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May 15, 2001
BVY 01-43

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Subject: Vermont Yankee Nuclear Power Station
License No. DPR-28 (Docket No. 50-271)
2000 Annual Radiological Environmental Operating Report

In accordance with Vermont Yankee Technical Specification 6.6.E, attached is a copy of the 2000 Annual Radiological Environmental Operating Report. This report contains a summary and analysis of the radiological environmental data collected for the calendar year 2000.

We trust that the information provided is adequate; however, should you have questions or require additional information, please contact Mr. David P. Tkatch at (802) 258-5500.

Sincerely,

VERMONT YANKEE NUCLEAR POWER CORPORATION

Gautam Sen

Gautam Sen
Licensing Manager

Attachment

cc: USNRC Region 1 Administrator
USNRC Resident Inspector – VYNPS
USNRC Project Manager – VYNPS
Vermont Department of Public Service
Vermont Division of Occupational and Radiological Health

IE25

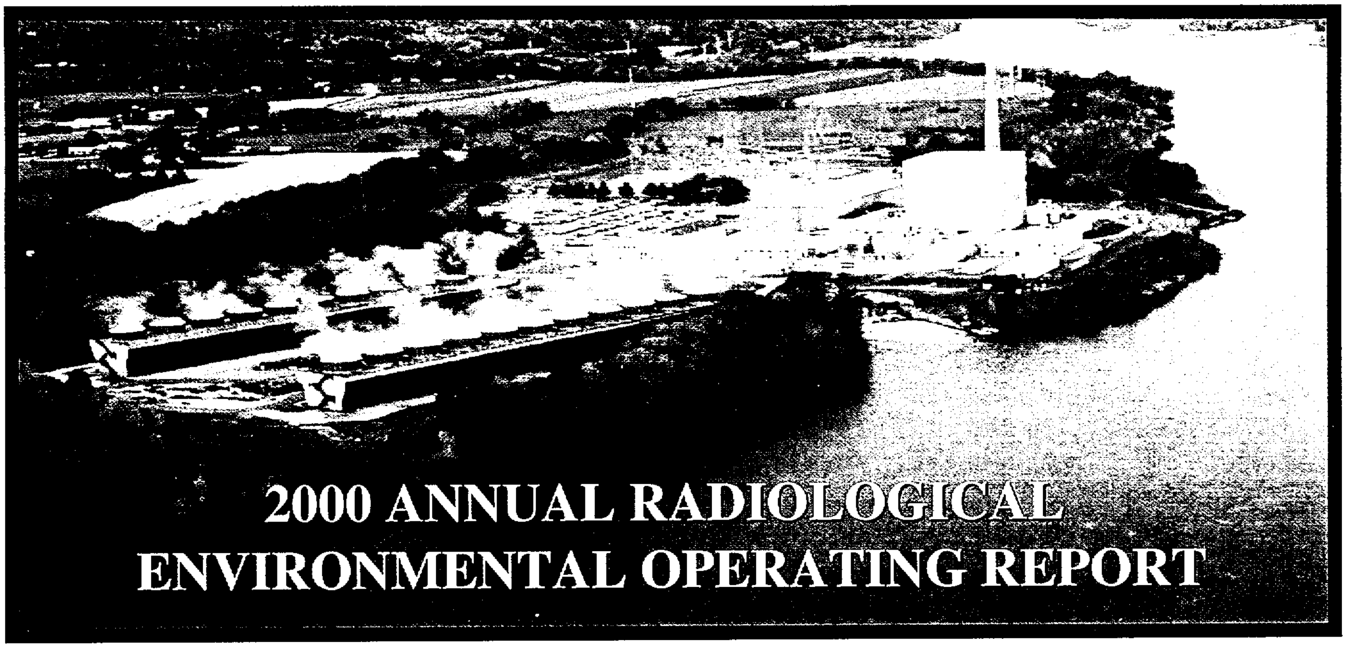
SUMMARY OF VERMONT YANKEE COMMITMENTS

BVY NO.: 01-43

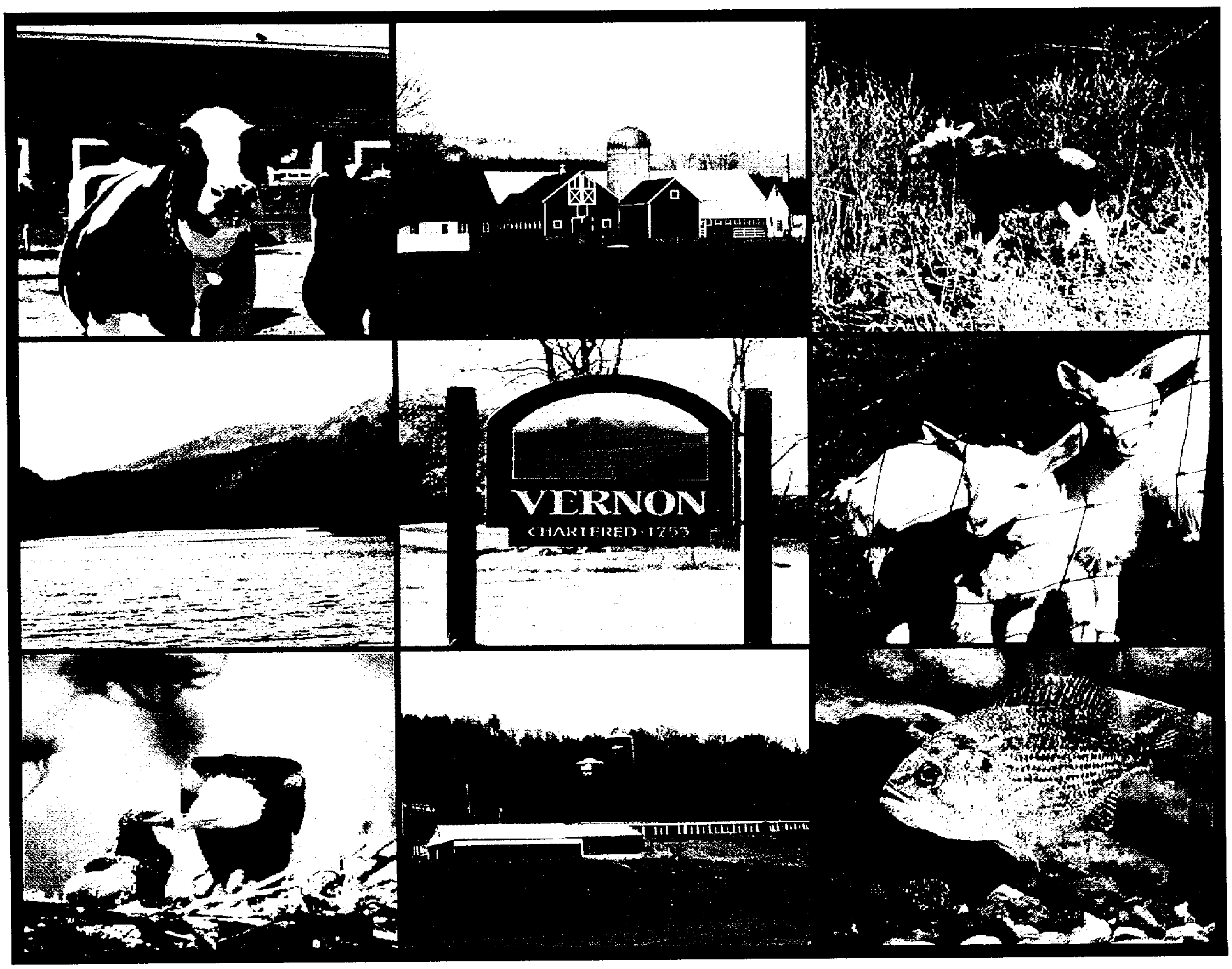
The following table identifies commitments made in this document by Vermont Yankee. Any other actions discussed in the submittal represent intended or planned actions by Vermont Yankee. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the Licensing Manager of any questions regarding this document or any associated commitments.

COMMITMENT	COMMITTED DATE OR "OUTAGE"
None	N/A

VERMONT YANKEE NUCLEAR POWER STATION



2000 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT



VERMONT YANKEE NUCLEAR POWER STATION

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

January - December 2000

May 2001

Prepared by:
Vermont Yankee Nuclear Power Corporation
Chemistry Department

Acknowledgment

Special thanks to the United States Fish and Wildlife Service (USFWS) for the use of their photographs of the Rock Bass and Bald Eagles used on the cover.

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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 2000. 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 2000 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 2000 environmental TLD measurements.

Section 6: Provides the results of the 2000 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 the Duke Engineering & Services Laboratory and Teledyne Brown Engineering Laboratory. Included are the laboratories' results of the Analytics Intercomparison Program.

Section 8: Summarizes the requirements and the results of the 2000 Land Use Census.

Section 9: Gives a summary of the 2000 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 land 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.

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 sediment samples. In 2000, analytical measurements of environmental samples were performed at the Duke Engineering & Services Environmental Laboratory (DESEL) and Teledyne Brown Engineering Laboratory (TBE). TLD badges are posted and retrieved by the Vermont Yankee Chemistry Department, and are analyzed by the DESEL.

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 are collected biweekly, and to allow for the decay of radon daughter products, the analysis for gross beta radioactivity is delayed for more than 24 hours. The biweekly filters are 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 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 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 biweekly 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, and the pump delivering river water to the sampler is maintained by Normandeau Associates. 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 performed on each sample. The monthly composite and grab samples are composited by location by the contracted environmental laboratory for a quarterly 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-screened container. This container 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 processes them.

4.3.11 Special Monitoring

Special interest samples may be taken throughout the year that are not required as part of the REMP. These locations may not appear on the ODCM Table 7.1, nor do all appear in Table 4.1 or 4.2 of this report. The results are discussed in Section 5 and 6 of this report.

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	Semimonthly	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 Upstream: grab	Monthly	Gamma Isotopic Tritium (H-3)	Each Sample Quarterly Composite
b. Ground water	2	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 I-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 2000
VERMONT YANKEE NUCLEAR POWER STATION

Exposure Pathway	Station Code	Station Description	Zone[a]	Distance From Plant Stack (km)	Direction From Plant
1. 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 2000
VERMONT YANKEE NUCLEAR POWER STATION

Exposure Pathway	Station Code	Station Description	Zone[(a)]	Direction From Plant Stack(km)	Distance From Plant Stack
3. Ingestion					
a. Milk	TM-11	Miller Farm	I	0.8	W
	TM-14	Brown Farm	I	2.2	S
	TM-16	Meadow Crest Farm	I	4.3	NW
	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-16	Meadow Crest Farm	I	4.3	NW
	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 2000
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 2000
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/m3)	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					
1-131		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/m3)	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					
1-131		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 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.

