclides reported in this table are those with LLD requirements and those for which positive radioactivity was detected. See Section 5 of this report for a discussion of other radionucides that were analyzed.

**Non-Routine refers to those radionuclides that exceeded the Reporting Lveles in Technical Specification Table 3.9.4.

***The fraction of sampling analyses yielding detectable measurements (i.e. >3 standard deviations). Note, this does not include measurements that were less than the Minimum Detectable Concentration.

WT

Table 5.1

Radiological Environmental Program Summary

Vermont Yankee Nuclear Power Plant, Vernon, VT

(January - December 2002)

Medium: Test Wells (WT) UNITS: pCi/L

WT				
*Radionuclides**	*Required LLD*	*Indicator Station*	*Station with Highest Mean*	*Control Station*
Ba-La-140	None Required		*Station*	
Number of Analyses	8		16	
*Non-Routine***	0			
Range — *Mean*		-0.3080	1.0545	*No Data*
Range — *Maximum*		2.2400	1.5000	*No Data*
Range — *Minimum*		-3.7700	0.6090	*No Data*
*Number Detected****		0	0	0
Total Analyzed		8	2	0
Co-58	None Required		*Station*	
Number of Analyses	8		16	
*Non-Routine***	0			
Range — *Mean*		-0.6889	-0.0538	*No Data*
Range — *Maximum*		0.2510	0.0465	*No Data*
Range — *Minimum*		-2.8300	-0.1540	*No Data*
*Number Detected****		0	0	0
Total Analyzed		8	2	0
Co-60	None Required		*Station*	
Number of Analyses	8		16	
*Non-Routine***	0			
Range — *Mean*		-0.3011	0.5505	*No Data*
Range — *Maximum*		1.6500	1.6500	*No Data*
Range — *Minimum*		-2.1900	-0.5490	*No Data*
*Number Detected****		0	0	0
Total Analyzed		8	2	0
Cs-134	None Required		*Station*	
Number of Analyses	8		18	
*Non-Routine***	0			
Range — *Mean*		-0.2756	0.1033	*No Data*
Range — *Maximum*		0.3920	0.1870	*No Data*
Range — *Minimum*		-2.1300	0.0196	*No Data*
*Number Detected****		0	0	0
Total Analyzed		8	2	0

WT

Radionuclides*	Required LLD	Indicator Station	Station with Highest Mean	Control Station
Cs-137	None Required		Station	
Number of Analyses	8		18	
Non-Routine**	0			
Range — Mean		0.2567	0.7891	No Data
Range — Maximum		1.5000	1.5000	No Data
Range — Minimum		-1.0600	0.0783	No Data
Number Detected***		0	0	0
Total Analyzed		8	2	0
Fe-59	None Required		Station	
Number of Analyses	8		16	
Non-Routine**	0			
Range — Mean		1.8136	2.4760	No Data
Range — Maximum		4.7500	4.7500	No Data
Range — Minimum		0.1210	0.2020	No Data
Number Detected***		0	0	0
Total Analyzed		8	2	0
GR-B	None Required		Station	
Number of Analyses	8		14	
Non-Routine**	0			
Range — Mean		15.1500	21.5500	No Data
Range — Maximum		24.7000	23.0000	No Data
Range — Minimum		4.1000	20.1000	No Data
Number Detected***		8	2	0
Total Analyzed		8	2	0
H-3	None Required		Station	
Number of Analyses	8		14	
Non-Routine**	0			
Range — Mean		8.6125	33.2000	No Data
Range — Maximum		38.1000	38.1000	No Data
Range — Minimum		-76.9000	28.3000	No Data
Number Detected***		0	0	0
Total Analyzed		8	2	0

WT

Radionuclides*	Required LLD	Indicator Station	Station with Highest Mean	Control Station
I-131	None Required		Station	
Number of Analyses	8		16	
Non-Routine**	0			
Range — Mean		0.4789	1.8700	No Data
Range — Maximum		1.9800	1.9800	No Data
Range — Minimum		-2.5800	1.7600	No Data
Number Detected***		0	0	0
Total Analyzed		8	2	0
K-40	None Required		Station	
Number of Analyses	8		18	
Non-Routine**	0			
Range — Mean		18.8038	28.6000	No Data
Range — Maximum		33.4000	33.4000	No Data
Range — Minimum		-5.3800	23.8000	No Data
Number Detected***		2	1	0
Total Analyzed		8	2	0
Mn-54	None Required		Station	
Number of Analyses	8		18	
Non-Routine**	0			
Range — Mean		0.1091	1.1190	No Data
Range — Maximum		1.2900	1.2900	No Data
Range — Minimum		-1.4900	0.9480	No Data
Number Detected***		0	0	0
Total Analyzed		8	2	0
NB-95	None Required		Station	
Number of Analyses	8		16	
Non-Routine**	0			
Range — Mean		0.0941	0.6640	No Data
Range — Maximum		1.8800	1.8800	No Data
Range — Minimum		-1.2000	-0.5520	No Data
Number Detected***		1	1	0
Total Analyzed		8	2	0

TM

Table 5.1

Radiological Environmental Program Summary

Vermont Yankee Nuclear Power Plant, Vernon, VT

(January - December 2002)

Medium: Milk (TM) UNITS: pCi/L

TM

*Radionuclides**	*Required LLD*	*Indicator Station*	*Station with Highest Mean*	*Control Station*
Ac-228	None Required		*Station*	
Number of Analyses	16		14	
*Non-Routine***	0			
Range — *Mean*		1.5837	5.7439	0.9708
Range — *Maximum*		10.8800	10.8800	5.2640
Range — *Minimum*		-4.8900	0.6078	-1.6280
*Number Detected****		1	1	0
Total Analyzed		13	2	3
Ba-La-140	15		*Station*	
Number of Analyses	133		14	
*Non-Routine***	0			
Range — *Mean*		0.1284	0.5773	-1.3413
Range — *Maximum*		14.8600	6.3000	1.5200
Range — *Minimum*		-6.2100	-5.4200	-11.6100
*Number Detected****		1	0	0
Total Analyzed		112	19	21
Be-7	None Required		*Station*	
Number of Analyses	122		26	
*Non-Routine***	0			
Range — *Mean*		1.0351	4.1976	3.1954
Range — *Maximum*		36.9000	23.3000	22.9000
Range — *Minimum*		-27.9000	-18.0000	-16.0000
*Number Detected****		0	0	0
Total Analyzed		104	18	18
Cs-134	15		*Station*	
Number of Analyses	122		26	
*Non-Routine***	0			
Range — *Mean*		0.0190	0.9964	-0.0977
Range — *Maximum*		13.4000	13.4000	12.2000
Range — *Minimum*		-10.6000	-7.0100	-8.8390
*Number Detected****		0	0	0
Total Analyzed		104	18	18

TM

Radionuclides*		Required LLD	Indicator Station	Station with Highest Mean	Control Station
Cs-137		18	Station		
Number of Analyses	122		25		
Non-Routine**	0				
Range	Mean		1.7696	3.9046	1.0548
	Maximum		6.4860	6.4860	4.4500
	Minimum		-3.3700	0.5980	-1.1930
Number Detected***			11	5	0
Total Analyzed			104	14	18
I-131		1	Station		
Number of Analyses	122		14		
Non-Routine**	0				
Range	Mean		0.0060	0.0768	-0.0025
	Maximum		1.4000	0.3610	1.7530
	Minimum		-4.3500	-0.1480	-1.0800
Number Detected***			0	0	0
Total Analyzed			104	18	18
K-40		None Required	Station		
Number of Analyses	122		25		
Non-Routine**	0				
Range	Mean		1496.0962	2000.7142	1423.8167
	Maximum		2320.0000	2320.0000	1630.0000
	Minimum		947.0000	1430.0000	968.7000
Number Detected***			104	14	18
Total Analyzed			104	14	18
Ra-226		None Required	Station		
Number of Analyses	122		25		
Non-Routine**	0				
Range	Mean		-0.6360	2.3679	1.0199
	Maximum		109.3000	88.6900	96.8000
	Minimum		-168.0000	-71.3000	-96.5000
Number Detected***			1	0	0
Total Analyzed			104	14	18

TM

Radionuclides*		Required LLD	Indicator Station	Station with Highest Mean	Control Station
Sr-89		None Required	Station		
Number of Analyses	28		14		
Non-Routine**	0				
Range	Mean		-0.2763	1.2050	-0.7140
	Maximum		3.4800	3.4800	0.2060
	Minimum		-6.4300	0.2870	-1.6200
Number Detected***			0	0	0
Total Analyzed			24	4	4
Sr-90		None Required	Station		
Number of Analyses	28		25		
Non-Routine**	0				
Range	Mean		1.4043	2.6275	1.1110
	Maximum		3.5100	3.5100	1.6100
	Minimum		0.4330	1.9100	0.7620
Number Detected***			19	4	4
Total Analyzed			24	4	4
Th-228		None Required	Station		
Number of Analyses	122		25		
Non-Routine**	0				
Range	Mean		-1.4512	9.7661	-1.1535
	Maximum		104.7000	104.7000	7.8200
	Minimum		-147.7000	-5.2800	-12.6000
Number Detected***			2	1	0
Total Analyzed			104	14	18
Th-232		None Required	Station		
Number of Analyses	121		11		
Non-Routine**	0				
Range	Mean		2.5261	3.6721	1.6886
	Maximum		23.0000	17.3000	14.6000
	Minimum		-7.9200	-7.9200	-9.9300
Number Detected***			7	2	0
Total Analyzed			103	18	18

The only radionuclides reported in this table are those with LLD requirements and those for which positive radioactivity was detected. See Section 5 of this report for a discussion of other radionucides that were analyzed.

***Non-Routine refers to those radionuclides that exceeded the Reporting Lveles in Technical Specification Table 3.9.4.*

****The fraction of sampling analyses yielding detectable measurements (i.e. >3 standard deviations). Note, this does not include measurements that were less than the Minimum Detectable Concentration.*

TC

Table 5.1

Radiological Environmental Program Summary

Vermont Yankee Nuclear Power Plant, Vernon, VT

(January - December 2002)

Medium: Silage (TC) UNITS: pCi/Kg

TC				
*Radionuclides**	*Required LLD*	*Indicator Station*	*Station with Highest Mean*	*Control Station*
Be-7	None Required		*Station*	
Number of Analyses	6		14	
*Non-Routine***	0			
Range — *Mean*		477.8000	682.0000	353.0000
Range — *Maximum*		682.0000	682.0000	353.0000
Range — *Minimum*		345.0000	682.0000	353.0000
*Number Detected****		5	1	1
Total Analyzed		5	1	1
Cs-134	60		*Station*	
Number of Analyses	6		18	
*Non-Routine***	0			
Range — *Mean*		-4.6840	5.1800	-2.0300
Range — *Maximum*		5.1800	5.1800	-2.0300
Range — *Minimum*		-15.6000	5.1800	-2.0300
*Number Detected****		0	0	0
Total Analyzed		5	1	1
Cs-137	80		*Station*	
Number of Analyses	6		22	
*Non-Routine***	0			
Range — *Mean*		13.1340	21.1000	1.8000
Range — *Maximum*		21.1000	21.1000	1.8000
Range — *Minimum*		6.3300	21.1000	1.8000
*Number Detected****		0	0	0
Total Analyzed		5	1	1
I-131	60		*Station*	
Number of Analyses	6		22	
*Non-Routine***	0			
Range — *Mean*		23.3200	181.0000	-8.2100
Range — *Maximum*		181.0000	181.0000	-8.2100
Range — *Minimum*		-54.0000	181.0000	-8.2100
*Number Detected****		0	0	0
Total Analyzed		5	1	1

TC

Radionuclides*		Required LLD	Indicator Station	Station with Highest Mean	Control Station
K-40		None Required		Station	
Number of Analyses		6		22	
Non-Routine**		0			
Range	Mean		8872.0000	24100.0000	2870.0000
	Maximum		24100.000	24100.0000	2870.0000
	Minimum		3350.0000	24100.0000	2870.0000
Number Detected***			5	1	1
Total Analyzed			5	1	1
Th-232		None Required		Station	
Number of Analyses		6		22	
Non-Routine**		0			
Range	Mean		18.7620	82.8000	30.4000
	Maximum		82.8000	82.8000	30.4000
	Minimum		-28.5000	82.8000	30.4000
Number Detected***			0	1	1
Total Analyzed			5	1	1

The only radionuclides reported in this table are those with LLD requirements and those for which positive radioactivity was detected. See Section 5 of this report for a discussion of other radionucides that were analyzed.