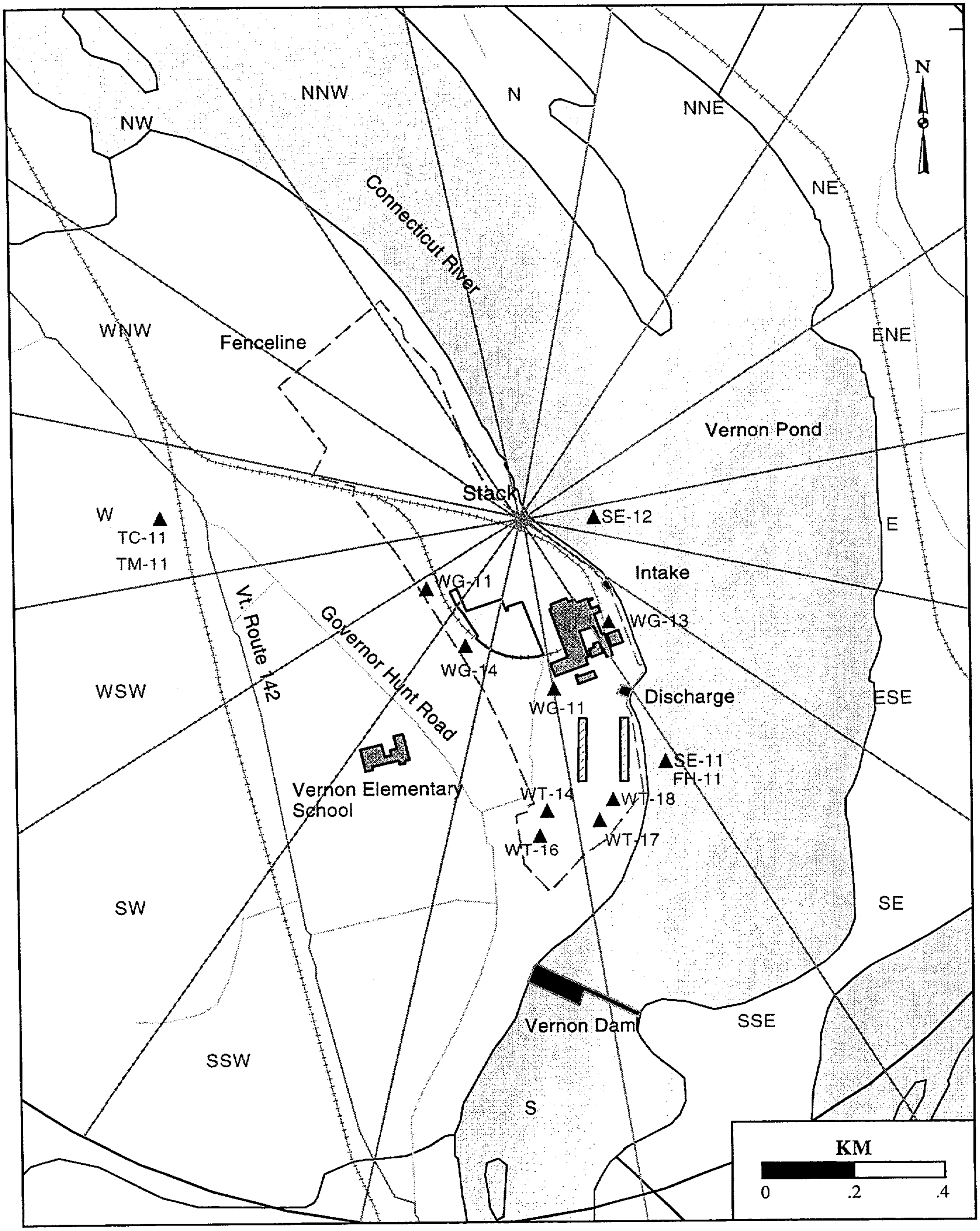


Figure 4-1 Environmental Sampling Locations in Close Proximity to the Plant

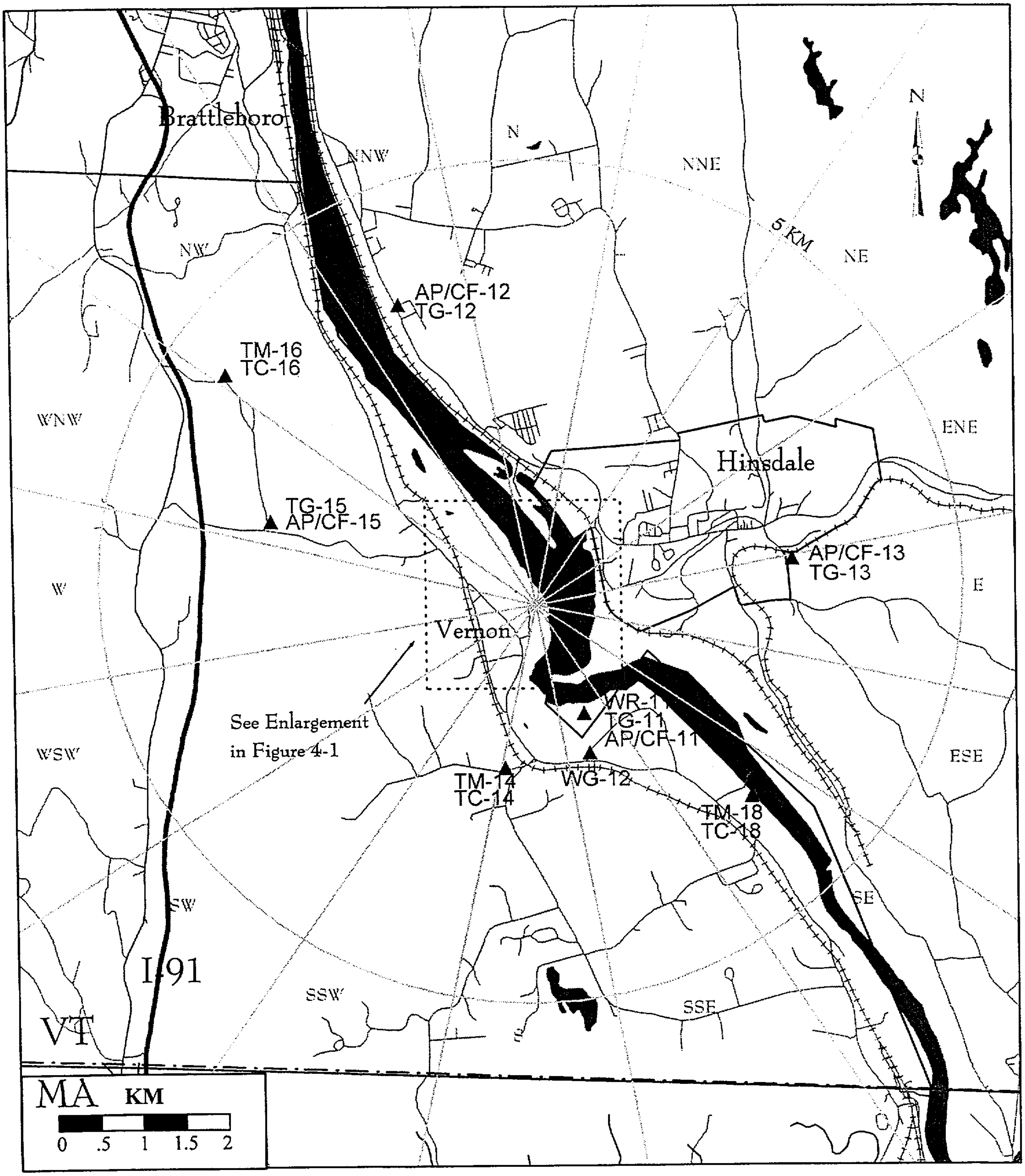


Figure 4-2 Environmental Sampling Locations

Within 5 Km of Plant

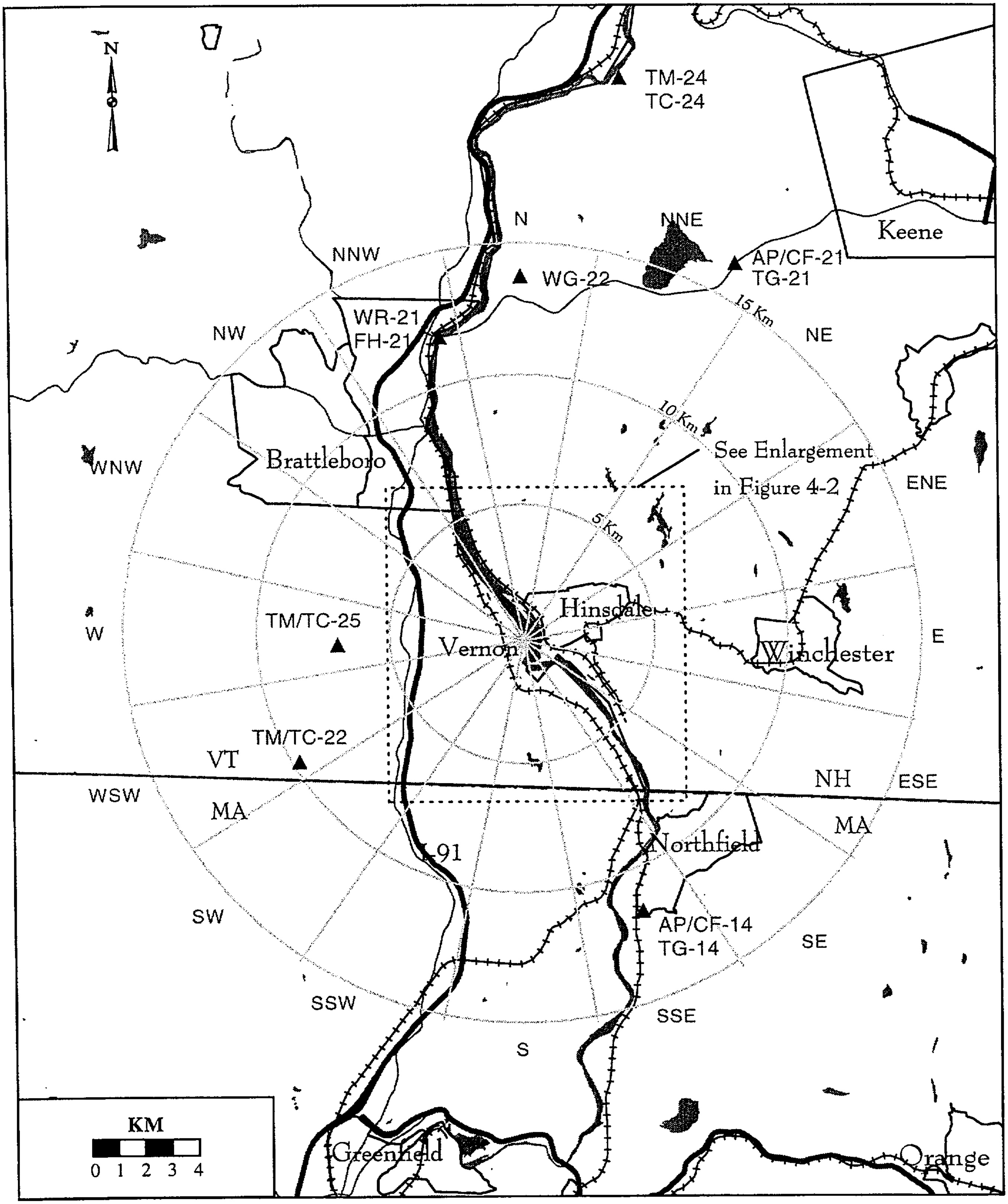


Figure 4-3 Environmental Sampling Locations

Greater than 5 Km from Plant

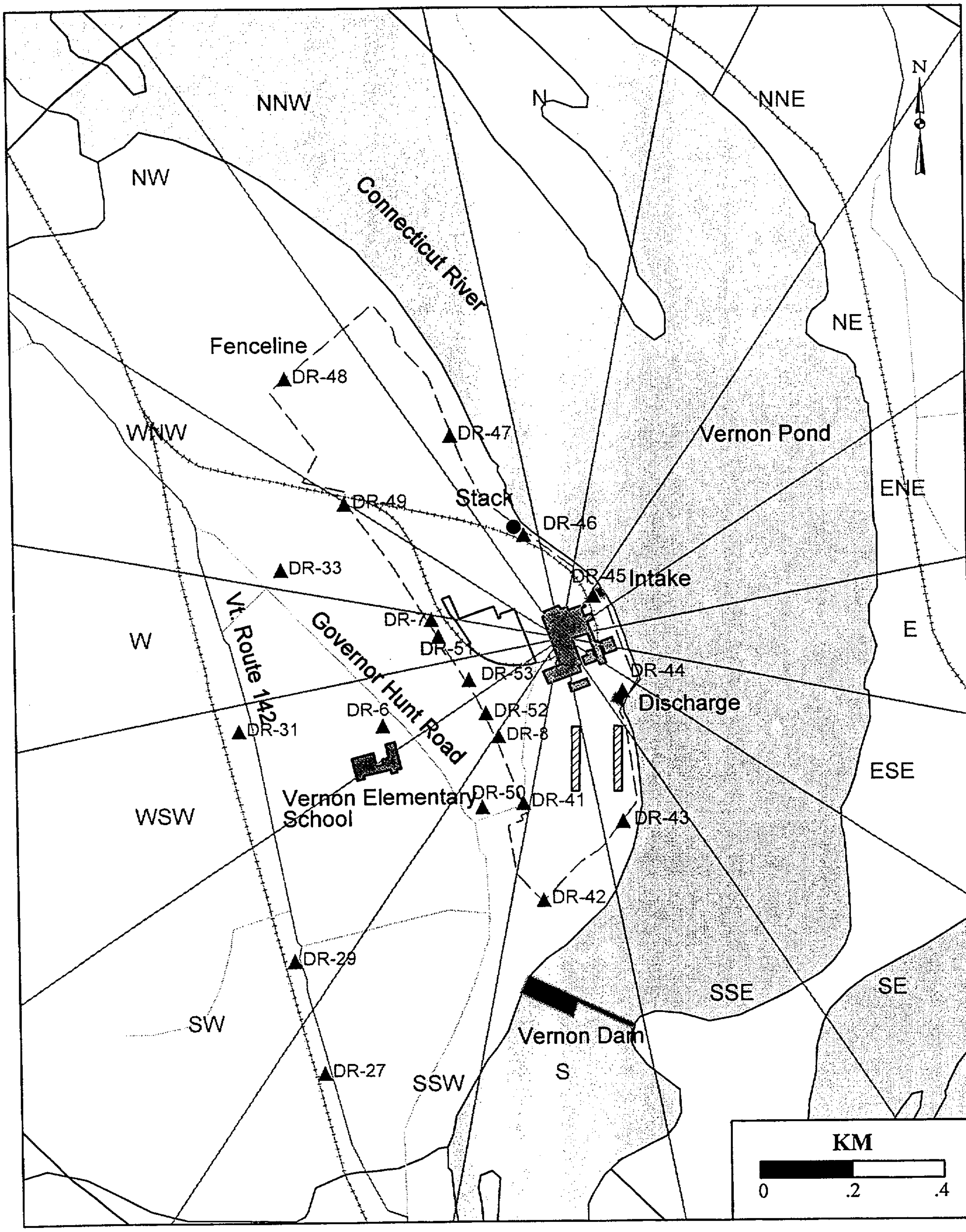


Figure 4-4 TLD Locations in Close Proximity to Plant

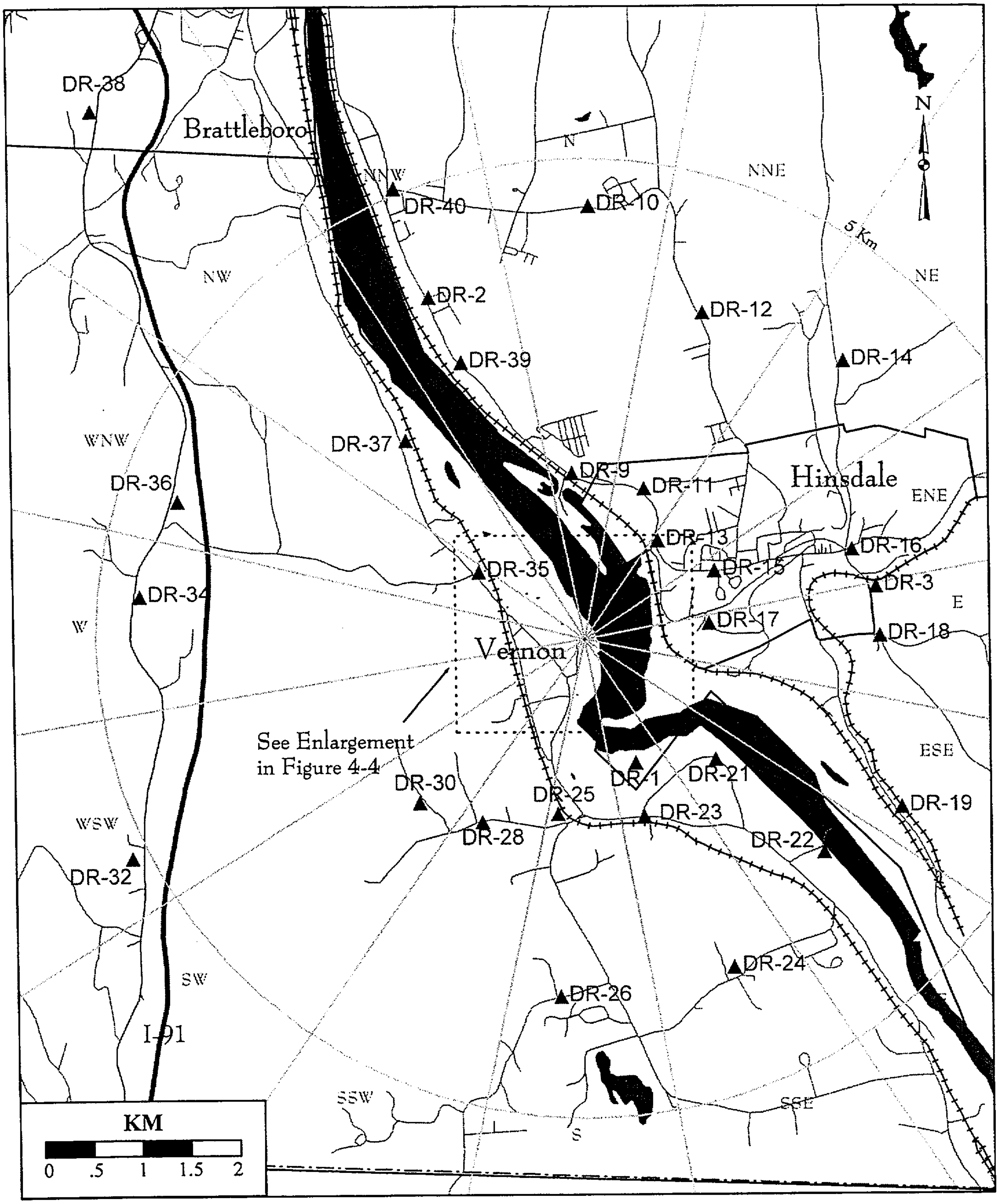


Figure 4-5 TLD Locations Within 5 Km of Plant

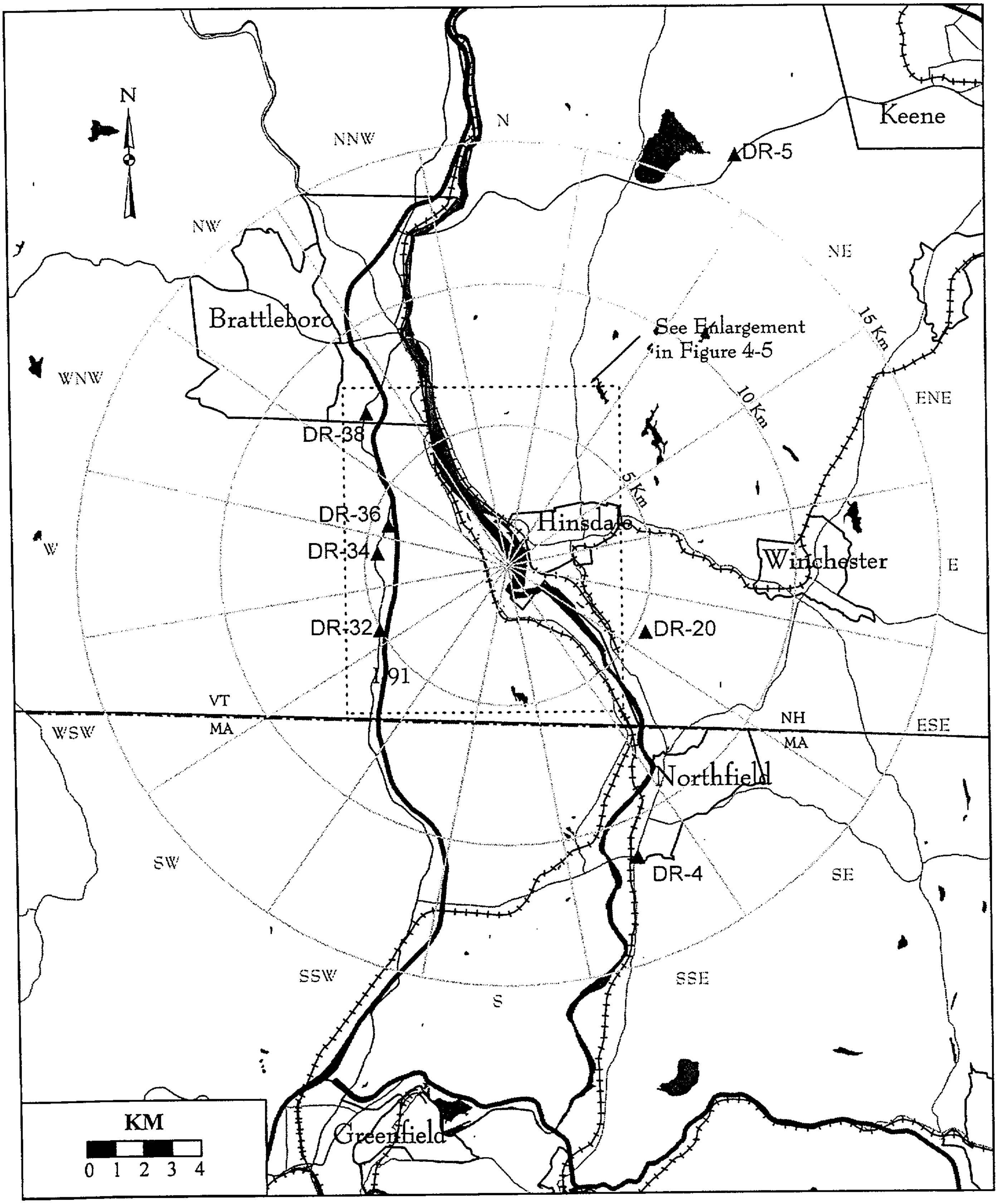


Figure 4-6 TLD Locations Greater Than 5 Km from Plant

5. RADIOLOGICAL DATA SUMMARY TABLES

This section summarizes the analytical results of the environmental samples that were collected during 2000. 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 2000, Vermont Yankee contracted with two laboratories for the analyses of the environmental samples. The first laboratory was used during the 1st and 4th quarters. The second laboratory was used during the 2nd and 3rd quarters of 2000. A portion of the analyses from the second laboratory is not included in Table 5.1. This portion of the data was excluded because it is not consistent with the historical environmental data, reactor vessel radionuclide inventory, or effluent data. See Section 5.1 for a detailed discussion of this suspect data. The following discussion of the data included in Table 5.1 does not include this questionable data.

The left-most column of Table 5.1 contains the radionuclide of interest, the total number of analyses for that radionuclide in 2000, 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 is not met. This may be due to malfunctions in sampling equipment, which results in low sample volume or delays in analysis at the laboratory. Such cases are 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 2000 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 and is reported as a concentration plus or minus a one standard deviation uncertainty. The standard deviation on each measurement represents only the random uncertainty associated with the radioactive decay process (counting statistics), and not the propagation of all possible uncertainties in the analytical procedure.

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 and greater than or equal to the *a posteriori* LLD.

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-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, Zn-65 and Zr-95.

Data from direct radiation measurements made by TLDs are provided in Table 5.2 in a format essentially the same as above. The complete listing of quarterly TLD data is provided in Table 5.3.

5.1 DISCUSSION OF QUESTIONABLE DATA

During 2000, Vermont Yankee switched vendor laboratories in the 2nd quarter. In September, several Vermont Yankee personnel visited the new vendor laboratory to observe the laboratory's activities. As a result of the visit, Vermont Yankee decided that it was necessary to cease sample shipments to this laboratory and resume analyses at the first laboratory. The questionable data obtained from the second laboratory used for the 2nd and 3rd quarters of 2000 is confined to gamma analyses. Most of the questionable data was generated at this laboratory during the 3rd quarter. None of the questionable data was obtained from the first laboratory. Once the questionable data was identified, the entire gamma analysis for each questionable result was eliminated from the data used to produce the Summary Table 5.1.

Vermont Yankee Nuclear Power Station has never had to doubt the results of environmental sample analyses in previous years. Some results for 2000 were separated from the bulk of the data because of apparent analytical problems. In order to justify eliminating sample results from the Summary Table 5.1, several types of supporting information were considered and are summarized here.

- Vermont Yankee had no liquid releases during 2000.
- Some isotopes identified in VY's reactor vessel coolant in 2000, but not in REMP samples, include Mo-99, Nb-95, Co-60, Zn-65, Ce-141, Mn-54, and Cr-51.
- Some isotopes not identified in the reactor vessel coolant in 2000, but were identified in REMP samples, include Co-57, Zr-95, Ag-100m, Eu-154, and Se-75.
- Isotopes in particulate form identified in plant stack effluents include only Sr-89, Cr-51, Ce-141, and Zn-65.
- Isotopes in particulate form identified in ground releases from the burning of used oil include only Cs-137, Mn-54, Co-60, and Zn-65. This effluent occurred only during the first quarter of 2000.
- The presence of identified isotopes in ground water samples (potable water sources from drilled wells) is extremely doubtful based on the time it takes for radionuclides to travel through soils.
- Vermont Yankee has accumulated decades of data from environmental samples. The data eliminated as questionable includes isotopes that have not been identified in the specific sample media at least since 1990. Verification previous to 1990 was not done.
- Some of the questionable data was obtained from the control locations. These locations are chosen to be beyond the influence of VY operations.
- During the 2nd and 3rd quarters, duplicates of some samples sent to the second lab that were returned with questionable results were also sent to first lab. This first laboratory did not see any of the suspect activity that the second laboratory reported.
- There appeared to be extensive delays in counting samples at the second laboratory such that LLDs were not met and isotopic results were decayed back from essentially background activity, which resulted in absurdly large decay-corrected activities.

One dubious result is the positive identification of Co-60 at Tyler Hill in the 2nd quarter composite of the particulate filters from this location. In order for Co-60 to be present on the filter at the concentration determined from the second laboratory, the annual average concentration of Co-60 in the stack effluent would have to be approximately 1.88E-11 uCi/cc. During all of 2000, we did not detect Co-60 in the stack effluent. The typical Minimum Detectable Concentration (MDC) of Co-60 in the stack effluent for each weekly sample analysis is approximately 1.2E-13 uCi/cc, less than 1/100th of the concentration required to produce the Co-60 on the Tyler Hill filter. Vermont Yankee's laboratory can easily detect the putative Co-60 concentration. Therefore, it is extremely doubtful that the second lab's results are valid for this sample.

The milk sample results are questionable on various grounds as already mentioned above. The same type of calculation as for the Tyler Hill particulate filter demonstrates again that these results are problematic. In order for TM 14 to contain Nb-95 and Zr-95, the stack effluent concentration throughout the year would be approximately 1.26E-09 uCi/cc and 1.05E-06 uCi/cc respectively. The typical MDC on the weekly samples for these two isotopes are both less than 2 E-13 uCi/cc and neither were seen. An even higher stack concentration would be required for the Zr-95 reported at TM 11.

The groundwater results are equally problematic. Information obtained from an evaluation of the rate of transport of radionuclides through soil at the Vermont Yankee site stated that the travel distance for Cesium in 27 years is only 1.6 feet, less than 1 inch in a year. Similarly, the travel distance for Cobalt in 27 years is only 0.4 feet, less than 0.2 inches in a year. Even though Mo-99 probably travels faster than these isotopes, it does not travel faster than water, which is estimated to travel about 15 feet in a year at the Vermont Yankee site. Since Mo-99 has a half-life of 66 hours, it is impossible for it to travel to the water table quickly enough to still be present in a concentration that would be identifiable. NUREG/CR-3130, "Influence of Leach Rate and Other Parameters on Groundwater Migration," was the source for this information on relative leach rates. Groundwater samples collected in the 1st and the 4th quarters had no questionable results.

Vermont Yankee Nuclear Power Station does not release radioactive liquid effluents to the Connecticut River. The plant storm drain system is known to have small levels of contamination that have contributed to the identification of Co-60 and Cs-137 in river sediment samples at the North Storm Drain Outfall. See section 6.5.2.6 and Table 6.1 of this report for information on the plant storm drain system. The identification of Nb-95, with a half-life of 87 hours, in river sediment samples is inexplicable due to no liquid releases and the lack of identification of this nuclide previously in river sediment or storm drain samples. The second set of samples collected after these samples with the questionable data was analyzed at the other laboratory with no identification of Nb-95, Co-57, or Eu-154. The only possible plant-related activity that has been identified in these sediments over the years is Cs-137 and Co-60. We have never before seen plant-related activity in the river water samples. Fish samples have previously had only very low levels of Cs-137 identified.

On-site samples were also subject to similar questionable results. Vermont Yankee has monitored the storm drain system of the plant for many years in order to verify that the contamination levels in the storm drain system stay within bounds that do not contribute significant dose. See section 6.5.2.6 of this report.

Samples of sediment are generally collected every month from two or more manholes for gamma analysis. Water from two manholes is collected monthly for gamma analysis. Samples analyzed at the first laboratory had no questionable results. Several samples analyzed at the second laboratory had questionable results. The questionable isotopes identified include those that have never been seen in these samples before.

For all of the sample types with dubious results, it should be kept in mind that the first laboratory performed analyses on samples collected in the 1^{st} and 4^{th} quarters of the year with no suspect results reported. All questionable data is from the second laboratory. The following table summarizes the samples that were deleted from the environmental samples summary table (Table 5.1) for 2000. In all cases, these sample analyses identified isotopes that have never been seen in these sample types in the past decade.

Questionable Data Eliminated from Table 5.1 Summary

Media	Station	Week	Year	Test	Activity	1 Std Dev	MDC	
TM	11	31	2000	CO-57	1.66E+01	1.46E+00	4.35E+00	*
		31	2000	EU-154	3.08E+01	3.11E+00	9.07E+00	*
		31	2000	ZR-95	1.83E+01	4.01E+00	9.62E+00	*
TM	14	25	2000	NB-95	3.50E+00	1.00E+00	3.00E+00	
		25	2000	NP-239	4.40E+03	9.00E+02	3.00E+03	*
		25	2000	ZR-95	6.50E+00	2.00E+00	7.00E+00	*
TM	16	33	2000	MO-99	2.90E+01	7.50E+00	3.00E+01	
TM	16	38	2000	CR-51	3.96E+03	1.30E+03	3.75E+03	
TM	22	29	2000	MO-99	1.30E+01	4.00E+00	1.00E+01	Duplicate at 1st lab - ND
TM	22	31	2000	CO-60	4.87E+00	1.24E+00	4.16E+00	Duplicate at 1st lab - ND
TM	24	33	2000	CO-60	3.30E+00	1.05E+00	4.00E+00	Control location
		33	2000	MO-99	6.30E+01	1.70E+01	6.00E+01	Control location
TM	26	27	2000	MO-99	1.40E+02	3.55E+01	1.00E+02	
AP	15	2nd Qtr	2000	CO-60	9.80E-04	1.95E-04	8.00E-04	
WG	11	32	2000	CS-137	3.21E+00	9.30E-01	3.05E+00	Duplicate at both labs - N
			2000	MO-99	1.94E+04	4.51E+03	5.72E+03	Duplicate at both labs - N
WG	12	32	2000	CS-137	6.42E+00	1.13E+00	3.81E+00	
			2000	CO-60	5.86E+00	1.03E+00	3.27E+00	
WG	14	32	2000	CS-137	1.73E+01	1.87E+00	6.45E+00	
			2000	EU-154	1.59E+01	2.43E+00	8.03E+00	*
			2000	AG-110M	1.02E+01	1.84E+00	5.98E+00	*
			2000	CO-57	8.87E+00	1.17E+00	3.93E+00	*
			2000	CO-60	3.01E+01	2.28E+00	7.96E+00	
			2000	SE-75	3.86E+01	6.45E+00	6.31E+00	*
WG	22	32	2000	CS-137	7.79E+00	1.39E+00	4.71E+00	Control location
SE	14	17	2000	CO-57	8.57E+01	1.97E+01	5.62E+01	*
			2000	EU-154	1.53E+02	3.50E+01	9.99E+01	*
SE	18	17	2000	CO-57	9.11E+01	2.05E+01	5.89E+01	*
			2000	EU-154	2.07E+02	3.66E+01	1.07E+02	*
SE	24	17	2000	NB-95	1.18E+02	3.42E+01	1.17E+02	
SE	25	17	2000	CO-57	1.02E+02	1.86E+01	5.46E+01	*
			2000	EU-154	1.67E+02	3.38E+01	9.79E+01	*
			2000	NB-95	1.58E+02	4.35E+01	1.42E+02	
SE	35	17	2000	CO-57	8.88E+01	1.74E+01	5.07E+01	*
SE	39	17	2000	NB-95	1.85E+02	5.55E+01	1.86E+02	
SE	44	17	2000	CO-57	8.38E+01	1.74E+01	5.05E+01	*
			2000	EU-154	1.52E+02	3.13E+01	9.05E+01	*
SE	49	17	2000	NB-95	1.73E+02	5.10E+01	1.71E+02	
SE	50	17	2000	CE-141	5.33E+02	1.54E+02	4.86E+02	
WR	11	33	2000	CS-134	1.16E+01	2.57E+00	7.71E+00	
			2000	ZN-65	3.34E+01	8.05E+00	2.55E+01	
WR	21	29	2000	CO-57	1.55E+01	1.64E+00	4.86E+00	*Control location
			2000	EU-154	2.92E+01	3.30E+00	9.68E+00	*Control location
WR	21	33	2000	CS-134	1.81E+01	2.90E+00	8.93E+00	Control location
FH	11	19	2000	CO-57	4.10E+01	4.50E+00	2.00E+01	*
			2000	CO-60	3.60E+02	1.50E+01	6.00E+01	
			2000	NP-239	8.90E+07	3.00E+06	1.00E+07	*
			2000	ZR-95	4.90E+01	1.50E+01	5.00E+01	*
WT	14	14	2000	MO-99	1.30E+02	3.10E+01	1.00E+02	
WW	10	23	2000	ZR-95	7.20E+00	2.10E+00	7.00E+00	* Storm drain water
				CS-137	2.60E+00	8.5E-01	3.00E+00	
				MO-99	9.40E+02	2.60E+02	9.00E+02	
				NB-95	3.10E+00	9.50E-01	3.00E+00	
WW	10	31	2000	MO-99	2.40E+02	6.50E+01	2.00E+02	Storm drain water
WW	12	15	2000	MO-99	3.70E+04	6.50E+03	2.00E+04	Storm drain water

ND means not detected

*** Not detected in reactor coolant in 2000**

Questionable Data Eliminated from Table 5.1 Summary-continued

Media	Station	Week	Year	Test	Activity	1 Std Dev	MDC	
WW	12	36	2000	MO-99	7.80E+00	2.30E+00	8.00E+00	Storm drain water
SE	95	18	2000	NB-95	9.10E+01	2.70E+01	9.00E+01	Storm drain sediment
SE	95	27	2000	CE-141	1.63E+03	3.57E+02	2.02E+03	Storm drain sediment
				ZR-95	6.94E+01	6.55E+00	3.07E+01	*
SE	98	31	2000	NB-95	3.60E+01	9.00E+00	3.00E+01	Storm drain sediment
			2000	ZR-95	1.00E+02	2.00E+01	7.00E+01	*
SE	99	15	2000	NB-95	3.50E+01	5.50E+00	2.00E+01	Storm drain sediment
				ZR-95	1.40E+02	1.00E+01	4.00E+01	*

*** Not detected in reactor coolant in 2000** **ND means not detected**

In all cases, these isotopes in the above table have not been detected in prior years in these sample media.

Radiological Environmental Program Summary

2000 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 2000)

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

AP

*Radionuclides**		*Required LLD*	*Indicator Stations*	*Station with Highest Mean*	*Control Station*
Be-7		None Required			
Number of Analyses 27				*Station*	
*Non-Routine*** 0				13	
Range	*Mean*		9.550E-02	1.226E-01	6.512E-02
	Maximum		2.070E-01	1.990E-01	1.470E-01
	Minimum		-6.055E-02	6.392E-02	-2.150E-02
	*Number Detected****		9	2	3
	Total Analyzed		23	4	4
Co-60		None Required			
Number of Analyses 27				*Station*	
*Non-Routine*** 0				40	
Range	*Mean*		-1.367E-04	1.497E-05	1.727E-04
	Maximum		4.816E-04	1.272E-04	5.210E-04
	Minimum		-1.034E-03	-9.382E-05	-2.843E-05
	*Number Detected****		0	0	0
	Total Analyzed		23	4	4
Cs-134		0.05			
Number of Analyses 27				*Station*	
*Non-Routine*** 0				15	
Range	*Mean*		-4.909E-05	3.420E-04	5.163E-04
	Maximum		8.338E-04	8.338E-04	2.036E-03
	Minimum		-1.090E-03	-6.589E-05	-8.522E-05
	*Number Detected****		0	0	0
	Total Analyzed		23	3	4
Cs-137		0.06			
Number of Analyses 27				*Station*	
*Non-Routine*** 0				14	
Range	*Mean*		-6.765E-05	1.591E-04	2.655E-04
	Maximum		1.030E-03	6.156E-04	7.427E-04
	Minimum		-1.343E-03	-1.356E-04	-3.406E-04
	*Number Detected****		0	0	0
	Total Analyzed		23	4	4
GR-B		0.01			
Number of Analyses 181				*Station*	
*Non-Routine*** 0				11	
Range	*Mean*		1.675E-02	1.741E-02	1.614E-02
	Maximum		3.360E-02	3.143E-02	2.836E-02
	Minimum		6.595E-03	8.400E-03	8.500E-03
	*Number Detected****		149	25	25
	Total Analyzed		149	25	25

AP

*Radionuclides**		*Required LLD*	*Indicator Stations*	*Station with Highest Mean*	*Control Station*
Ra-226		None Required			
Number of Analyses 27				*Station*	
*Non-Routine*** 0				15	
	Mean		1.380E-03	1.011E-02	4.111E-03
Range	*Maximum*		2.771E-02	1.170E-02	6.643E-03
	Minimum		-1.222E-02	7.149E-03	-3.400E-03
	*Number Detected****		1	0	0
	Total Analyzed		23	3	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 Levels 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 2000)

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

CF

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
I-131		.07			
Number of Analyses 181				Station	
Non-Routine** 0				14	
	Mean		-5.542E-03	2.568E-03	-4.366E-04
Range	Maximum		3.000E-02	3.000E-02	1.500E-02
	Minimum		-5.000E-01	-1.200E-02	-1.414E-02
	Number Detected***		0	0	0
	Total Analyzed		155	26	26

*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 Levels 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.

WR

Table 5.1

Radiological Environmental Program Summary

Vermont Yankee Nuclear Power Plant, Vernon, VT

(January - December 2000)

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

WR

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
Ba-La-140		15			
Number of Analyses 21				Station	
Non-Routine** 0				11	
Range	Mean		1.773E+04	1.773E+04	2.660E+04
	Maximum		1.950E+05	1.950E+05	2.660E+05
	Minimum		-1.800E+01	-1.800E+01	-1.418E+00
	Number Detected***		0	0	0
	Total Analyzed		11	11	10
Co-58		15			
Number of Analyses 21				Station	
Non-Routine** 0				21	
Range	Mean		-1.012E+00	-3.004E-01	-3.004E-01
	Maximum		1.652E+00	6.002E-01	6.002E-01
	Minimum		-6.910E+00	-1.400E+00	-1.400E+00
	Number Detected***		0	0	0
	Total Analyzed		11	10	10
Co-60		15			
Number of Analyses 21				Station	
Non-Routine** 0				11	
Range	Mean		3.920E-01	3.920E-01	1.768E-01
	Maximum		2.970E+00	2.970E+00	2.003E+00
	Minimum		-1.503E+00	-1.503E+00	-2.100E+00
	Number Detected***		0	0	0
	Total Analyzed		11	11	10
Cs-134		15			
Number of Analyses 21				Station	
Non-Routine** 0				21	
Range	Mean		-3.465E-01	-6.826E-01	-6.826E-01
	Maximum		8.400E-01	1.009E+00	1.009E+00
	Minimum		-2.610E+00	-4.830E+00	-4.830E+00
	Number Detected***		0	0	0
	Total Analyzed		11	10	10
Cs-137		18			
Number of Analyses 21				Station	
Non-Routine** 0				11	
Range	Mean		7.575E-01	7.575E-01	-4.531E-01
	Maximum		9.940E+00	9.940E+00	9.990E-01
	Minimum		-1.659E+00	-1.659E+00	-2.400E+00
	Number Detected***		1	1	0
	Total Analyzed		11	11	10

WR

Radionuclides*	Required LLD	Indicator Stations	Station with Highest Mean	Control Station
Fe-59	30			
Number of Analyses 21			Station	
Non-Routine** 0			11	
Range: Mean		4.922E+00	4.922E+00	8.695E-01
Range: Maximum		4.870E+01	4.870E+01	5.683E+00
Range: Minimum		-4.979E+00	-4.979E+00	-2.711E+00
Number Detected***		0	0	0
Total Analyzed		11	11	10
GR-B	4			
Number of Analyses 24			Station	
Non-Routine** 0			11	
Range: Mean		1.959E+00	1.959E+00	1.963E+00
Range: Maximum		3.600E+00	3.600E+00	5.120E+00
Range: Minimum		3.020E-01	3.020E-01	1.656E-01
Number Detected***		8	8	9
Total Analyzed		12	12	12
H-3	3000			
Number of Analyses 8			Station	
Non-Routine** 0			21	
Range: Mean		-6.477E+01	-1.293E+01	-1.293E+01
Range: Maximum		2.130E+02	3.181E+01	3.181E+01
Range: Minimum		-3.293E+02	-8.350E+01	-8.350E+01
Number Detected***		0	0	0
Total Analyzed		4	4	4
I-131	None Required			
Number of Analyses 21			Station	
Non-Routine** 0			21	
Range: Mean		-1.009E+07	-1.600E+07	-1.600E+07
Range: Maximum		7.700E+01	4.600E+01	4.600E+01
Range: Minimum		-1.110E+08	-1.600E+08	-1.600E+08
Number Detected***		0	0	0
Total Analyzed		11	10	10
K-40	None Required			
Number of Analyses 21			Station	
Non-Routine** 0			11	
Range: Mean		5.579E+01	5.579E+01	9.264E+00
Range: Maximum		4.440E+02	4.440E+02	5.690E+01
Range: Minimum		-1.731E+01	-1.731E+01	-2.300E+01
Number Detected***		2	2	0
Total Analyzed		11	11	10
Mn-54	15			
Number of Analyses 21			Station	
Non-Routine** 0			21	
Range: Mean		-3.292E-01	1.404E-01	1.404E-01
Range: Maximum		1.040E+00	1.320E+00	1.320E+00
Range: Minimum		-2.460E+00	-1.125E+00	-1.125E+00
Number Detected***		0	0	0
Total Analyzed		11	10	10