***Non-Routine refers to those radionuclides that exceeded the Reporting Lveles in Technical Specification Table 3.9.4.*

****The fraction of sampling analyses yielding detectable measurements (i.e. >3 standard deviations).*

TG

Table 5.1
Radiological Environmental Program Summary
Vermont Yankee Nuclear Power Plant, Vernon, VT
(January - December 2002)
Medium: Mixed Grass (TG) UNITS: pCi/Kg

TG				
*Radionuclides**	*Required LLD*	*Indicator Station*	*Station with Highest Mean*	*Control Station*
Ac-228	None Required		*Station*	
Number of Analyses	5		12	
*Non-Routine***	0			
Range — *Mean*		74.6320	149.2000	0.0000
Range — *Maximum*		149.2000	149.2000	0.0000
Range — *Minimum*		24.0600	149.2000	0.0000
*Number Detected****		1	0	0
Total Analyzed		5	1	0
Be-7	None Required		*Station*	
Number of Analyses	21		12	
*Non-Routine***	0			
Range — *Mean*		1654.8889	3114.6667	1956.6667
Range — *Maximum*		7213.0000	7213.0000	2500.0000
Range — *Minimum*		151.0000	151.0000	1440.0000
*Number Detected****		17	2	3
Total Analyzed		18	3	3
Cs-134	60		*Station*	
Number of Analyses	21		11	
*Non-Routine***	0			
Range — *Mean*		-13.1089	-1.9877	0.0143
Range — *Maximum*		28.9000	28.9000	1.9600
Range — *Minimum*		-90.4600	-35.2200	-2.7200
*Number Detected****		0	0	0
Total Analyzed		18	3	3
Cs-137	80		*Station*	
Number of Analyses	21		13	
*Non-Routine***	0			
Range — *Mean*		10.8893	24.2323	6.1517
Range — *Maximum*		46.0000	46.0000	15.1000
Range — *Minimum*		-8.6620	1.3970	0.2750
*Number Detected****		3	2	0
Total Analyzed		18	3	3

TG

Radionuclides*		Required LLD	Indicator Station	Station with Highest Mean	Control Station
I-131		60	Station		
Number of Analyses		42		12	
Non-Routine**		0			
Range	Mean		-2.7556	9.9850	-1.8900
	Maximum		48.5900	48.5900	14.3000
	Minimum		-85.1000	-12.4000	-15.6000
Number Detected***			0	0	0
Total Analyzed			36	6	6
K-40		None Required		Station	
Number of Analyses		21		14	
Non-Routine**		0			
Range	Mean		5623.8889	6270.3335	5603.3333
	Maximum		8464.0000	7401.0000	6480.0000
	Minimum		2860.0000	5030.0000	4030.0000
Number Detected***			18	3	3
Total Analyzed			18	3	3
Th-228		None Required		Station	
Number of Analyses		21		12	
Non-Routine**		0			
Range	Mean		37.4206	182.9300	14.5967
	Maximum		519.1000	519.1000	26.2000
	Minimum		-78.3600	5.1900	5.9900
Number Detected***			0	0	0
Total Analyzed			18	3	3
Th-232		None Required		Station	
Number of Analyses		21		11	
Non-Routine**		0			
Range	Mean		29.8339	35.7900	25.3000
	Maximum		60.2000	40.4000	28.3000
	Minimum		-36.8000	31.5700	21.6000
Number Detected***			1	1	0
Total Analyzed			18	3	3

*The only radionuclides reported in this table are those with LLD requirements and those for which positive radioactivity was detected. See Section 5 of this report for a discussion of other radionucides that were analyzed.

**Non-Routine refers to those radionuclides that exceeded the Reporting Lveles in Technical Specification Table 3.9.4.

***The fraction of sampling analyses yielding detectable measurements (i.e. >3 standard deviations). Note, this does not include measurements that were less than the Minimum Detectable Concentration.

FH

Table 5.1

Radiological Environmental Program Summary

Vermont Yankee Nuclear Power Plant, Vernon, VT

(January - December 2002)

Medium: Fish (FH) UNITS: pCi/Kg

FH

*Radionuclides**	*Required LLD*	*Indicator Station*	*Station with Highest Mean*	*Control Station*
Co-58	130		*Station*	
Number of Analyses	4		21	
*Non-Routine***	0			
Range — *Mean*		-16.6500	-15.8650	-15.8650
Range — *Maximum*		-12.2000	-9.8900	-9.8900
Range — *Minimum*		-21.1000	-21.8400	-21.8400
*Number Detected****		0	0	0
Total Analyzed		2	2	2
Co-60	130		*Station*	
Number of Analyses	4		11	
*Non-Routine***	0			
Range — *Mean*		11.0705	11.0705	-4.0165
Range — *Maximum*		12.9000	12.9000	-2.3400
Range — *Minimum*		9.2410	9.2410	-5.6930
*Number Detected****		0	0	0
Total Analyzed		2	2	2
Cs-134	130		*Station*	
Number of Analyses	4		21	
*Non-Routine***	0			
Range — *Mean*		-29.0470	-7.4800	-7.4800
Range — *Maximum*		-2.3940	2.4200	2.4200
Range — *Minimum*		-55.7000	-17.3800	-17.3800
*Number Detected****		0	0	0
Total Analyzed		2	2	2
Cs-137	150		*Station*	
Number of Analyses	4		21	
*Non-Routine***	0			
Range — *Mean*		5.9075	15.0865	15.0865
Range — *Maximum*		14.5000	28.7000	28.7000
Range — *Minimum*		-2.6850	1.4730	1.4730
*Number Detected****		1	1	1
Total Analyzed		2	2	2

FH

Radionuclides*	Required LLD	Indicator Station	Station with Highest Mean	Control Station
Fe-59	260	Station		
Number of Analyses	4	21		
Non-Routine**	0			
Range — Mean		-7.7375	-2.2725	-2.2725
Range — Maximum		-7.6300	2.4050	2.4050
Range — Minimum		-7.8450	-6.9500	-6.9500
Number Detected***		0	0	0
Total Analyzed		2	2	2
K-40	None Required	Station		
Number of Analyses	4	11		
Non-Routine**	0			
Range — Mean		3627.5000	3627.5000	3419.5000
Range — Maximum		4310.0000	4310.0000	3420.0000
Range — Minimum		2945.0000	2945.0000	3419.0000
Number Detected***		2	2	2
Total Analyzed		2	2	2
Mn-54	130	Station		
Number of Analyses	4	11		
Non-Routine**	0			
Range — Mean		4.4105	4.4105	-4.5510
Range — Maximum		5.8310	5.8310	-1.8620
Range — Minimum		2.9900	2.9900	-7.2400
Number Detected***		0	0	0
Total Analyzed		2	2	2
Th-232	None Required	Station		
Number of Analyses	4	21		
Non-Routine**	0			
Range — Mean		14.1400	59.6830	59.6830
Range — Maximum		15.0000	118.0000	118.0000
Range — Minimum		13.2800	1.3660	1.3660
Number Detected***		0	1	1
Total Analyzed		2	2	2
Zn-65	260	Station		
Number of Analyses	4	11		
Non-Routine**	0			
Range — Mean		-1.7177	-1.7177	-60.9000
Range — Maximum		-0.2654	-0.2654	-14.4000
Range — Minimum		-3.1700	-3.1700	-107.4000
Number Detected***		0	0	0
Total Analyzed		2	2	2