WR

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
TH-228		None Required			
Number of Analyses	21			Station	
Non-Routine**	0			11	
Range	Mean		4.114E+00	4.114E+00	9.606E-01
	Maximum		2.100E+01	2.100E+01	8.078E+00
	Minimum		-4.213E+00	-4.213E+00	-2.764E+00
	Number Detected***		2	2	0
	Total Analyzed		11	11	10
TH-232		None Required			
Number of Analyses	9			Station	
Non-Routine**	0			11	
Range	Mean		4.136E+00	4.136E+00	5.750E-02
	Maximum		2.990E+01	2.990E+01	3.930E+00
	Minimum		-6.000E+00	-6.000E+00	-2.000E+00
	Number Detected***		1	1	0
	Total Analyzed		5	5	4
Zn-65		30			
Number of Analyses	21			Station	
Non-Routine**	0			21	
Range	Mean		-2.213E+00	-2.651E+00	-2.651E+00
	Maximum		2.877E+00	6.760E-01	6.760E-01
	Minimum		-9.910E+00	-9.580E+00	-9.580E+00
	Number Detected***		0	0	0
	Total Analyzed		11	10	10
Zr-95		15			
Number of Analyses	21			Station	
Non-Routine**	0			21	
Range	Mean		2.065E-02	3.267E+00	3.267E+00
	Maximum		1.040E+01	3.010E+01	3.010E+01
	Minimum		-3.750E+00	-4.609E+00	-4.609E+00
	Number Detected***		0	0	0
	Total Analyzed		11	10	10

**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 Levels 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.*

Table 5.1

Radiological Environmental Program Summary

Vermont Yankee Nuclear Power Plant, Vernon, VT

(January - December 2000)

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

WG

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
Ba-La-140		15			
Number of Analyses 17				Station	
Non-Routine** 0				13	
Range	Mean		5.103E+00	2.361E+01	2.336E+00
	Maximum		8.360E+01	8.360E+01	4.832E+00
	Minimum		-1.400E+01	1.056E+00	9.000E-01
	Number Detected***		0	0	0
	Total Analyzed		14	4	3
Co-58		15			
Number of Analyses 17				Station	
Non-Routine** 0				13	
Range	Mean		-7.510E-01	-2.108E-01	-1.288E+00
	Maximum		7.000E-01	5.000E-01	1.600E-01
	Minimum		-4.187E+00	-7.588E-01	-3.601E+00
	Number Detected***		0	0	0
	Total Analyzed		14	4	3
Co-60		15			
Number of Analyses 17				Station	
Non-Routine** 0				13	
Range	Mean		1.872E-01	5.458E-01	-1.373E+00
	Maximum		1.620E+00	1.620E+00	2.700E-02
	Minimum		-2.711E+00	1.330E-01	-2.811E+00
	Number Detected***		0	0	0
	Total Analyzed		14	4	3
Cs-134		15			
Number of Analyses 17				Station	
Non-Routine** 0				13	
Range	Mean		6.119E-01	2.779E+00	-7.988E-01
	Maximum		1.180E+01	1.180E+01	4.266E-01
	Minimum		-2.810E+00	-1.852E+00	-2.915E+00
	Number Detected***		0	0	0
	Total Analyzed		14	4	3
Cs-137		18			
Number of Analyses 17				Station	
Non-Routine** 0				13	
Range	Mean		2.347E-01	7.472E-01	-6.123E-01
	Maximum		2.826E+00	1.926E+00	3.300E-01
	Minimum		-3.003E+00	-5.633E-01	-1.909E+00
	Number Detected***		0	0	0
	Total Analyzed		14	4	3

WG

Radionuclides*	Required LLD	Indicator Stations	Station with Highest Mean	Control Station
GR-B	4			
Number of Analyses 22			Station	
Non-Routine** 0			11	
Range — Mean		5.210E+00	6.708E+00	1.499E+00
Range — Maximum		1.074E+01	1.074E+01	1.703E+00
Range — Minimum		1.821E+00	4.200E+00	1.295E+00
Number Detected***		17	6	3
Total Analyzed		18	6	4
H-3	3000			
Number of Analyses 22			Station	
Non-Routine** 0			12	
Range — Mean		-1.914E+02	-3.033E+01	-1.199E+02
Range — Maximum		3.479E+02	2.256E+02	9.500E+01
Range — Minimum		-7.993E+02	-4.179E+02	-3.196E+02
Number Detected***		0	0	0
Total Analyzed		18	4	4
I-131	None Required			
Number of Analyses 17			Station	
Non-Routine** 0			13	
Range — Mean		-1.190E+00	3.284E+00	-3.524E+00
Range — Maximum		8.800E+00	8.800E+00	2.550E+00
Range — Minimum		-2.100E+01	-1.252E+00	-1.200E+01
Number Detected***		0	0	0
Total Analyzed		14	4	3
K-40	None Required			
Number of Analyses 17			Station	
Non-Routine** 0			12	
Range — Mean		-1.474E+00	5.435E+00	-8.247E+00
Range — Maximum		8.850E+01	2.103E+01	1.403E+01
Range — Minimum		-4.200E+01	-4.900E+00	-2.377E+01
Number Detected***		1	0	0
Total Analyzed		14	3	3
Mn-54	15			
Number of Analyses 17			Station	
Non-Routine** 0			22	
Range — Mean		-2.931E-01	6.137E-01	6.137E-01
Range — Maximum		2.586E+00	9.400E-01	9.400E-01
Range — Minimum		-2.047E+00	0.000E+00	0.000E+00
Number Detected***		0	0	0
Total Analyzed		14	3	3
TH-228	None Required			
Number of Analyses 17			Station	
Non-Routine** 0			13	
Range — Mean		2.583E+00	5.594E+00	-4.033E-01
Range — Maximum		1.803E+01	1.420E+01	3.443E+00
Range — Minimum		-7.438E+00	-3.116E+00	-3.253E+00
Number Detected***		1	1	0
Total Analyzed		14	4	3

WG

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
TH-232		None Required			
Number of Analyses 6				Station	
Non-Routine** 0				13	
Range	Mean		3.860E+00	1.275E+01	-4.700E+00
	Maximum		2.890E+01	2.890E+01	-4.700E+00
	Minimum		-4.000E+00	-3.400E+00	-4.700E+00
	Number Detected***		1	1	0
	Total Analyzed		5	2	1
Zn-65		30			
Number of Analyses 17				Station	
Non-Routine** 0				11	
Range	Mean		4.821E-01	3.822E+00	7.133E-02
	Maximum		1.418E+01	1.418E+01	5.127E+00
	Minimum		-7.767E+00	-6.182E+00	-6.113E+00
	Number Detected***		0	0	0
	Total Analyzed		14	4	3
Zr-95		15			
Number of Analyses 17				Station	
Non-Routine** 0				13	
Range	Mean		-2.210E-01	3.930E-01	-1.045E+00
	Maximum		2.412E+00	1.800E+00	1.400E+00
	Minimum		-3.255E+00	-5.774E-01	-2.399E+00
	Number Detected***		0	0	0
	Total Analyzed		14	4	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 Levels 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 2000)

Medium: Sediment (SE) UNITS: pCi/kg

SE

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
Co-60		None Required			
Number of Analyses 46				Station	
Non-Routine** 0				49	
	Mean		1.759E+01	1.104E+02	No Data
Range	Maximum		1.104E+02	1.104E+02	No Data
	Minimum		-5.724E+01	1.104E+02	No Data
	Number Detected***		0	0	
	Total Analyzed		46	1	
Cs-134		150			
Number of Analyses 46				Station	
Non-Routine** 0				35	
	Mean		2.043E+01	5.877E+01	No Data
Range	Maximum		8.256E+01	5.877E+01	No Data
	Minimum		-1.860E+01	5.877E+01	No Data
	Number Detected***		0	0	
	Total Analyzed		46	1	
Cs-137		180			
Number of Analyses 46				Station	
Non-Routine** 0				14	
	Mean		1.391E+02	2.145E+02	No Data
Range	Maximum		2.530E+02	2.145E+02	No Data
	Minimum		4.790E+01	2.145E+02	No Data
	Number Detected***		32	1	
	Total Analyzed		46	1	
K-40		None Required			
Number of Analyses 46				Station	
Non-Routine** 0				16	
	Mean		1.520E+04	1.963E+04	No Data
Range	Maximum		2.480E+04	2.480E+04	No Data
	Minimum		8.800E+03	1.445E+04	No Data
	Number Detected***		46	2	
	Total Analyzed		46	2	
Ra-226		None Required			
Number of Analyses 46				Station	
Non-Routine** 0				18	
	Mean		1.592E+03	3.327E+03	No Data
Range	Maximum		3.717E+03	3.327E+03	No Data
	Minimum		-1.343E+03	3.327E+03	No Data
	Number Detected***		36	1	
	Total Analyzed		46	1	

SE

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
Th-228		None Required			
Number of Analyses	46			Station	
Non-Routine**	0			24	
Range	Mean		9.794E+02	1.749E+03	No Data
	Maximum		1.749E+03	1.749E+03	No Data
	Minimum		3.430E+02	1.749E+03	No Data
	Number Detected***		45	1	
	Total Analyzed		46	1	
TH-232		None Required			
Number of Analyses	18			Station	
Non-Routine**	0			16	
Range	Mean		1.134E+03	1.710E+03	No Data
	Maximum		1.710E+03	1.710E+03	No Data
	Minimum		5.390E+02	1.710E+03	No Data
	Number Detected***		18	1	
	Total Analyzed		18	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 Levels 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.*

Table 5.1

Radiological Environmental Program Summary

Vermont Yankee Nuclear Power Plant, Vernon, VT

(January - December 2000)

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

WT

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
Ba-La-140		None Required			
Number of Analyses	7			Station	
Non-Routine**	0			17	
Range	Mean		-9.918E+00	-6.643E+00	No Data
	Maximum		-4.100E+00	-4.100E+00	No Data
	Minimum		-1.916E+01	-9.185E+00	No Data
	Number Detected***		0	0	
	Total Analyzed		7	2	
Co-58		None Required			
Number of Analyses	7			Station	
Non-Routine**	0			16	
Range	Mean		-1.943E-01	6.497E-01	No Data
	Maximum		8.094E-01	8.094E-01	No Data
	Minimum		-1.733E+00	4.900E-01	No Data
	Number Detected***		0	0	
	Total Analyzed		7	2	
Co-60		None Required			
Number of Analyses	7			Station	
Non-Routine**	0			17	
Range	Mean		-1.154E-01	5.925E-02	No Data
	Maximum		3.300E-01	3.300E-01	No Data
	Minimum		-5.680E-01	-2.115E-01	No Data
	Number Detected***		0	0	
	Total Analyzed		7	2	
Cs-134		None Required			
Number of Analyses	7			Station	
Non-Routine**	0			17	
Range	Mean		-2.631E-01	2.518E-01	No Data
	Maximum		4.900E-01	4.900E-01	No Data
	Minimum		-7.500E-01	1.369E-02	No Data
	Number Detected***		0	0	
	Total Analyzed		7	2	
Cs-137		None Required			
Number of Analyses	7			Station	
Non-Routine**	0			14	
Range	Mean		-5.237E-01	3.311E-01	No Data
	Maximum		5.400E-01	3.311E-01	No Data
	Minimum		-3.000E+00	3.311E-01	No Data
	Number Detected***		0	0	
	Total Analyzed		7	1	

WT

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
Fe-59		None Required			
Number of Analyses	7			Station	
Non-Routine**	0			18	
Range	Mean		-6.223E-01	8.350E-01	No Data
	Maximum		2.620E+00	2.620E+00	No Data
	Minimum		-2.900E+00	-9.500E-01	No Data
	Number Detected***		0	0	
	Total Analyzed		7	2	
GR-B		None Required			
Number of Analyses	8			Station	
Non-Routine**	0			18	
Range	Mean		6.375E+01	1.050E+02	No Data
	Maximum		1.300E+02	1.100E+02	No Data
	Minimum		2.000E+01	1.000E+02	No Data
	Number Detected***		8	2	
	Total Analyzed		8	2	
H-3		None Required			
Number of Analyses	8			Station	
Non-Routine**	0			16	
Range	Mean		2.583E+02	3.649E+02	No Data
	Maximum		7.344E+02	7.344E+02	No Data
	Minimum		-6.800E+00	-4.500E+00	No Data
	Number Detected***		0	0	
	Total Analyzed		8	2	
I-131		None Required			
Number of Analyses	7			Station	
Non-Routine**	0			14	
Range	Mean		1.575E+01	1.138E+02	No Data
	Maximum		1.138E+02	1.138E+02	No Data
	Minimum		-9.779E+01	1.138E+02	No Data
	Number Detected***		0	0	
	Total Analyzed		7	1	
K-40		None Required			
Number of Analyses	7			Station	
Non-Routine**	0			14	
Range	Mean		-1.991E+01	6.275E+00	No Data
	Maximum		2.436E+01	6.275E+00	No Data
	Minimum		-8.700E+01	6.275E+00	No Data
	Number Detected***		0	0	
	Total Analyzed		7	1	
Mn-54		None Required			
Number of Analyses	7			Station	
Non-Routine**	0			18	
Range	Mean		5.126E-02	1.179E+00	No Data
	Maximum		2.200E+00	2.200E+00	No Data
	Minimum		-1.334E+00	1.575E-01	No Data
	Number Detected***		0	0	
	Total Analyzed		7	2	

WT

Radionuclides*			Required LLD	Indicator Stations	Station with Highest Mean	Control Station
Zn-65			None Required			
Number of Analyses		7			Station	
Non-Routine**		0			18	
	Mean			-2.075E+00	5.253E-01	No Data
Range	Maximum			1.100E+00	1.100E+00	No Data
	Minimum			-4.571E+00	-4.939E-02	No Data
	Number Detected***			0	0	
	Total Analyzed			7	2	
Zr-95			None Required			
Number of Analyses		7			Station	
Non-Routine**		0			16	
	Mean			2.580E-02	8.176E-01	No Data
Range	Maximum			1.500E+00	1.000E+00	No Data
	Minimum			-2.286E+00	6.352E-01	No Data
	Number Detected***			0	0	
	Total Analyzed			7	2	

**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 Levels 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.*

Table 5.1

Radiological Environmental Program Summary

Vermont Yankee Nuclear Power Plant, Vernon, VT

(January - December 2000)

Medium: Milk TM) UNITS: pCi/Liter

TM

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
Ba-La-140		15			
Number of Analyses 139				Station 25	
Non-Routine** 0					
Range	Mean		-2.769E+02	5.651E+03	1.495E+03
	Maximum		9.040E+04	9.040E+04	7.500E+04
	Minimum		-6.110E+04	-1.000E+01	-4.960E+04
	Number Detected***		0	0	0
	Total Analyzed		122	16	17
Cs-134		15			
Number of Analyses 139				Station 22	
Non-Routine** 0					
Range	Mean		-1.180E-01	8.502E-01	-5.128E-01
	Maximum		3.813E+00	2.944E+00	2.070E+00
	Minimum		-2.910E+01	-1.245E+00	-2.900E+00
	Number Detected***		0	0	0
	Total Analyzed		122	19	17
Cs-137		18			
Number of Analyses 139				Station 25	
Non-Routine** 0					
Range	Mean		1.723E+00	4.626E+00	4.673E-01
	Maximum		1.000E+01	1.000E+01	3.770E+00
	Minimum		-6.328E+00	-3.900E+00	-1.799E+00
	Number Detected***		16	7	0
	Total Analyzed		122	16	17
I-131		1			
Number of Analyses 140				Station 16	
Non-Routine** 0					
Range	Mean		5.818E-02	8.490E-02	2.603E-02
	Maximum		8.528E-01	8.528E-01	2.119E-01
	Minimum		-2.100E-01	-1.200E-01	-1.500E-01
	Number Detected***		0	0	0
	Total Analyzed		123	15	17
K-40		None Required			
Number of Analyses 139				Station 25	
Non-Routine** 0					
Range	Mean		1.422E+03	1.829E+03	1.456E+03
	Maximum		2.021E+03	2.021E+03	2.090E+03
	Minimum		8.240E+02	1.430E+03	1.290E+03
	Number Detected***		122	16	17
	Total Analyzed		122	16	17

TM

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
RA-226		None Required			
Number of Analyses 139				Station	
Non-Routine** 0				22	
Range	Mean		-1.398E+01	1.617E+01	-1.371E-01
	Maximum		1.477E+02	1.477E+02	8.625E+01
	Minimum		-2.100E+02	-1.000E+02	-1.300E+02
	Number Detected***		4	1	1
	Total Analyzed		122	19	17
Sr-89		None Required			
Number of Analyses 32				Station	
Non-Routine** 0				22	
Range	Mean		-3.858E+00	-2.640E+00	-3.571E+00
	Maximum		3.753E+00	3.753E+00	-8.114E-01
	Minimum		-1.214E+01	-9.569E+00	-7.769E+00
	Number Detected***		0	0	0
	Total Analyzed		28	4	4
Sr-90		None Required			
Number of Analyses 32				Station	
Non-Routine** 0				25	
Range	Mean		1.465E+00	2.852E+00	1.541E+00
	Maximum		5.938E+00	5.938E+00	3.942E+00
	Minimum		8.331E-03	4.517E-01	3.687E-01
	Number Detected***		10	3	1
	Total Analyzed		28	4	4
TH-228		None Required			
Number of Analyses 139				Station	
Non-Routine** 0				16	
Range	Mean		-2.257E+00	-2.153E-01	2.034E+00
	Maximum		1.260E+01	7.150E+00	1.494E+01
	Minimum		-3.100E+01	-8.153E+00	-1.700E+01
	Number Detected***		1	1	2
	Total Analyzed		122	15	17

*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 Levels 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.

Table 5.1

Radiological Environmental Program Summary

Vermont Yankee Nuclear Power Plant, Vernon, VT

(January - December 2000)

Medium: Silage (TC) UNITS: pCi/kg

TC

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
Be-7		None Required			
Number of Analyses	7			Station	
Non-Routine**	0			22	
Range	Mean		1.514E+03	5.121E+03	-1.659E+02
	Maximum		5.121E+03	5.121E+03	-1.659E+02
	Minimum		-3.074E+02	5.121E+03	-1.659E+02
	Number Detected***		4	1	0
	Total Analyzed		6	1	1
Cs-134		60			
Number of Analyses	7			Station	
Non-Routine**	0			22	
Range	Mean		5.225E+00	2.535E+01	1.168E+01
	Maximum		2.535E+01	2.535E+01	1.168E+01
	Minimum		-6.978E+00	2.535E+01	1.168E+01
	Number Detected***		0	0	0
	Total Analyzed		6	1	1
Cs-137		80			
Number of Analyses	7			Station	
Non-Routine**	0			25	
Range	Mean		7.908E-01	3.141E+01	-1.344E+01
	Maximum		3.141E+01	3.141E+01	-1.344E+01
	Minimum		-2.406E+01	3.141E+01	-1.344E+01
	Number Detected***		0	0	0
	Total Analyzed		6	1	1
I-131		60			
Number of Analyses	7			Station	
Non-Routine**	0			22	
Range	Mean		6.659E+00	1.618E+01	9.474E+00
	Maximum		1.618E+01	1.618E+01	9.474E+00
	Minimum		1.533E+00	1.618E+01	9.474E+00
	Number Detected***		0	0	0
	Total Analyzed		6	1	1
K-40		None Required			
Number of Analyses	7			Station	
Non-Routine**	0			22	
Range	Mean		8.232E+03	1.978E+04	5.027E+03
	Maximum		1.978E+04	1.978E+04	5.027E+03
	Minimum		3.675E+03	1.978E+04	5.027E+03
	Number Detected***		6	1	1
	Total Analyzed		6	1	1

TC

*Radionuclides**	*Required LLD*	*Indicator Stations*	*Station with Highest Mean*	*Control Station*
Th-228	None Required			
Number of Analyses 7			*Station*	
*Non-Routine*** 0			22	
Range *Mean*		7.995E+01	2.333E+02	2.689E+01
Maximum		2.333E+02	2.333E+02	2.689E+01
Minimum		-7.245E+01	2.333E+02	2.689E+01
*Number Detected****		1	0	0
Total Analyzed		6	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 Levels 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.*

TG

Table 5.1

Radiological Environmental Program Summary

Vermont Yankee Nuclear Power Plant, Vernon, VT

(January - December 2000)

Medium: Mixed Grass (TG) UNITS: pCi/kg

TG

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
Be-7		None Required			
Number of Analyses 28				Station	
Non-Routine** 0				12	
Range	Mean		2.153E+03	3.090E+03	2.443E+03
	Maximum		9.250E+03	6.351E+03	3.878E+03
	Minimum		1.500E+02	6.220E+02	6.330E+02
	Number Detected***		23	4	4
	Total Analyzed		24	4	4
Cs-134		60			
Number of Analyses 28				Station	
Non-Routine** 0				12	
Range	Mean		3.122E+00	8.750E+00	7.732E+00
	Maximum		1.900E+01	1.900E+01	2.078E+01
	Minimum		-1.030E+01	-1.200E+00	-2.860E+00
	Number Detected***		0	0	0
	Total Analyzed		24	4	4
Cs-137		80			
Number of Analyses 28				Station	
Non-Routine** 0				40	
Range	Mean		4.211E+00	1.248E+01	5.268E+00
	Maximum		3.794E+01	2.502E+01	1.802E+01
	Minimum		-1.662E+01	3.600E+00	-3.943E+00
	Number Detected***		2	0	0
	Total Analyzed		24	4	4
I-131		60			
Number of Analyses 28				Station	
Non-Routine** 0				15	
Range	Mean		6.694E+00	1.187E+01	-2.270E+00
	Maximum		3.600E+01	2.132E+01	1.100E+01
	Minimum		-1.088E+01	8.799E-01	-1.465E+01
	Number Detected***		0	0	0
	Total Analyzed		24	4	4
K-40		None Required			
Number of Analyses 28				Station	
Non-Routine** 0				12	
Range	Mean		4.958E+03	6.012E+03	5.002E+03
	Maximum		7.690E+03	7.690E+03	5.390E+03
	Minimum		1.817E+03	4.812E+03	4.749E+03
	Number Detected***		24	4	4
	Total Analyzed		24	4	4

TG

*Radionuclides**		*Required LLD*	*Indicator Stations*	*Station with Highest Mean*	*Control Station*
Ra-226		None Required			
Number of Analyses 28				*Station*	
*Non-Routine*** 0				13	
Range	*Mean*		-7.926E+00	1.263E+02	1.798E+02
	Maximum		1.028E+03	5.711E+02	4.147E+02
	Minimum		-6.869E+02	-1.643E+02	-3.600E+01
	*Number Detected****		2	1	0
	Total Analyzed		24	4	4
Th-228		None Required			
Number of Analyses 28				*Station*	
*Non-Routine*** 0				11	
Range	*Mean*		3.986E+01	4.728E+01	5.970E+01
	Maximum		1.580E+02	7.504E+01	1.256E+02
	Minimum		-5.000E+01	1.400E+01	8.100E+00
	*Number Detected****		2	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 Levels 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 2000)

Medium: Fish (FH) UNITS: pCi/kg

FH

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
Co-58		130			
Number of Analyses 4				Station 21	
Non-Routine** 0					
Range	Mean		-1.242E+01	2.417E+00	2.417E+00
	Maximum		-1.242E+01	1.370E+01	1.370E+01
	Minimum		-1.242E+01	-7.100E+00	-7.100E+00
	Number Detected***		0	0	0
	Total Analyzed		1	3	3
Co-60		130			
Number of Analyses 4				Station 21	
Non-Routine** 0					
Range	Mean		-1.751E+01	2.395E+00	2.395E+00
	Maximum		-1.751E+01	6.300E+00	6.300E+00
	Minimum		-1.751E+01	-2.615E+00	-2.615E+00
	Number Detected***		0	0	0
	Total Analyzed		1	3	3
Cs-134		130			
Number of Analyses 4				Station 11	
Non-Routine** 0					
Range	Mean		5.192E+00	5.192E+00	4.160E+00
	Maximum		5.192E+00	5.192E+00	1.308E+01
	Minimum		5.192E+00	5.192E+00	-5.000E+00
	Number Detected***		0	0	0
	Total Analyzed		1	1	3
Cs-137		150			
Number of Analyses 4				Station 11	
Non-Routine** 0					
Range	Mean		2.310E+01	2.310E+01	1.698E+01
	Maximum		2.310E+01	2.310E+01	4.000E+01
	Minimum		2.310E+01	2.310E+01	-9.668E+00
	Number Detected***		0	0	2
	Total Analyzed		1	1	3
Fe-59		260			
Number of Analyses 4				Station 21	
Non-Routine** 0					
Range	Mean		-1.674E+01	1.750E+00	1.750E+00
	Maximum		-1.674E+01	2.535E+01	2.535E+01
	Minimum		-1.674E+01	-1.600E+01	-1.600E+01
	Number Detected***		0	0	0
	Total Analyzed		1	3	3

FH

Radionuclides*		Required LLD	Indicator Stations	Station with Highest Mean	Control Station
K-40		None Required			
Number of Analyses	4			Station	
Non-Routine**	0			21	
Range	Mean		2.791E+03	2.795E+03	2.795E+03
	Maximum		2.791E+03	3.170E+03	3.170E+03
	Minimum		2.791E+03	2.590E+03	2.590E+03
	Number Detected***		1	3	3
	Total Analyzed		1	3	3
Mn-54		130			
Number of Analyses	4			Station	
Non-Routine**	0			11	
Range	Mean		-4.328E+00	-4.328E+00	-6.440E+00
	Maximum		-4.328E+00	-4.328E+00	4.000E+00
	Minimum		-4.328E+00	-4.328E+00	-1.712E+01
	Number Detected***		0	0	0
	Total Analyzed		1	1	3
Zn-65		260			
Number of Analyses	4			Station	
Non-Routine**	0			11	
Range	Mean		-6.899E+00	-6.899E+00	-5.940E+01
	Maximum		-6.899E+00	-6.899E+00	9.100E+00
	Minimum		-6.899E+00	-6.899E+00	-1.798E+02
	Number Detected***		0	0	0
	Total Analyzed		1	1	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 Levels 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.*

Environmental TLD Data

2000 Radiological Environmental Operating Report
Vermont Yankee

Tables:

5.2 – Data Summary
5.3 - Measurements

Table 5.2

Environmental TLD Data Summary
Vermont Yankee Nuclear Power Station, Vernon, VT
(January – December 2000)

Inner Ring TLDs	Outer Ring TLDs	Offsite Station With Highest Mean	Control TLDs
Mean* Range* (No. Measurements)**	Mean* Range* (No. Measurements)**	Sta. No. Mean* Range* (No. Measurements)**	Mean* Range* (No. Measurements)**
6.79 ± 0.5 5.77 - 8.07 83	6.89 ± 0.7 5.22 - 8.16 62	DR - 36 8.1 ± 0.2 7.8 - 8.2 4	6.76 ± 0.5 5.95 - 7.54 8

Site Boundry TLD With Highest Mean	Site Boundary TLDs
Sta. No. Mean* Range* (No. Measurements)**	Mean* Range* (No. Measurements)**
DR - 45 13.8 ± 0.5 13.2 - 14.3 4	8.5 ± 1.7 6.68 - 14.26 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
2000
(Micro-R per Hour)

Station 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 STATION No. 3.3	7.2 ±	0.3	5.9 ±	0.2	6.2 ±	0.3	6.2 ±	0.3	6.4
DR-02	N HINSDALE, NH	7.1 ±	0.7	6.4 ±	0.3	7.0 ±	0.3	6.9 ±	0.3	6.9
DR-03	HINSDALE SUBSTATION	8.1 ±	0.5	7.5 ±	0.3	7.9 ±	0.4	7.9 ±	0.3	7.8
DR-04	NORTHFIELD, MA	6.7 ±	0.4	6.0 ±	0.3	6.3 ±	0.4	6.6 ±	0.2	6.4
DR-05	SPOFFORD LAKE, NH	7.5 ±	0.6	6.9 ±	0.3	6.8 ±	0.3	7.2 ±	0.2	7.1
DR-06	VERNON SCHOOL	7.4 ±	0.8	6.6 ±	0.3	6.9 ±	0.3	6.9 ±	0.2	7.0
DR-07	SITE BOUNDARY	8.4 ±	0.5	8.0 ±	0.3	8.2 ±	0.3	8.3 ±	0.2	8.2
DR-08	SITE BOUNDARY	8.5 ±	0.4	8.2 ±	0.3	8.1 ±	0.5	8.3 ±	0.2	8.3
DR-09	INNER RING	7.0 ±	0.3	5.8 ±	0.3	6.3 ±	0.4	6.5 ±	0.3	6.4
DR-10	OUTER RING	6.0 ±	0.4	5.2 ±	0.2	5.5 ±	0.3	5.9 ±	0.2	5.6
DR-11	INNER RING	6.4 ±	0.2	5.9 ±	0.2	6.2 ±	0.2	6.3 ±	0.3	6.2
DR-12	OUTER RING	6.2 ±	0.3	5.8 ±	0.2	6.0 ±	0.3	6.1 ±	0.3	6.0
DR-13	INNER RING	6.9 ±	0.3	6.3 ±	0.2	6.5 ±	0.4	6.8 ±	0.3	6.6
DR-14	OUTER RING	7.7 ±	0.3	7.6 ±	0.3	7.8 ±	0.3	*		7.7
DR-15	INNER RING	7.2 ±	0.3	6.4 ±	0.2	6.6 ±	0.2	6.9 ±	0.2	6.8
DR-16	OUTER RING	7.9 ±	0.3	6.8 ±	0.3	7.0 ±	0.3	7.4 ±	0.3	7.3
DR-17	INNER RING	6.4 ±	0.4	6.2 ±	0.2	6.3 ±	0.3	6.5 ±	0.2	6.4
DR-18	OUTER RING	6.9 ±	0.3	6.7 ±	0.3	6.6 ±	0.3	6.9 ±	0.3	6.8
DR-19	INNER RING	7.5 ±	0.3	7.0 ±	0.3	7.3 ±	0.3	7.7 ±	0.3	7.4
DR-20	OUTER RING	7.4 ±	0.3	7.3 ±	0.4	7.3 ±	0.4	7.8 ±	0.4	7.5
DR-21	INNER RING	7.0 ±	0.4	6.4 ±	0.3	6.7 ±	0.3	6.9 ±	0.3	6.8
DR-22	OUTER RING	6.8 ±	0.3	6.7 ±	0.3	6.7 ±	0.3	7.0 ±	0.3	6.8
DR-23	INNER RING	6.6 ±	0.3	6.1 ±	0.3	6.5 ±	0.3	6.4 ±	0.2	6.4
DR-24	OUTER RING	6.4 ±	0.3	5.8 ±	0.3	6.0 ±	0.5	6.0 ±	0.2	6.1
DR-25	INNER RING	6.8 ±	0.3	6.4 ±	0.4	6.7 ±	0.3	6.8 ±	0.2	6.7
DR-26	OUTER RING	7.0 ±	0.2	6.8 ±	0.2	6.9 ±	0.2	6.9 ±	0.3	6.9
DR-27	INNER RING	6.6 ±	0.2	6.8 ±	0.3	6.8 ±	0.3	7.1 ±	0.3	6.8
DR-28	OUTER RING	6.6 ±	0.3	6.4 ±	0.3	6.6 ±	0.3	6.5 ±	0.2	6.5
DR-29	INNER RING	7.5 ±	0.2	6.5 ±	0.2	6.6 ±	0.3	6.8 ±	0.4	6.8
DR-30	OUTER RING	6.9 ±	0.2	6.8 ±	0.3	6.8 ±	0.3	7.2 ±	0.4	6.9
DR-31	INNER RING	7.3 ±	0.7	6.7 ±	0.2	7.0 ±	0.3	*		7.0
DR-32	OUTER RING	*		6.5 ±	0.3	6.6 ±	0.3	6.8 ±	0.3	6.6
DR-33	INNER RING	6.9 ±	0.2	6.8 ±	0.3	6.9 ±	0.3	6.9 ±	0.4	6.9
DR-34	OUTER RING	7.4 ±	0.3	7.2 ±	0.3	7.5 ±	0.4	7.6 ±	0.3	7.4
DR-35	INNER RING	7.4 ±	0.3	6.4 ±	0.2	6.7 ±	0.2	6.8 ±	0.2	6.8
DR-36	OUTER RING	8.1 ±	0.3	7.8 ±	0.4	8.1 ±	0.3	8.2 ±	0.2	8.1
DR-37	INNER RING	6.6 ±	0.2	6.5 ±	0.2	6.8 ±	0.3	6.7 ±	0.2	6.7
DR-38	OUTER RING	7.0 ±	0.3	7.2 ±	0.3	7.5 ±	0.4	7.8 ±	0.4	7.4
DR-39	INNER RING	7.1 ±	0.2	6.6 ±	0.3	6.9 ±	0.3	7.1 ±	0.3	6.9
DR-40	OUTER RING	6.9 ±	0.3	6.7 ±	0.3	6.6 ±	0.3	6.8 ±	0.3	6.7
DR-41	SITE BOUNDARY	7.5 ±	0.2	7.6 ±	0.4	7.7 ±	0.3	7.8 ±	0.4	7.7

Table 5.3

Environmental TLD Measurements
2000
(Micro-R per Hour)

Station		1ST Quarter		2nd Quarter		3rd Quarter		4th Quarter		ANNUAL AVE.
No.	Description	EXP .	S.D.	EXP .	S.D.	EXP	S.D	EXP .	S.D	EXP.
DR-42	SITE BOUNDARY	±	0.3	7.1 ±	0.2	6.9 ±	0.3	7.2 ±	0.3	7.0
DR-43	SITE BOUNDARY	7.2 ±	0.3	7.5 ±	0.3	7.5 ±	0.3	7.6 ±	0.3	7.5
DR-44	SITE BOUNDARY	8.8 ±	0.3	7.9 ±	0.3	7.7 ±	0.3	8.0 ±	0.3	8.1
DR-45	SITE BOUNDARY	14.3 ±	0.4	13.2 ±	0.4	14.1 ±	0.6	13.8 ±	0.7	13.8
DR-46	SITE BOUNDARY	8.8 ±	0.3	8.6 ±	0.3	8.9 ±	0.3	9.1 ±	0.3	8.9
DR-47	SITE BOUNDARY	8.0 ±	0.4	8.0 ±	0.4	8.3 ±	0.2	8.2 ±	0.3	8.1
DR-48	SITE BOUNDARY	7.0 ±	0.4	7.2 ±	0.3	7.2 ±	0.5	7.2 ±	0.3	7.2
DR-49	SITE BOUNDARY	6.7 ±	0.2	6.9 ±	0.3	6.7 ±	0.3	6.9 ±	0.3	6.8
DR-50	GOVERNOR. HUNT HOUSE	7.3 ±	0.4	7.0 ±	0.5	7.1 ±	0.3	7.2 ±	0.3	7.1
DR-51	SITE BOUNDARY	8.0 ±	0.3	8.4 ±	0.3	8.7 ±	0.3	8.7 ±	0.4	8.5
DR-52	SITE BOUNDARY	8.8 ±	0.3	8.6 ±	0.3	8.8 ±	0.3	8.8 ±	0.3	8.7
DR-53	SITE BOUNDARY	9.4 ±	0.4	9.6 ±	0.3	9.5 ±	0.4	9.7 ±	0.5	9.6