FH

*Radionuclides**	*Required LLD*	*Indicator Station*	*Station with Highest Mean*	*Control Station*

**The only radionuclides reported in this table are those with LLD requirements and those for which positive radioactivity was detected. See Section 5 of this report for a discussion of other radionucides that were analyzed.*

***Non-Routine refers to those radionuclides that exceeded the Reporting Lveles in Technical Specification Table 3.9.4.*

****The fraction of sampling analyses yielding detectable measurements (i.e. >3 standard deviations).*

Environmental TLD Data

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Tables:

5.2 – Data Summary
5.3 - Measurements

TABLE 5.2

ENVIRONMENTAL TLD DATA SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT
(JANUARY - DECEMBER 2002)

INNER RING TLD	OUTER RING TLD	OFFSITE STATION WITH HIGHEST MEAN	CONTROL TLDs
MEAN*	MEAN*	STA.NO MEAN*	MEAN*
RANGE*	RANGE*	RANGE*	RANGE*
(N0. MEASUREMENTS)**	(N0. MEASUREMENTS)**	(N0. MEASUREMENTS)**	(N0. MEASUREMENTS)**
6.5 ± 0.3	6.6 ± 0.3	DR-36 8 ± 0.3	6.3 ± 0.3
5.9 - 7.5	5.4 - 6.4	7.3 - 8.5	6 - 6.7
84	63	3	8

SITE BOUNDARY TLD WITH HIGHEST MEAN	SITE BOUNDARY TLD
STA.NO. MEAN*	MEAN*
RANGE*	RANGE*
(NO. MEASUREMENTS)**	(NO. MEASUREMENTS)**
DR-45 12.1 ± 0.7	8.1 ± 0.4
11.0 - 13.2	7.0 - 12.1
4	56

* Units are in micro-R per hour.

** Each "measurement" is based typically on quarterly readings from five TLD elements.

TABLE 5.3

ENVIRONMENTAL TLD MEASUREMENTS
2002
(Micro-R per Hour)

Sta. No.	Description	1ST QUARTER EXP.	S.D.	2ND QUARTER EXP.	S.D.	3RD QUARTER EXP.	S.D.	4TH QUARTER EXP.	S.D.	ANNUAL AVE. EXP.
DR-01	River Sta. No. 3.3	5.4	± 0.3	6.4	± 0.7	6.1	± 0.2	5.9	± 0.4	6.0
DR-02	N Hinsdale, NH	6.1	± 0.3	6.8	± 0.3	6.6	± 0.2	6.6	± 0.5	6.5
DR-03	Hinsdale Substation	7.3	± 0.3	7.6	± 0.4	7.4	± 0.2	7.5	± 0.5	7.5
DR-04	Northfield, MA	5.5	± 0.3	6.1	± 0.3	6.2	± 0.3	6.1	± 0.4	6.0
DR-05	Spofford Lake, NH	6.3	± 0.4	6.8	± 0.3	6.7	± 0.2	6.9	± 0.5	6.7
DR-06	Vernon School	6.1	± 0.3	6.8	± 0.3	6.8	± 0.2	6.6	± 0.4	6.6
DR-07	Site Boundary	7.3	± 0.5	7.9	± 0.4	7.7	± 0.3	7.6	± 0.6	7.6
DR-08	Site Boundary	8.0	± 0.3	7.9	± 0.4	8.3	± 0.3	7.7	± 0.5	8.0
DR-09	Inner Ring	5.6	± 0.2	5.9	± 0.4	5.9	± 0.2	5.9	± 0.4	5.9
DR-10	Outer Ring	4.9	± 0.3	5.6	± 0.2	5.2	± 0.2	5.6	± 0.3	5.4
DR-11	Inner Ring	5.4	± 0.3	6.1	± 0.3	6.0	± 0.2	6.2	± 0.4	5.9
DR-12	Outer Ring	5.2	± 0.2	5.9	± 0.3	5.7	± 0.2	5.9	± 0.4	5.7
DR-13	Inner Ring	6.1	± 0.3	6.6	± 0.3	6.4	± 0.3	6.3	± 0.4	6.4
DR-14	Outer Ring	6.9	± 0.4	7.6	± 0.4	7.5	± 0.3	7.7	± 0.6	7.4
DR-15	Inner Ring	6.2	± 0.3	6.9	± 0.3	6.4	* 0.2	7.0	± 0.5	6.6
DR-16	Outer Ring	6.7	± 0.3	6.9	± 0.3	6.8	± 0.3	7.2	± 0.5	6.9
DR-17	Inner Ring	6.0	± 0.3	6.4	± 0.3	6.5	± 0.3	6.6	± 0.4	6.4
DR-18	Outer Ring	6.0	± 0.3	6.7	± 0.3	6.7	± 0.3	6.7	± 0.5	6.5
DR-19	Inner Ring	6.5	± 0.3	7.5	± 0.4	7.1	± 0.4	7.5	± 0.5	7.1
DR-20	Outer Ring	6.4	± 0.3	7.2	± 0.3	7.2	± 0.3	7.4	± 0.5	7.0
DR-21	Inner Ring	6.0	± 0.3	6.9	± 0.3	6.5	± 0.3	6.5	± 0.5	6.5
DR-22	Outer Ring	6.4	± 0.3	6.7	± 0.3	6.6	± 0.2	6.3	± 0.5	6.5
DR-23	Inner Ring	6.0	± 0.3	6.4	± 0.4	6.4	± 0.2	6.2	± 0.4	6.2
DR-24	Outer Ring	5.5	± 0.3	5.9	± 0.2	5.7	± 0.2	5.7	± 0.5	5.7
DR-25	Inner Ring	6.1	± 0.3	6.6	± 0.3	6.7	± 0.2	6.4	± 0.4	6.5
DR-26	Outer Ring	6.1	± 0.3	6.8	± 0.4	6.9	± 0.3	6.5	± 0.5	6.6
DR-27	Inner Ring	6.0	± 0.3	6.8	± 0.3	6.5	± 0.3	6.4	± 0.4	6.4
DR-28	Outer Ring	5.9	± 0.3	6.8	± 0.3	6.6	± 0.2	6.4	± 0.6	6.4
DR-29	Inner Ring	5.9	± 0.4	6.5	± 0.3	6.6	± 0.3	6.9	± 0.5	6.5
DR-30	Outer Ring	6.1	± 0.3	7.0	± 0.3	6.7	± 0.3	6.6	± 0.5	6.6
DR-31	Inner Ring	5.5	± 0.3	6.9	± 0.3	6.8	± 0.3	6.7	± 0.4	6.5
DR-32	Outer Ring	6.3	± 0.3	6.5	± 0.4	6.7	± 0.3	6.6	± 0.5	6.5
DR-33	Inner Ring	6.2	± 0.3	6.9	± 0.2	7.0	± 0.4	6.9	± 0.5	6.8
DR-34	Outer Ring		±	7.0	± 0.3	7.1	± 0.3	6.8	± 0.5	7.0
DR-35	Inner Ring	6.1	± 0.3	6.7	± 0.4	6.7	± 0.3	6.4	± 0.4	6.5
DR-36	Outer Ring	7.3	± 0.3	8.5	± 0.3	8.1	± 0.4		±	8.0
DR-37	Inner Ring	6.0	± 0.3	6.8	± 0.3	6.7	± 0.3	6.7	± 0.6	6.5
DR-38	Outer Ring	6.8	* 0.4	7.3	± 0.4	7.4	± 0.3	7.1	± 0.5	7.1
DR-39	Inner Ring	6.0	± 0.3	6.9	± 0.2	6.9	± 0.3	6.5	± 0.4	6.6
DR-40	Outer Ring	6.1	± 0.3	6.5	± 0.4	6.4	± 0.3	6.7	± 0.4	6.4