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 2000, several deviations were noted in the REMP. These deviations did not compromise the program's effectiveness and in fact are considered typical with respect to what is normally anticipated for any radiological environmental monitoring program. The specific deviations for 2000 were:

a) The outer ring TLD in the NE sector, DR-14, was reported missing for the 4th quarter of the year. The inner ring TLD in the WSW sector, DR-31, was reported missing for the 4th quarter of the year. The technician reported that it appeared as though snow plows had caused the loss of the TLDs.

b) The outer ring TLD in the WSW sector, DR-32 was reported missing for the 1st quarter of the year. Several utility poles in this area had recently been replaced. The old pole was nearby with the TLD cage still strapped to it, but the cage was empty. Attempts to contact the utility crews did not help to find the TLD.

c) On June 27, during a routine check of the composite pump at the river station, the technician discovered that the river water pump that supplies water to the composite sampler was not working. The breaker was reset to start the pump. This problem may have been caused by electrical storm activity. The sampler had last been checked for operability on June 19, so it may have missed up to 8 days of sampling.

d) The Meadow Crest Farm, TM-16, went out of business in late 2000. Milk samples were not available for the December sample collection. The silage sample from this location, TC-16, was collected in 2000 prior to the farm going out of business.

e) The 1st quarter samples of vegetation at all of the required locations were not collected since vegetation was not available that quarter of the year. The Vermont Yankee ODCM allows for missed vegetation samples due to lack of availability as described in ODCM Table 3.5.1, Note a.

f) The Franklin Farm, TM-22, did not have milk available for the March sample. They let their cows "go dry" before calving each spring. The Downey-Spencer location, TM-25, did not have goat milk available for the monthly collections in January, February, and March of 2000. This location is not required by the ODCM but is an enhancement of the monitoring program.

g) A silage sample was not available from the Cheney Hill Farm, TC-26, in 2000. They do not grow the corn at their farm. This location is not required by the ODCM.

h) The power at AP/CF-12 in N. Hinsdale, NH was disconnected by Public Service Company of New Hampshire. The company had been asked to disconnect the power at an abandoned air station and mistakenly disconnected it at this location. This problem was discovered on 11/28/00 during the normal sample collection. The sampling station missed 318 hours of sampling from

11/14/00 until 11/29/00 when the power was restored. This sample was not included in Table 5.1 since the extremely low sample volume made it an invalid sample.

i) The following data indicates the percentage of time that each air sampling station operated during the year. The data was based on an electric timer at each station. This data indicates that any power interruptions did not result in a significant loss of data for the airborne sampling program. Location AP/CF-15 is not a location required by the ODCM. Minor power interruptions are expected due to minor maintenance repairs during the year. For example, the N. Hinsdale location, AP/CF-12, was reconstructed in the 2nd quarter. This maintenance took about 3 hours. Local thunderstorm activity often results in scattered minor power outages during the summer months.

AP/CF-11	99.1%	AP/CF-13	100.0%	AP/CF-15	99.7%	AP/CF-40	99.9%
AP/CF-12	96.2%	AP/CF-14	97.6%	AP/CF-21	99.9%		

The timers at stations AP/CF-11 and 14 were not operating accurately during the end of 4th quarter of the year. The timers were subsequently replaced. If the timer data were not used for the weeks of suspected problems, the percent operability for those two locations would increase to 99.7% and 100% respectively for the year. The lower operability rating at AP/CF-12 reflects the problems with the power disconnection event already discussed in items above.

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. In such a case, ODCM 10.2 requires a discussion of the situation. At the contracted environmental laboratory, the target LLD for any analysis is typically 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 2000, there were several samples where the *a posteriori* LLD exceeded a corresponding LLD requirement. All but three of these analyses were obtained from the laboratory used in the 2nd and 3rd quarters of the year. All but one of the analyses appeared to have had delays in counting at the contractor laboratory, which resulted in the analyses not meeting the target LLD. The exception to this was the Air Particulate gross beta and I-131 analysis at Station 12 during week 48. This sample had an insufficient sample volume due to loss of power at the air sampling station (see item h in Section 6.1). The following table lists the samples and the isotope measured that did not meet the required LLD of Table 4.5.1 of the ODCM.

Sample Analyses Not Meeting the Required LLD

Media	Station	Week	Test	Activity	1 Std Dev	MDA
AP	12	48	Gross Beta	4.02E-03	1.66E-02	5.06E-02
CF	12	48	I-131	3.30E-01	1.50E-01	4.90E-01
CF	12	22	I-131	-5.00E-01	7.15E-01	2.00E+00
CF	12	36	I-131	-3.60E-03	3.10E-02	1.00E-01
TG	14	46	I-131	2.95E+00	2.11E+01	7.66E+01
WG	11	18	Ba-La-140	-8.40E+00	9.15E+00	3.00E+01
WG	22	18	Ba-La-140	9.00E-01	8.30E+00	3.00E+01
WG	12	46	Gross Beta	6.10E+00	1.52E+00	4.73E+00
WR	11	15	Ba-La-140	-1.70E+01	2.30E+01	7.00E+01
WR	21	15	Ba-La-140	4.20E+00	2.32E+01	8.00E+01
WR	11	20	Ba-La-140	-1.80E+01	9.00E+00	3.00E+01
WR	11	24	Ba-La-140	-6.60E+00	7.40E+00	2.00E+01
WR	11	29	Ba-La-140	7.21E+01	4.36E+01	1.23E+02
WR	11	33	Ba-La-140	-1.06E+06	1.83E+06	5.07E+06
			FE-59	1.37E+02	1.27E+02	3.78E+02
			CO-58	-3.89E+01	1.95E+01	5.48E+01
			ZR-95	6.16E+01	3.70E+01	1.16E+02
WR	11	37	Ba-La-140	1.95E+05	4.62E+05	1.31E+06
			FE-59	4.87E+01	5.50E+01	1.65E+02
			ZR-95	1.04E+01	1.68E+01	5.25E+01
			CO-58	-6.91E+00	8.95E+00	2.56E+01
WR	21	20	Ba-La-140	1.30E+01	9.00E+00	3.00E+01
WR	21	24	Ba-La-140	6.30E+00	5.15E+00	2.00E+01
WR	21	29	Ba-La-140	-1.32E+02	5.70E+01	1.39E+02
WR	21	33	Ba-La-140	5.39E+05	8.70E+05	2.46E+06
			FE-59	3.69E+01	1.17E+02	3.45E+02
			ZR-95	9.31E+00	3.49E+01	1.07E+02
			CO-58	-4.53E+01	1.94E+01	5.38E+01
WR	21	37	Ba-La-140	2.66E+05	5.45E+05	1.55E+06
			FE-59	4.11E+00	7.50E+01	2.18E+02
			ZR-95	3.01E+01	2.44E+01	7.38E+01
			CO-58	-1.18E+00	1.10E+01	3.20E+01
TM	11	18	Ba-La-140	8.10E+00	5.80E+00	2.00E+01
TM	14	18	Ba-La-140	6.90E+00	6.25E+00	2.00E+01
TM	16	18	Ba-La-140	4.60E+00	7.50E+00	2.00E+01
TM	18	18	Ba-La-140	-5.70E+00	6.25E+00	2.01E+01
TM	24	18	Ba-La-140	-2.60E+00	5.15E+00	1.68E+01

Several other samples submitted to the second laboratory failed to meet the required LLDs, but the samples were not from locations required by the ODCM. Those missed LLD analyses are not included in this table. They were from locations voluntarily added as enhancements to the program.

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 2000, 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 2000.

One sampling location change not related to the Land Use Census results was made to the program. Milk sampling location TM-16, Meadow Crest Farm, went out of business with the last sample collection in November of 2000. The silage sample from this location, TC-16, was also removed from the program. The Miller Farm, TM-11 and TC-11, replaced the Meadow Crest Farm as the REMP required sampling location. It had already been included in the REMP as a voluntary enhancement of the monitoring program.

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

6.5 Data Analysis by Media Type

The 2000 REMP data for each media type is discussed below. Whenever a specific measurement result is presented, it is given as the concentration plus or minus one standard deviation. This standard deviation represents only the random uncertainty associated with the radioactive decay process (counting statistics), and not the propagation of all possible uncertainties in the analytical procedure. 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." For the following discussions for each media type, the suspect data discussed in Section 5.1 is not included. Differences are observed in the data displayed in the Table 5.1 from previous years. Some of these differences may be explained by the use of two laboratories during 2000. The Ba-La-140 data for River Water (WR) and Milk (TM) has huge ranges, although no detectable values, due to the delay in sample analysis that occurred at the second laboratory. More importantly, this year we are reporting the values as supplied by the laboratories. In previous years, we converted values that were less than the MDC to zero.

6.5.1 Airborne Pathways

6.5.1.1 Air Particulates

The bi-weekly air particulate filters from each of the seven sampling sites were analyzed for gross-beta radioactivity. At the end of each quarter, the bi-weekly filters from each sampling site were composited for a gamma analysis. The results of the weekly air particulate sampling program are shown in Table 5.1 and Figures 6.1 through 6.7. This is the first 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. (The filter discussed in Section 6.1, item h, was excluded due to the insufficient air volume.) 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. Also 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. In 2000, the data indicated a larger range of values that in recent years. Data trends were compared with the nearby Pilgrim plant where a similar trend was observed for the year.

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. It can also 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 are only two gamma emitting radionuclides detected on the air particulate filters. Be-7, a naturally-occurring cosmogenic radionuclide, was detected on 12 of 27 filters. Ra-226, a naturally occurring primordial radionuclide, was detected on one filter.

6.5.1.2 Charcoal Cartridges

The bi-weekly charcoal cartridges from each of the seven air sampling sites were analyzed for I-131. 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 first year that the results for the on-site air iodine sampling station, Gov. Hunt (CF-40) have been included.

6.5.2 Waterborne Pathways

6.5.2.1 River Water

Aliquots of river water were automatically collected hourly from the Connecticut River downstream from the plant discharge area, location WR-11. 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 8 out of 12 indicator samples and 9 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 2000.

One sample had a very small amount of detectable Cs-137 (just 55% of the required LLD in Table 4.4) at 9.94E+00 + 1.51E+00 pCi/liter. Although possibly plant-related activity, Cs-137 does exist in the environment, mostly from atmospheric nuclear weapons tests. Naturally occurring K-40, found in soil and rock, was also detected in this same sample at 1.76E+02 pCi/liter. Cs-137 is found in soil and vegetation, so it is possible that the Cs-137 was with the K-40 in sediment in the river sample. However, Cs-137 is detected in the Vermont Yankee storm drain system and is known to exist in river sediment samples due to the storm drain system. See the discussion in section 6.5.2.6. The source of this Cs-137, whether from Vermont Yankee or man-made background radioactivity (see Section 2.2) cannot be determined. Vermont Yankee has not made routine radioactive liquid releases to the Connecticut River since 1982.

Naturally-occurring K-40 was detected in two samples, Th-228 in two samples, and Th-232 in one sample. Like K-40, Th-228 and Th-232 are naturally occurring in soil, so it is expected to detect them in river water.

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

Quarterly ground water samples were collected from four indicator locations (only one is required by VYNPS ODCM) and one control location during 2000. 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 17 out of 18 indicator samples and in 3 out of 4 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 that detected in previous years. Naturally occurring K-40, Th-228 and Th-232 were also detected in one sample each. No other gamma-emitting radionuclides or tritium were detected in any of the samples.

6.5.2.3 Sediment

Semi-annual river sediment grab samples were collected from two indicator locations during 2000. 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 2000, 26 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 36 of 46 samples. Thorium-228 (Th-228) was detected in 45 of 46 samples. Thorium-232 (Th-232) was detected 18 samples analyzed. (The first laboratory did not report results for Th-232.) Cesium-137 (Cs-137) was detected in 32 out of 46 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 not detected this year although it often has been detected in recent years at very low levels. Co-60 is sometimes 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. See section 6.5.2.6 for more information.

6.5.2.4 Test Wells

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 2000. 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 2000, two samples were taken at each of the four locations and all were analyzed for gamma isotopic, gross beta and H-3 activity. There were no gamma emitting radionuclides or H-3 detected in this year's samples.

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 20 to 130 pCi/kg.

6.5.2.5 Air Compressor Condensate

During 2000, monthly samples of condensate from air compressors were taken when available. A total of 8 samples was obtained. The samples were analyzed for tritium activity. The analytical results of the eight samples are concentrations of H-3 ranging from 2.64E-05 uCi/ml to 1.10E-04 uCi/ml, with a mean of 4.96E-05 uCi/ml. The presence of H-3 in the condensate is an incidental result of the normal operation of the air compressor. This condensate is discharged to the Turbine Building Clean Sump and ultimately to the Circulating Water System. The small volume of condensate relative to the volume of water in the clean sump results in a dilution of the H-3 to below detectable levels. This dilution is also an incidental result of the system's normal operation. The Turbine Building Clean Sump is sampled weekly for H-3. In 2000, there were no detectable levels of H-3 in the weekly samples.

A review of the dose consequences of potential releases to the Connecticut River was performed based on the tritium detected in the Air Compressor condensate. The assessment concluded that the dose impact associated with the postulated releases of tritium, through the Air Compressors represent insignificant fractions of all ODCM Controls "which limit either effluent concentrations, or doses to the required values associated with the ALARA objectives of 10CFR50, Appendix I and the total dose standard of 40CFR190."

In October of 2000, a technician reported that an analysis of fire suppression system water had a tritium value of 2.2E-06 μCi/ml. The Minimum Detectable Activity reported that day was 2.13E-06 μCi/ml. Against procedures, the technician issued a permit for 2,000 gallons of this water to be drained to the Turbine Building Clean Sump. It is very unlikely that this water did contain tritium. The water in the fire suppression system is service water that is routinely checked for activity. The system is pressurized, so it is unlikely that the water could become contaminated once in the system. Additionally, the Turbine Building Clean Sump is monitored weekly for tritium. In 2000, none of the weekly samples indicated the presence of tritium. It is likely that it is a flawed analysis. If this water did contain tritium, this would be a total release of 16.1 μCi of tritium. Using the Method I dose calculation in the ODCM, this yields an approximate total body dose of 3.32E-09 mrem and an approximate maximum organ dose of 3.32E-09 mrem. This is an insignificant fraction of the ODCM limits (1.5 mrem/quarter and 5 mrem/quarter respectively).

6.5.2.6 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 2000 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 2000 for a total of 24 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 2000 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 2000. No gamma emitting isotopes were detected in any of the samples. Low levels of gross beta activity were detected in 20 out of 22 samples analyzed at concentrations that are typical of any environmental water sample. Tritium (H-3) was detected in none of the 117 samples analyzed with a typical detection level of 700 pCi/kg.

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 2000 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	18/24	7.2 E 3	(0.38 – 28.4) E 3	MH-12 (SE-95)
K-40	23/24	1.1 E 4	(0.48 - 1.44) E 4	MH-11F (SE-98)
Th-232	9/24	7.3 E 2	(3.2-17) E 2	MH-11E (SE-99)
Th-228	19/24	6.5 E 2	(0.34-2.2) E 3	MH-11E (SE-99)
Mn-54	2/24	4.8 E 1	(4.5-5.0) E 1	MH-12 (SE-95)
Ra-226	14/24	1.8 E 3	(0.25-6.0) E 3	MH-11F (SE-98)
Cs-134	5/24	3.1 E 1	(1.8-4.9) E 1	MH-12 (SE-95)
Cs-137	16/24	1.5 E 3	(.009-4.7) E 3	MH-12 (SE-95)
Zn-65	1/24	2.2 E 2		MH-12 (SE-95)
Co-60	15/24	3.4 E 2	(0.28-9.1) E 2	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
Gross Beta	20/22	3.3 E 0	(1.6 – 6.6) E 0	MH-12A (WW-12)
H-3	0/117	ND	ND	ND

* 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 typical H-3 Minimum Detectable Activity is 7.0 E 2 pCi/kg.

6.5.3 Ingestion Pathways

6.5.3.1 Milk

Milk samples from cows or goats at several local farms were collected monthly during 2000. Semi-monthly 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 Ra-226 and Th-228 were detected in a few of the samples. Also expected was Sr-90. Sr-90 was detected in 10 out of 28 indicator samples and 1 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 16 of 139 samples in 2000. 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 difference in concentrations between farms.

6.5.3.2 Silage

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 4 of the 7 samples. Th-228, also naturally-occurring, was detected in 1 sample. No I-131 was detected in any sample.

6.5.3.3 Mixed Grass

Mixed grass samples were collected at each of the air sampling stations on four occasions during 2000. As expected with all biological media, naturally-occurring K-40 was detected in all samples. Naturally-occurring Be-7 was also detected in 23 out of 24 indicator samples and all 4 control samples. Ra-226 and Th-228 were each detected in 2 of the 24 indicator stations.

Cs-137 was detected in 2 of the 24 indicator stations, although at extremely low levels (13.6 $\pm$ 3.25 pCi/kg and 9.03$\pm$2.62 pCi/kg). The required LLD for this Cs-137 in this sample type is 80 pCi/kg. Even with these 2 positive identifications, the station with the highest mean had no detectable Cs-137. 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 inadvertently collected with the grass samples.

No other gamma emitting radionuclides were detected in any of the samples collected in 2000.

6.5.3.4 Fish

Semiannual samples of fish were collected from two locations in the Spring and Fall of 2000. 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 not detected in this year's samples although it has occasionally detected in past years. 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 2000 and previous years are typical of concentrations attributable to global nuclear weapons testing fallout. 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). 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 2000. 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.

6.5.5 Special Samples

During 2000, one additional sample type was collected. Water vegetation samples were collected from the North Storm Drain Outfall location and downstream of the Discharge Structure in July of 2000. These special samples were analyzed for gamma emitting nuclides. As shown in Table 6.3, the water vegetation sample analyses indicated the presence of Ac/Th-228, Be-7, Ra-226, and K-40, all naturally-occurring nuclides that are expected in such samples.

Table 6.3

Summary of Special Samples*

Water Vegetation

Isotope	No. Detected**	Mean (pCi/kg)	Range (pCi/kg)	Station With Highest Detected Concentration
Be-7	1/2	7.42E+02	7.42E+02	99(N. Storm Drain Outfall)
K-40	2/2	1.87E+03	(1.0 – 2.7) E+03	98(Discharge)
Ra-226	1/2	1.20E+03	1.20E+03	99(N. Storm Drain Outfall)
Ac/Th-228	2/2	3.56E+02	(2.7 – 5.0)E+02	99(N. Storm Drain Outfall)

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

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

Environmental Program Trend Graphs

2000 Radiological Environmental Operating Report
Vermont Yankee

Graphs:

6.1 – Gross Beta Measurements on Air Particulate Filters (Average Concentrations)
6.2 – Gross Beta Measurements on Air Particulate Filters (11)
6.3 – Gross Beta Measurements on Air Particulate Filters (12)
6.4 – Gross Beta Measurements on Air Particulate Filters (13)
6.5 – Gross Beta Measurements on Air Particulate Filters (14)
6.6 – Gross Beta Measurements on Air Particulate Filters (15)
6.7 – Gross Beta Measurements on Air Particulate Filters (40)
6.8 – Gross Beta Measurement on River Water (Average Concentrations)
6.9 – Gross Beta Measurement on Ground Water (Average Concentrations)
6.10 – Cesium-137 in Milk (Annual Average Concentrations)
6.11 - Strontium 90 in Milk (Annual Average Concentrations)
6.12 – Cesium-137 in Fish (Annual Average Concentrations)
6.13 – Exposure Rate at Inner Ring, Outer Ring, and Control TLDS
6.14 – Exposure Rate at Indicator TLDS, DR01-03
6.15 – Exposure Rate at Indicator TLDS, DR 06,50
6.16 – Exposure Rate at Site Boundary TLDS, DR 07 - 08, 41 - 42
6.17 – Exposure Rate at Site Boundary TLDS, DR 43-46
6.18 – Exposure Rate at Site Boundary TLDS, DR 47-49, 51-53
6.19 – Exposure Rate at Inner Ring TLDS, DR 09-15(odd)
6.20 – Exposure Rate at Inner Ring TLDS, DR-17-23 (odd)
6.21 – Exposure Rate at Inner Ring TLDS,DR 25-31 (odd)
6.22 - Exposure Rate at Inner Ring TLDS, DR 33-39 (odd)
6.23 – Exposure Rate at Outer Ring TLDS, DR 10 - 16 (even)
6.24 – Exposure Rate at Outer Ring TLDS, DR 18-24 (even)
6.25 – Exposure Rate at Outer Ring TLDS, DR 26-32 (even)
6.26 – Exposure Rate at Outer Ring TLDS, DR 34-40 (even)
6.27 – Exposure Rate at Control TLDS, DR 04-05

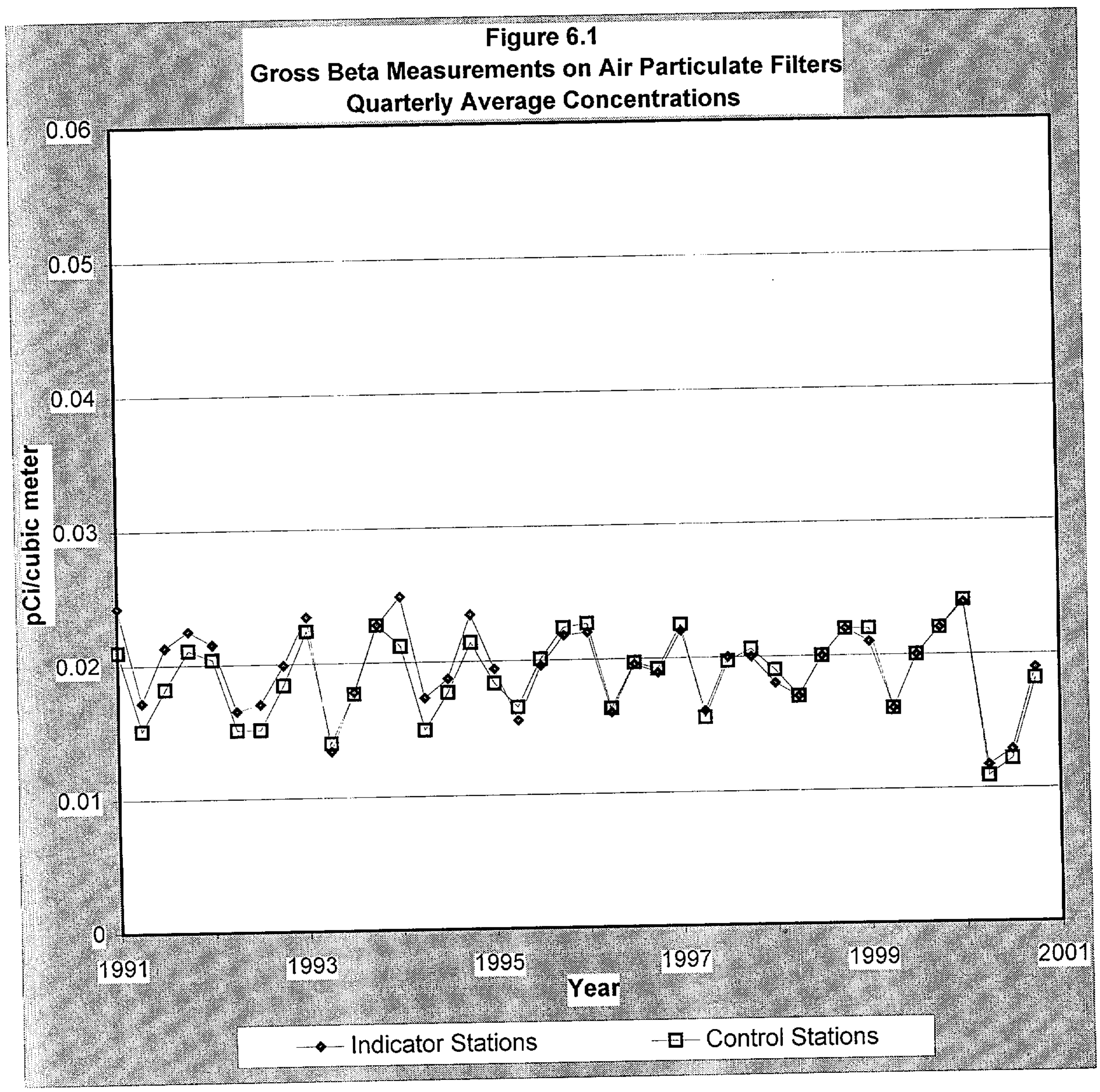


Figure 6.1
Gross Beta Measurements on Air Particulate Filters
Quarterly Average Concentrations
0.06
0.05
0.04
0.03
0.02
0.01
0
pCi/cubic meter
1991
1993
1995
1997
1999
2001
Year
Indicator Stations
Control Stations

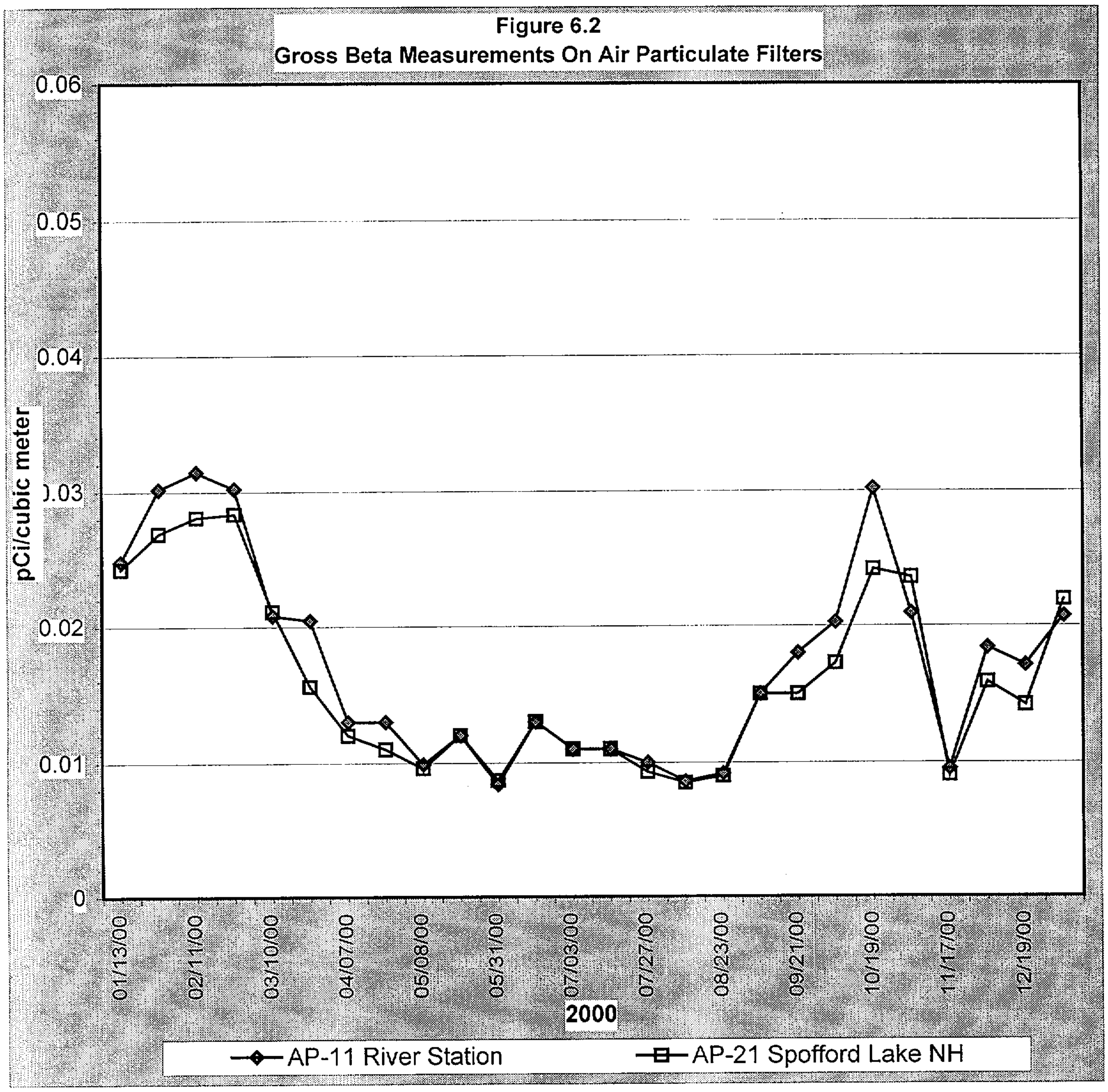


Figure 6.2
Gross Beta Measurements On Air Particulate Filters
0.06
0.05
0.04
0.03
0.02
0.01
0
pCi/cubic meter
01/13/00
02/11/00
03/10/00
04/07/00
05/08/00
05/31/00
07/03/00
07/27/00
08/23/00
09/21/00
10/19/00
11/17/00
12/19/00
2000
AP-11 River Station
AP-21 Spofford Lake NH

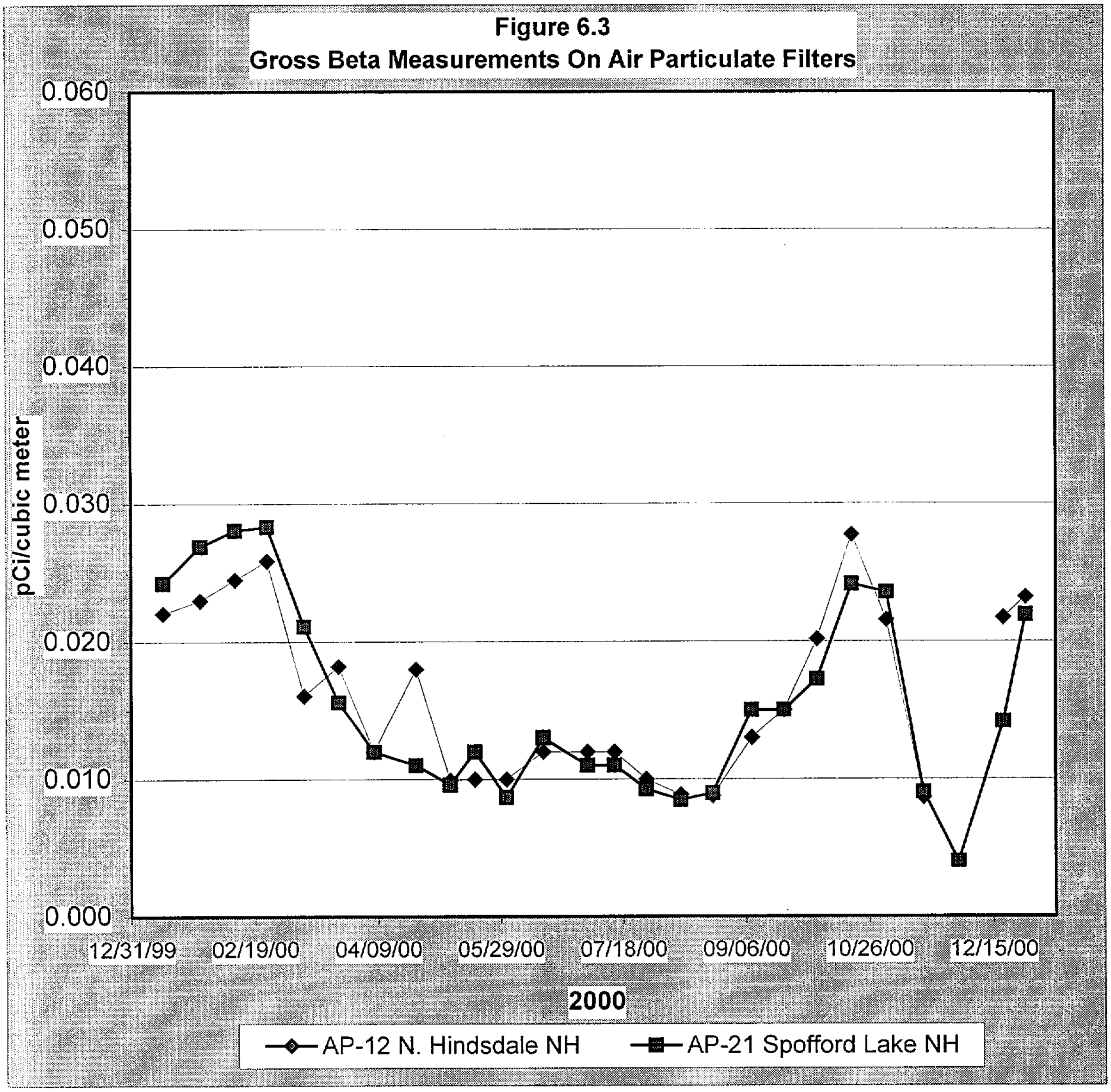


Figure 6.3
Gross Beta Measurements On Air Particulate Filters
pCi/cubic meter
0.060
0.050
0.040
0.030
0.020
0.010
0.000
12/31/99
02/19/00
04/09/00
05/29/00
07/18/00
09/06/00
10/26/00
12/15/00
2000
AP-12 N. Hindsdale NH
AP-21 Spofford Lake NH

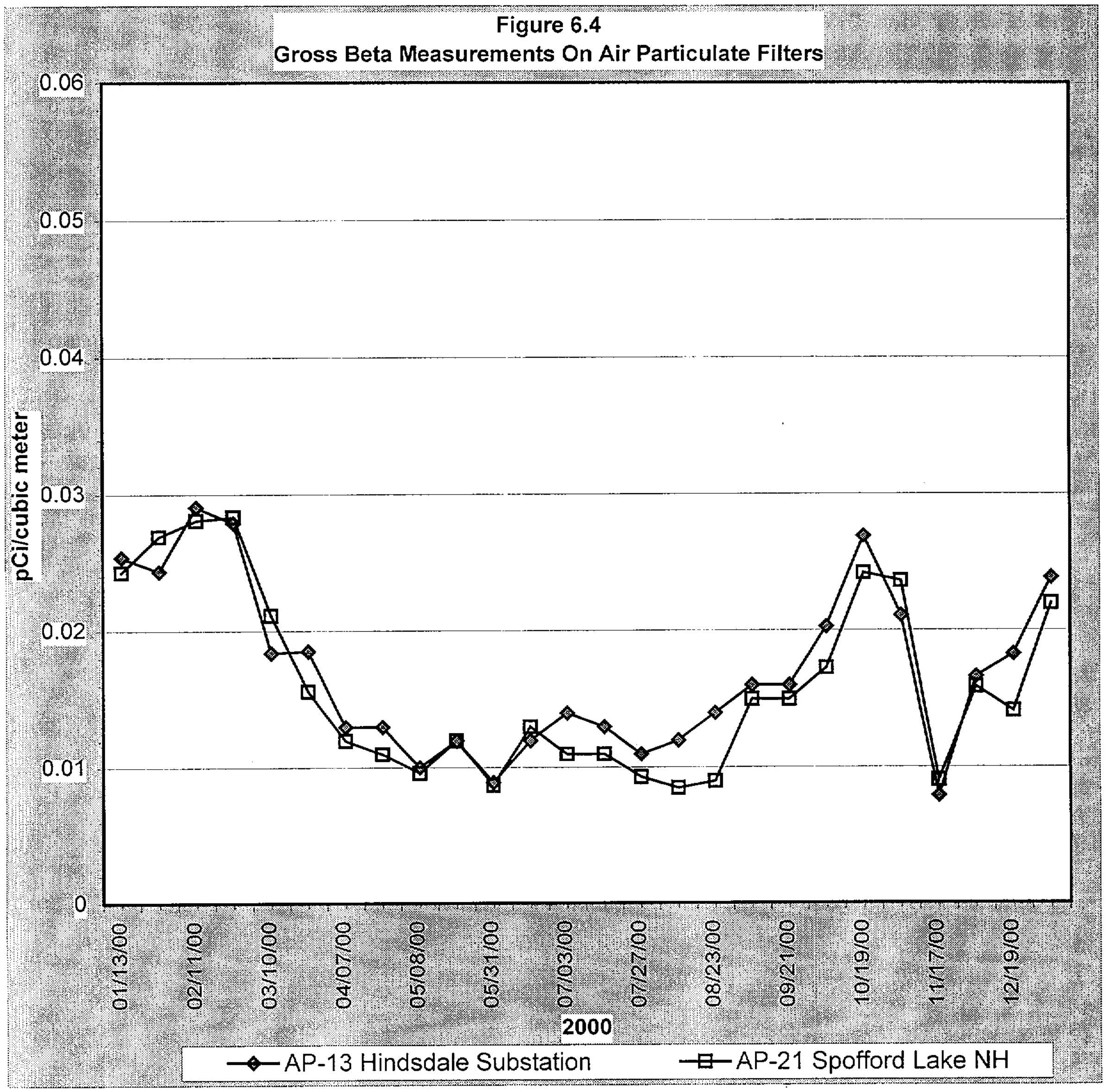


Figure 6.4
Gross Beta Measurements On Air Particulate Filters
pCi/cubic meter
0.06
0.05
0.04
0.03
0.02
0.01
0
01/13/00
02/11/00
03/10/00
04/07/00
05/08/00
05/31/00
07/03/00
07/27/00
08/23/00
09/21/00
10/19/00
11/17/00
12/19/00
2000
AP-13 Hindsdale Substation
AP-21 Spofford Lake NH