* Data not available due to missing TLD.

TABLE 5.3

ENVIRONMENTAL TLD MEASUREMENTS
2002
(Micro-R per Hour)

Sta. No.	Description	1ST QUARTER EXP.	S.D.	2ND QUARTER EXP.	S.D.	3RD QUARTER EXP.	S.D.	4TH QUARTER EXP.	S.D.	ANNUAL AVE. EXP.
DR-41	Site Boundary	6.8	± 0.4	7.8	± 0.5	7.8	± 0.3	7.2	± 0.4	7.4
DR-42	Site Boundary	6.1	± 0.3	7.3	± 0.5	7.0	± 0.3	6.6	± 0.4	6.7
DR-43	Site Boundary	6.8	± 0.3	7.6	± 0.6	7.9	± 0.3	7.2	± 0.6	7.4
DR-44	Site Boundary	7.8	± 0.4	7.7	± 0.5	8.2	± 0.4	7.4	± 0.2	7.8
DR-45	Site Boundary	13.2	± 0.7	12.3	± 0.5	11.0	± 0.4	11.8	± 1.1	12.1
DR-46	Site Boundary	8.3	± 0.3	8.7	± 0.5	9.0	± 0.3	8.4	± 0.6	8.6
DR-47	Site Boundary	7.4	± 0.3	8.2	± 0.7	8.1	± 0.3	7.8	± 0.4	7.9
DR-48	Site Boundary	6.6	± 0.7	7.4	± 0.5	7.0	± 0.4	7.1	± 0.4	7.0
DR-49	Site Boundary	6.0	± 0.3	7.0	± 0.6	6.5	± 0.2	6.3	± 0.4	6.4
DR-50	Governor Hunt House	6.2	± 0.3	7.2	± 0.5	7.0	± 0.2	6.7	± 0.4	6.8
DR-51	Site Boundary	7.7	± 0.4	8.7	± 0.5	8.6	± 0.4	7.8	± 0.6	8.2
DR-52	Site Boundary	8.0	± 0.3	8.7	± 0.7	9.8	± 0.6	8.2	± 0.5	8.7
DR-53	Site Boundary	8.5	± 0.3	9.7	± 0.6	9.9	± 0.3	8.8	± 0.5	9.2

6. ANALYSIS OF ENVIRONMENTAL RESULTS

6.1 Sampling Program Deviations

Off-site Dose Calculation Manual Control 3.5.1 allows for deviations "if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons." In 2002, four deviations were noted in the REMP. These deviations did not compromise the program's effectiveness and in fact, with the exception of the loss of a set of air samples during shipment, are considered typical with respect to what is normally anticipated for any radiological environmental monitoring program. The specific deviations for 2002 were:

a) The outer ring TLD in the W sector, DR-34 was discovered to be missing for the 1st quarter of the year on April 2, 2002 during the TLD changeout surveillance. The power pole which supported the TLD and holder had been replaced and the TLD discarded by power company personnel. A new holder and TLD was installed at this location and was successfully collected for all ensuing quarters.

b) Upon observing high river water conditions on May 14, 2002, as a result of winter snowmelt runoff and heavy spring rains, the Environmental Specialist investigated the operability of the river water pump supplying water to the River Water Sample Compositor (WR 11 – Station 3-3). He found that the pump was out of service and therefore no flow was reaching the sample compositor. Daily grab samples were immediately initiated until the river level receded and the river water pump could be restored to service. Grab samples were utilized as part of the composite for the collection period.

c) As a result of a blown fuse, the River Water Sample Compositor (WR 11 – Station 3-3) was out of service for a period of less than 24 hours from October 31, 2002 until November 1, 2002. Compensatory sampling was initiated for the period of time that the compositor was out of service. The fuse was replaced and the compositor was restored to service on November 1, 2002.

d) The outer ring TLD in the WNW sector, DR-36 was reported missing for the 4rd quarter of the year on December 31, 2002 during the TLD changeout surveillance. No sign of the TLD or its holder was evident following an area search by the technician. A new holder and TLD was installed at this location and was successfully collected in the first quarter of 2003.

e) A fuse was found blown in the Tyler Hill Air Sample Station (AP/CF 15) on December 17th, 2002. A further check revealed that the air pump had seized up. A new pump was installed. The station only collected approximately 22 cubic meters during the period, down from a normal volume of approximately 250 cubic meters. No further failures have occurred at this station.

f) The following data indicates the percentage of time that each air sampling station operated during year 2002. The data was based on an electric timer at each station and the clock time of sample collection. This data indicates that any power interruptions did not result in a significant loss of data for the airborne contaminant sampling program. Minor power interruptions are expected due to minor maintenance repairs and short duration electrical outages occurring during the year.

AP/CF #	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
11	100%	100.0%	100%	100%
12	100%	100%	100%	100%
13	100%	100%	100%	100%
14	100%	100%	99%	98%
15	100%	100%	100%	93%
21	100%	100%	100%	100%
40	100%	100%	100%	100%

6.2 Comparison of Achieved LLDs with Requirements

Table 4.5.1 of the VYNPS ODCM (also shown in Table 4.4 of this report) gives the required Lower Limits of Detection (LLDs) for environmental sample analyses. On occasion, an LLD is not achievable due to a situation such as a low sample volume caused by sampling equipment malfunction or limited sample availability. In such a case, ODCM 10.2 requires a discussion of the situation. At the contracted environmental laboratory, the target LLD for the majority of analyses is 50 percent of the most restrictive required LLD. Expressed differently, the typical sensitivities achieved for each analysis are at least 2 times greater than that required by the VYNPS ODCM.

For each analysis having an LLD requirement in ODCM Table 4.5.1, the *a posteriori* (after the fact) LLD calculated for that analysis was compared with the required LLD. During 2002, all sample analyses performed for the REMP program achieved an *a posteriori* LLD less than the corresponding LLD requirement.

6.3 Comparison of Results with Reporting Levels

ODCM Section 10.3.4 requires written notification to the NRC within 30 days of receipt of an analysis result whenever a Reporting Level in ODCM Table 3.5.2 is exceeded. Reporting Levels are the environmental concentrations that relate to the ALARA design dose objectives of 10 CFR 50, Appendix I. Environmental concentrations are averaged over the calendar quarters for the purposes of this

comparison. The Reporting Levels are intended to apply only to measured levels of radioactivity due to plant effluents. During 2002, no analytical result exceeded a corresponding reporting level requirement in Table 3.5.2 of the ODCM.

6.4 Changes in Sampling Locations

The Vermont Yankee Nuclear Power Station Off-Site Dose Calculation Manual Section 10.2 states that if "new environmental sampling locations are identified in accordance with Control 3.5.2, the new locations shall be identified in the next Annual Radiological Environmental Operating Report." There were no required sampling location changes due to the Land Use Census conducted in 2002.

This year Vermont Yankee is continuing to add data from the on-site air sampling station, AP/CF 40, at the Governor Hunt House. This location has been used continuously as a demonstration since early in the program, but the data had not previously been included in this report.

6.5 Data Analysis by Media Type

The 2002 REMP data for each media type is discussed below. Whenever a specific measurement result is presented, it is given as the concentration in the units of the sample (volume or weight). An analysis is considered to yield a "detectable measurement' when the concentration exceeds three times the standard deviation for that analysis and is greater than or equal to the Minimum Detectable Concentration (MDC) for the analysis. With respect to data plots, all net concentrations are plotted as reported, without regard to whether the value is "detectable" or "non-detectable." In previous years, we had converted values that were less than the MDC to zero.

6.5.1 Airborne Pathways

6.5.1.1 Air Particulates (AP)

The periodic air particulate filters from each of the seven sampling sites were analyzed for gross-beta radioactivity. At the end of each quarter, the filters from each sampling site were composited for a gamma analysis. The results of the air particulate sampling program are shown in Table 5.1 and Figures 6.1 through 6.7. This is the third year that the results for the on-site air particulate station, Gov. Hunt (AP-40) have been included.

Gross beta activity was detected in all air particulate filters that were analyzed. As shown in Figure 6.1, there is no significant difference between the quarterly average concentrations at the indicator (near-plant) stations and the control (distant from plant) stations. Notable in Figure 6.1 is a distinct annual cycle, with the minimum concentration in the second quarter, and the maximum concentration in the first quarter.

Figures 6.2 through 6.7 show the weekly gross beta concentration at each air particulate sampling location compared to the control air particulate sampling location at AP-21 (Spofford Lake, NH). Small differences are evident and expected between individual sampling locations. Figure 6.2 clearly demonstrates the distinct annual cycle, with the minimum concentration in the second quarter, and the maximum concentration in the first quarter. It can be seen that the gross-beta measurements on air particulate filters fluctuate significantly over the course of a year. The measurements from control station AP-21 vary similarly, indicating that these fluctuations are due to regional changes in naturally-occurring airborne radioactive materials, and not due to Vermont Yankee operations.

There were four naturally-occurring gamma-emitting radionuclides detected on the air particulate filters during this reporting period. Be-7, a naturally-occurring cosmogenic radionuclide, was detected on 28 of 28 filter sets analyzed. K-40 was detected on a total of 3 out of 28 analyzed. Ra-226 was detected once out of 28. Th-232 was detected once out of 28 analyzed.

6.5.1.2 Charcoal Cartridges (CF)

Charcoal cartridges from each of the seven air sampling sites were analyzed for I-131 each time they were collected. The results of these analyses are summarized in Table 5.1. As in previous years, no I-131 was detected in any charcoal cartridge. This is the third year that the results for the on-site air iodine sampling station, Governor Hunt House (CF-40) have been included.

6.5.2 Waterborne Pathways

6.5.2.1 River Water (WR)

Aliquots of river water were automatically collected periodically from the Connecticut River downstream from the plant discharge area and hydro station, location WR-11, with the exception of the two events of short duration when the sampling equipment was out of service (see Section 6.1). Monthly grab samples were also collected at the upstream control location, also on the Connecticut River, location WR-21. The composited samples at WR-11 were collected monthly and sent along with the WR-21 grab samples to

the contracted environmental laboratory for analysis. Table 5.1 shows that gross-beta measurements were positive in seven out of 12 indicator samples and ten out of 12 control samples, as would be expected, due to naturally-occurring radionuclides in the water. As seen in Figure 6.8, the mean concentration of the indicator locations was similar to the mean concentration at the control location in 2002.

For each sampling site, the monthly samples were composited into quarterly samples for H-3 (Tritium) analyses. None of the samples contained detectable quantities of H-3.

6.5.2.2 Ground Water (WG)

Quarterly ground water (deep wells supplying drinking water to the plant and selected offsite locations) samples were collected from four indicator locations (only one is required by VYNPS ODCM) and one control location during 2002. WG-13 (COB Well), an on-site well location, has been routinely sampled since the second half of 1996. In 1999, WG-14 (PBS Well) another on-site well location was added to the program. Table 5.1 and Figure 6.9 show that gross-beta measurements were positive in 12 out of 20 indicator samples and in 2 out of 5 control samples. The beta activity is due to naturally-occurring radionuclides in the water. The levels at all sampling locations, including the higher levels at station WG-11, were consistent with those detected in previous years. Nb-95 was minimally detected in two of the 25 analyses and is believed to be a result of cross-contamination of samples at the analytical laboratory since this nuclide could not be identified in subsequent samples. Naturally occurring Th-232 was also detected in two samples and is naturally-occurring. No other gamma-emitting radionuclides or tritium were detected in any of the samples.

6.5.2.3 Sediment (SE)

Semi-annual river sediment grab samples were collected from two indicator locations during 2002. The North Storm Drain Outfall location (SE-12) is an area where up to 40 different locations can be sampled within a 20 ft by 140 ft area. In 2002, 20 locations were sampled at SE-12 during each of the semi-annual collections. Two samples were collected at SE-11 during the year. As would be expected, naturally-occurring Potassium-40 (K-40) was detected in all of the samples. Radium-226 (Ra-226) was detected in 41 of 42 samples. Thorium-228 (Th-228) was detected in 42 of 42 samples analyzed. Thorium-232 (Th-232) was detected 42 samples analyzed. Cesium-137 (Cs-137) was detected in 42 out of 42 of the indicator samples. The levels of Cs-137 measured at both locations were consistent with what has been measured in the previous several years and with those detected at other New England locations. Cobalt-60 (Co-60) was detected this year in 6 of the 42 stations analyzed. Co-60 is present at the North Storm Drain Outfall sampling location as a result of the presence of plant related radionuclides in the onsite storm drain system. Other plant-related radionuclides are reported in trace quantities in Table 5.1 SE. Also see section 6.5.2.6 for more information.

6.5.2.4 Test Wells (WT)

During 1996, sampling was initiated at test wells around the outer edges of an area in the south portion of the VYNPS site where septic sludge is spread. This sampling continued through 2002. The test well locations are shown on Figure 4.1 and the results are summarized in Table 5.1 under the media category, Test Well (WT). In 2002, two samples were taken at each of the four locations and all were analyzed for gamma isotopic, gross beta and H-3 activity.

Prior to the gross beta analysis, each sample was filtered through a 0.45 micron Gelman Tuffryn membrane filter. Gross beta activity was detected in all 8 samples collected with levels ranging from 4 to 24 pCi/kg. K-40 was also detected in 2 of the 8 samples. Nb-95 was also detected in trace amount in one of the eight samples. This may be related to the cross-contamination issue described in section 6.5.2.2 above.

6.5.2.5 Storm Drain System

The presence of plant-related radionuclides in the onsite storm drain system has been identified in previous years at Vermont Yankee (VY). As a consequence, a 50.59 evaluation of radioactive materials discharged via the storm drain system was performed in 1998. This assessment was in response to I&E Information and Enforcement Bulletin No. 80-10 and NRC Information Notice No. 91-40. The evaluation demonstrated that the total curies released via the VYNPS storm drain system are not sufficient to result in a significant dose (i.e. dose does not exceed 10% of the technical specification objective of 0.3 millirem per year to the total body, and 1.0 millirem per year to the target organ for the maximally exposed receptor). Water and sediment in the onsite storm drain system was routinely sampled throughout 2002 at various points. The results of this sampling are summarized below.

Sediment samples were taken from the storm drain system at onsite manhole locations in 2002 for a total of 20 samples. All samples were analyzed for gamma emitting isotopes. Table 6-1 summarizes the analytical results of the sediment samples. Naturally occurring isotopes K-40, Th-228, Th-232, Ra-226, and Be-7 were found in most of the samples as expected. The highest detected concentration for all plant-related radionuclides that were detected in sediment samples was found in sample SE-95, which is also designated by the plant as Manhole 12.

Water samples were taken from the storm drain system at various access points in 2002 including Manholes MH-8, MH-11H, MH-12A, MH-13, and MH-14. Table 6-2 summarizes the analytical results of water samples from the storm drain system in 2002. Nb-95 was detected in trace amounts in just two of the samples. Naturally-occurring Th-232 was detected in two of the samples. Low levels of gross beta activity were detected in 19 out of 26 samples analyzed at concentrations that are typical of any

environmental water sample. Tritium (H-3) was detected in only nine of the 22 samples analyzed at a very low level of activity.

In 1998, an additional dose assessment was performed that incorporated all of the 1998 storm drain system analytical results (including both sediment and water). The dose assessment was performed using the maximum measured concentration of radionuclides in 1998, and a conservative estimate of the volume of sediment and water discharged via the storm drain system. The results of this dose assessment are estimates of the total body and maximum organ dose equaling 3.2% and 1.6% of the corresponding Technical Specification dose limits respectively. Therefore, there was no significant dose impact from plant-related radionuclides in the storm drain system in 1998. The sampling conducted in 2002 indicates that the presence of radionuclides in the storm drain system has not changed significantly. Therefore, the storm drain system remains an insignificant impact to dose. The VYNPS staff will continue to monitor the presence of plant related radionuclides in the storm drain system.

Table 6.1

Summary of Storm Drain System Sediment Sample Analyses*

Isotope	No. Detected**	Mean (pCi/kg)	Range (pCi/kg)	Station With Highest Detected Concentration
Be-7	20/20	5.7 E 3	(0.98 – 29.7) E 3	MH-12 (SE-95)
K-40	20/20	1.1 E 4	(0..33 - 1.60) E 4	MH-12A (SE-92)
Th-232	20/20	6.6 E 2	(1.46-11.7) E 2	MH-11E (SE-99)
Th-228	20/20	9.2 E 2	(0.13-2.65) E 3	MH-12A (SE-92)
Mn-54	11/20	3.0 E 1	(0.89-7.24) E 1	MH-12 (SE-95)
Ra-226	19/20	9.4 E 2	(0.27-1.63) E 3	MH-12 (SE-95)
Cs-134	1/20	1.9 E 1	NA	MH-12 (SE-95)
Cs-137	20/20	5.8 E 2	(0.23-19.9) E 2	MH-12 (SE-95)
Zn-65	1/20	1.1 E 2	NA	MH-12A (SE-92)
Ag-110m	2/20	6.4 E 1	(4.39-8.38) E 1	MH-12 (SE-95)
Ac-228	8/20	8.5 E 2	(0.52-15.9) E 2	MH-12A (SE-92)
Ce-144	1/20	2.6 E 1	NA	MH-12 (SE-95)
Nb-95	6/20	3.9 E 1	(0.75-8.46) E 1	MH-12 (SE-95)
Co-60	10/20	3.5 E 2	(0..65-8.20) E 3	MH-12 (SE-95)

* Radionuclides that were not detected in any sample are not listed

** The fraction of sample analyses yielding detectable measurements (i.e. >3 standard deviations). The mean and the range are determined only from the samples where activity was >3 standard deviations.

Table 6.2

Summary of Storm Drain System Water Sample Analyses*

Isotope	No. Detected **	Mean (pCi/kg)	Range (pCi/kg)	Station With Highest Detected Concentration
Be-7	1/22	1.7 E 1	NA	MH-14 (WW-10)
Gross Beta	19/22	4.7 E 0	(1.9 – 8.1) E 0	MH-12A (WW-12)
Cs-134	3/22	5.2 E 0	(2.94 – 7.78) E 0	MH-12A (WW-12)
Cs-137	1/22	2.4 E 0	NA	MH-12A (WW-12)
K-40	3/22	4.4 E 1	(3.50 – 5.49) E 1	MH-14 (WW-10)
Mo-99	1/22	8.8 E 2	NA	MH-12A (WW-12)
Nb-95	2/22	2.9 E 0	(2.34– 3.51) E 0	MH-14 (WW-10)
Ra-226	1/22	2.7 E 2	NA	MH-14 (WW-10)
Th-232	2/22	1.2 E 1	(0.89 – 1.41) E 1	MH-12A (WW-12)
H-3	9/22	1.7 E 2	(1.09 – 2.74) E 2	MH-14 (WW-10)

* Radionuclides that were not detected in any sample are not listed

** The fraction of sample analyses yielding detectable measurements (i.e. >3 standard deviations).

6.5.3 Ingestion Pathways

6.5.3.1 Milk (TM)

Milk samples from cows or goats at several local farms were collected monthly during 2002. Twice-per-month collections were made during the "pasture season" since the milking cows or goats were identified as being fed pasture grass during that time. Each sample was analyzed for I-131 and other gamma-emitting radionuclides. Quarterly composites (by location) were analyzed for Sr-89 and Sr-90.

As expected, naturally-occurring K-40 was detected in all samples. Naturally-occurring Th-232 and Th-228 were detected in a few of the samples. Also expected was Sr-90. Sr-90 was detected in 19 out of 24 indicator samples and 4 out of 4 control samples. Although Sr-90 is a by-product of nuclear power plant operations, the levels detected in milk are consistent with that expected from worldwide fallout from nuclear weapons tests, and to a much lesser degree from fallout from the Chernobyl incident. The Sr-90 levels shown in Table 5.1 and Figure 6.11 are consistent with those detected at other New England farms participating in other plant environmental monitoring programs. This radionuclide and Cs-137 are present throughout the natural environment as a result of atmospheric nuclear weapons testing that started primarily in the late 1950's and continued through 1980. They are found in soil and vegetation, as well as anything that feeds upon vegetation, directly or indirectly. The detection of Cs-137 in environmental milk samples is expected and has been detected in previous years. Cs-137 was detected in 11 of 122 samples in 2002. See Figure 6.10. It should be noted here that most of the Cs-137 concentrations and many of the Sr-90 concentrations shown on Figures 6.10 and 6.11, respectively, are considered "not detectable." All values have been plotted, regardless of whether they were considered statistically significant or not. As shown in these figures, the levels are also consistent with those detected in previous years near the VYNPS plant. There is also little actual difference in concentrations between farms.

6.5.3.2 Silage (TC)

A silage sample was collected from each of the required milk sampling stations during October. Each of these was analyzed for gamma-emitting radionuclides and I-131. As expected with all biological media, naturally-occurring K-40 was detected in all samples. Naturally-occurring Be-7 was also detected in 6 of the 6 samples. Th-232, also naturally-occurring, was detected in 3 of seven samples. Cs-137 was not detected in any of the six samples. No I-131 was detected in any sample.

6.5.3.3 Mixed Grass (TG)

Mixed grass samples were collected at each of the air sampling stations on three occasions during 2002. As expected with all biological media, naturally-occurring K-40 and Be-7 were detected in nearly all samples. Th-232 was detected in one of the 21 samples.

Cs-137 was detected in 3 of the 21 stations, although at extremely low levels. The required LLD for this Cs-137 in this sample type is 80 pCi/kg and the highest measurement was 46 pCi/kg. Although not common, Cs-137 has been detected in mixed grass samples occasionally. It is likely that it is present in a small amount of soil that was attached to the grass samples.

6.5.3.4 Fish (FH)

Semiannual samples of fish were collected from two locations in the Spring and Fall of 2002. Several species are collected such as Walleye, Small Mouth Bass, Large Mouth Bass, Yellow Perch, White Perch, and Rock Bass. The edible portions of each of these were analyzed for gamma-emitting radionuclides. As expected in biological matter, naturally-occurring K-40 was detected in all samples.

As shown in Table 5.1, Cs-137 was again detected in this year's samples although it was not detected in year 2000. It should be noted that most of the Cs-137 concentrations plotted in Figure 6.12 are considered "not detectable." All values were plotted regardless of whether they were considered statistically significant or not. The Cs-137 levels plotted for 2002 and previous years are typical of concentrations attributable to global nuclear weapons testing fallout.

Naturally-occurring Th-232 was detected in one sample from the 2 control station samples.

No other radionuclides were detected.

6.5.4 Direct Radiation Pathway

Direct radiation was continuously measured at 53 locations surrounding the Vermont Yankee plant with the use of thermoluminescent dosimeters (TLDs). Two exceptions to this program occurred in year 2002. A TLD was missing from Station DR-34 at the end of the first quarter and another TLD, DR-36, was found to be missing at the end of the fourth quarter. These events are further described in Section 6.1.

In 1999, DR-53 was added on the site boundary. The TLDs are collected every calendar quarter for readout at the environmental laboratory. The complete summary of data may be found in Table 5.3.

From Tables 5.2 and 5.3 and Figure 6.13, it can be seen that the Inner and Outer Ring TLD mean exposure rates were not significantly different in 2002. This indicates no significant overall increase in direct radiation exposure rates in the plant vicinity. It can also be seen from these tables that the Control TLD mean exposure rate was not significantly different than that at the Inner and Outer Rings. Figure

6.13 also shows an annual cycle at both indicator and control locations. The lowest point of the cycle occurs during the winter months. This is due primarily to the attenuating effect of the snow cover on radon emissions and on direct irradiation by naturally-occurring radionuclides in the soil. Differing amounts of these naturally-occurring radionuclides in the underlying soil, rock or nearby building materials result in different radiation levels between one field site and another.

Upon examining Figure 6.17, as well as Table 5.2, it is evident that in recent years, station DR-45 had a higher average exposure rate than any other station. This location is on-site, and the higher exposure rates are due to plant operations and activities in the immediate vicinity of this TLD. There is no significant dose potential to the surrounding population or any real individual from these sources since they are located on the back side of the plant site, between the facility and the river. The same can be said for station DR-46, which has shown higher exposure rates in previous years.