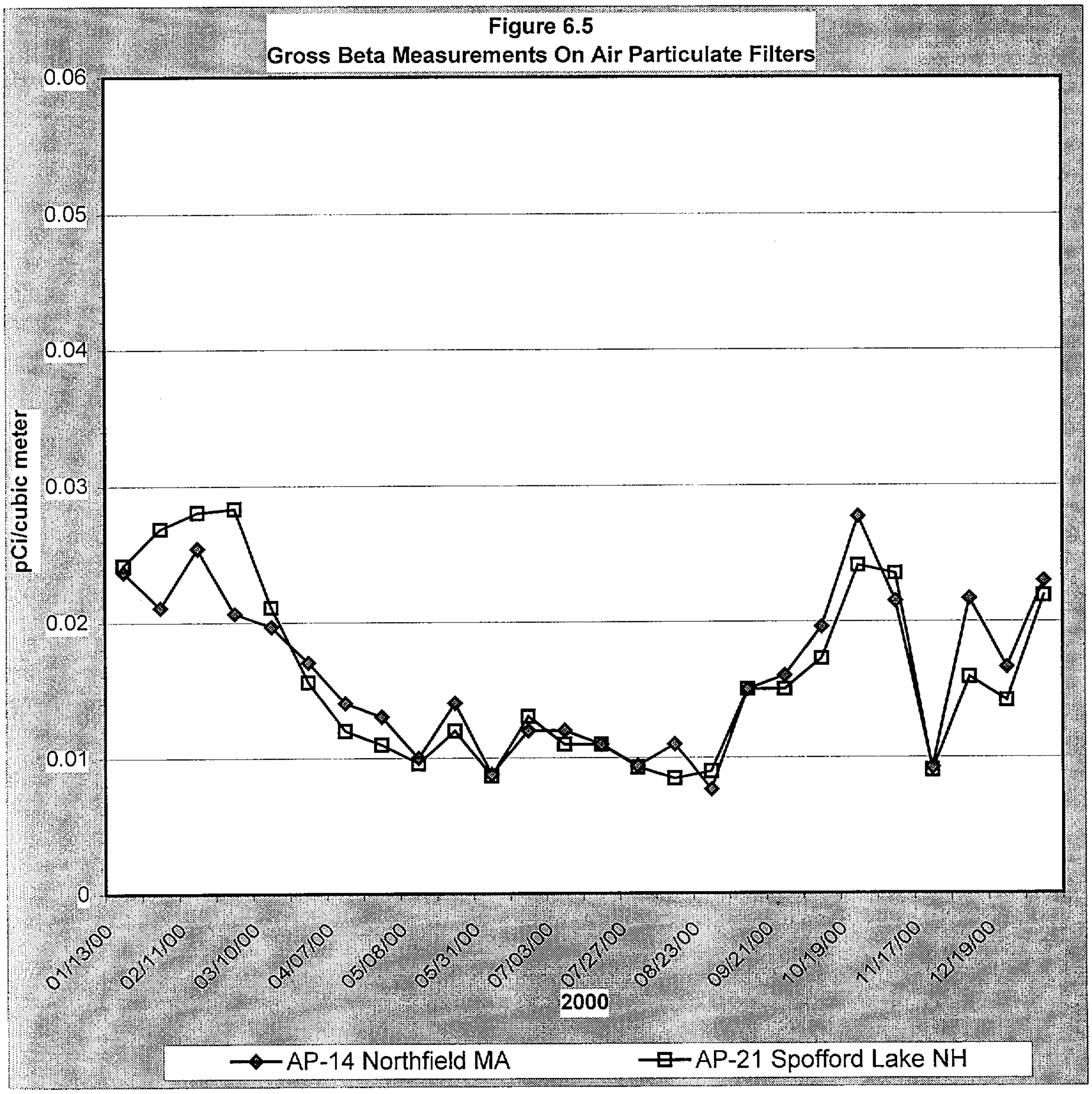


Figure 6.5
Gross Beta Measurements On Air Particulate Filters
0.06
0.05
0.04
0.03
0.02
0.01
0
pCi/cubic meter
01/13/00
02/11/00
03/10/00
04/07/00
05/08/00
05/31/00
07/03/00
07/27/00
08/23/00
09/21/00
10/19/00
11/17/00
12/19/00
2000
AP-14 Northfield MA
AP-21 Spofford Lake NH

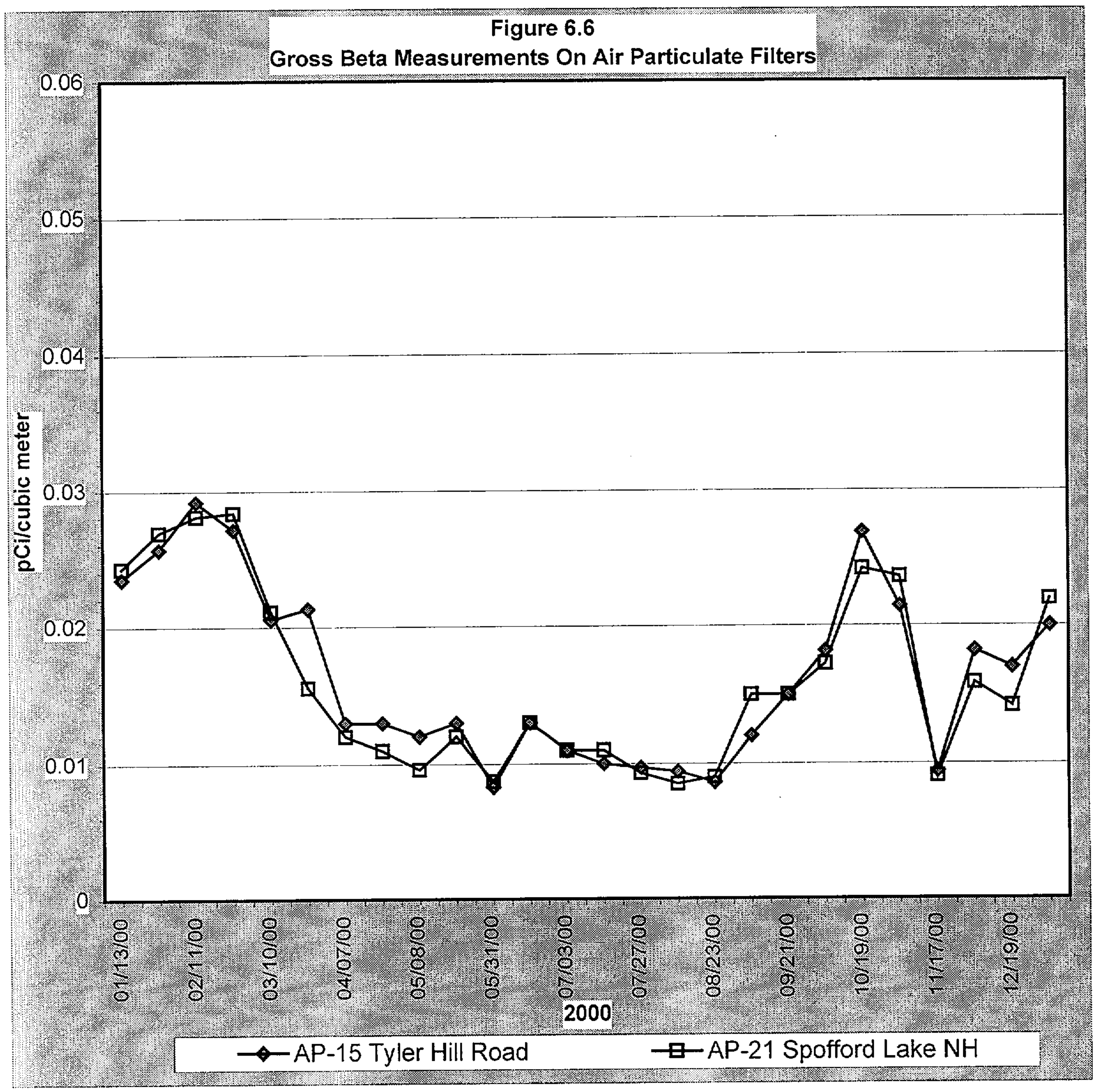


Figure 6.6
Gross Beta Measurements On Air Particulate Filters
0.06
0.05
0.04
0.03
0.02
0.01
0
pCi/cubic meter
01/13/00
02/11/00
03/10/00
04/07/00
05/08/00
05/31/00
07/03/00
07/27/00
08/23/00
09/21/00
10/19/00
11/17/00
12/19/00
2000
AP-15 Tyler Hill Road
AP-21 Spofford Lake NH

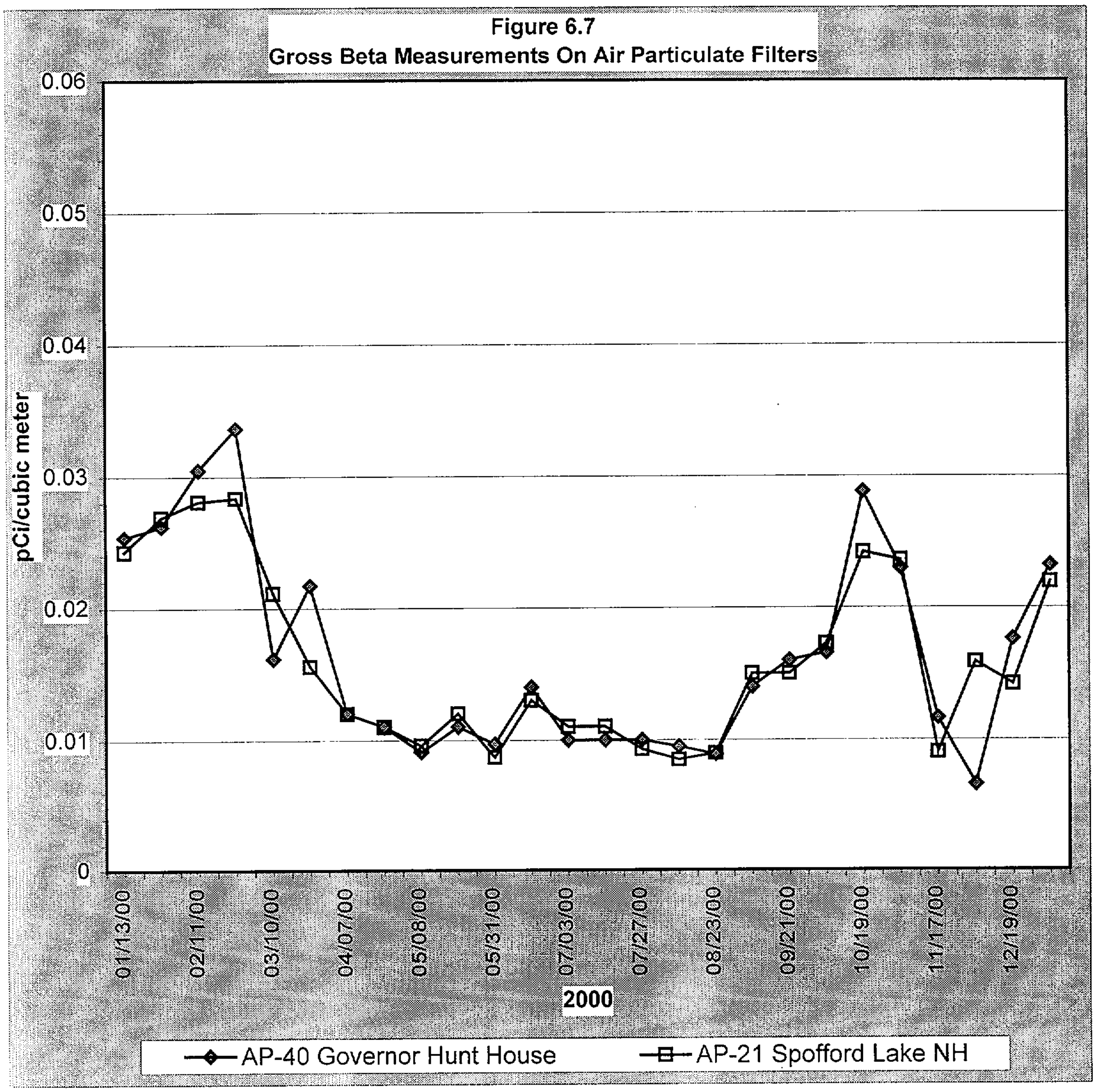


Figure 6.7
Gross Beta Measurements On Air Particulate Filters
pCi/cubic meter
0.06
0.05
0.04
0.03
0.02
0.01
0
01/13/00
02/11/00
03/10/00
04/07/00
05/08/00
05/31/00
07/03/00
07/27/00
08/23/00
09/21/00
10/19/00
11/17/00
12/19/00
2000
AP-40 Governor Hunt House
AP-21 Spofford Lake NH

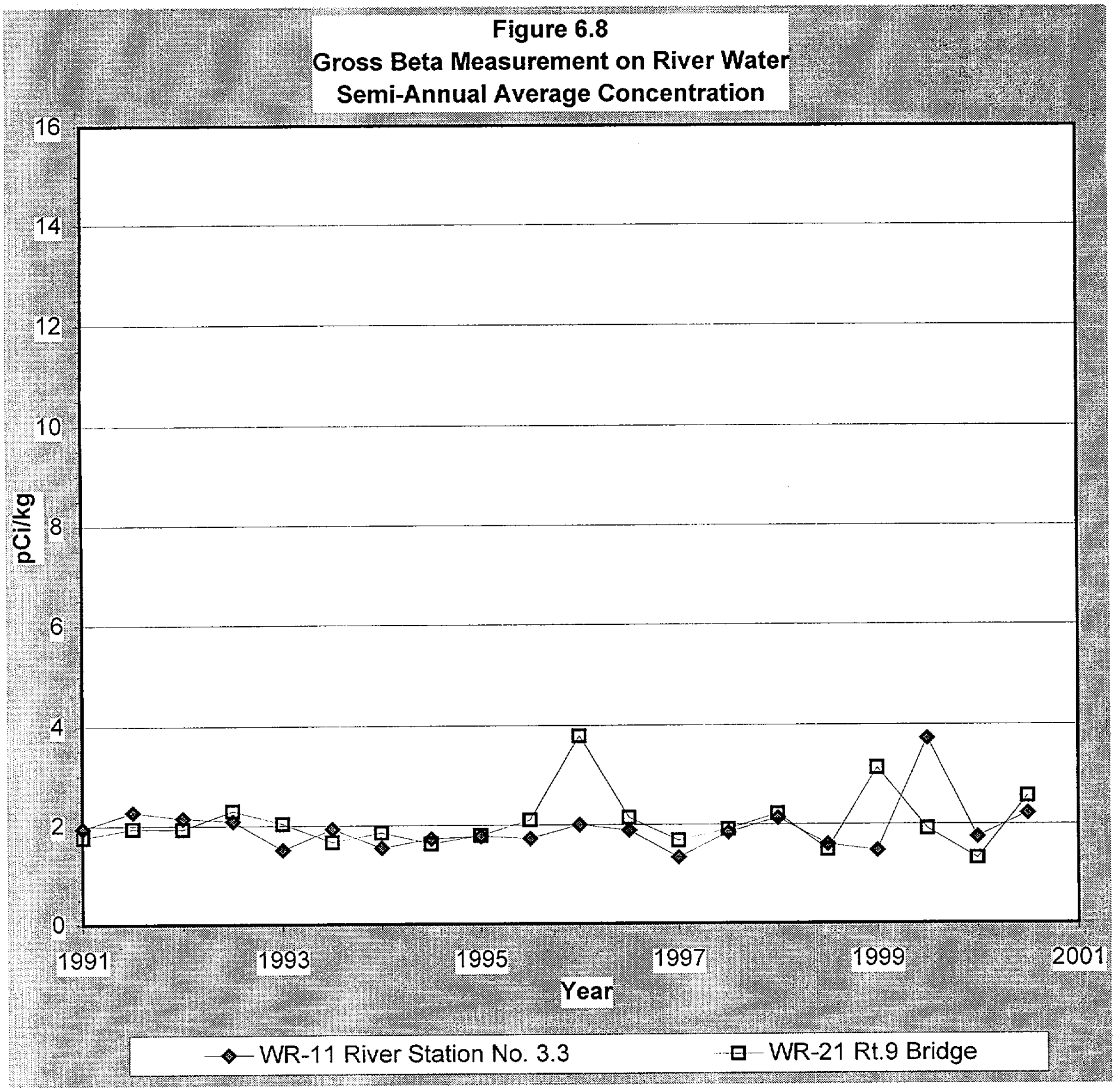


Figure 6.8
Gross Beta Measurement on River Water
Semi-Annual Average Concentration
16
14
12
10
8
6
4
2
0
pCi/kg
1991
1993
1995
1997
1999
2001
Year
WR-11 River Station No. 3.3
WR-21 Rt.9 Bridge

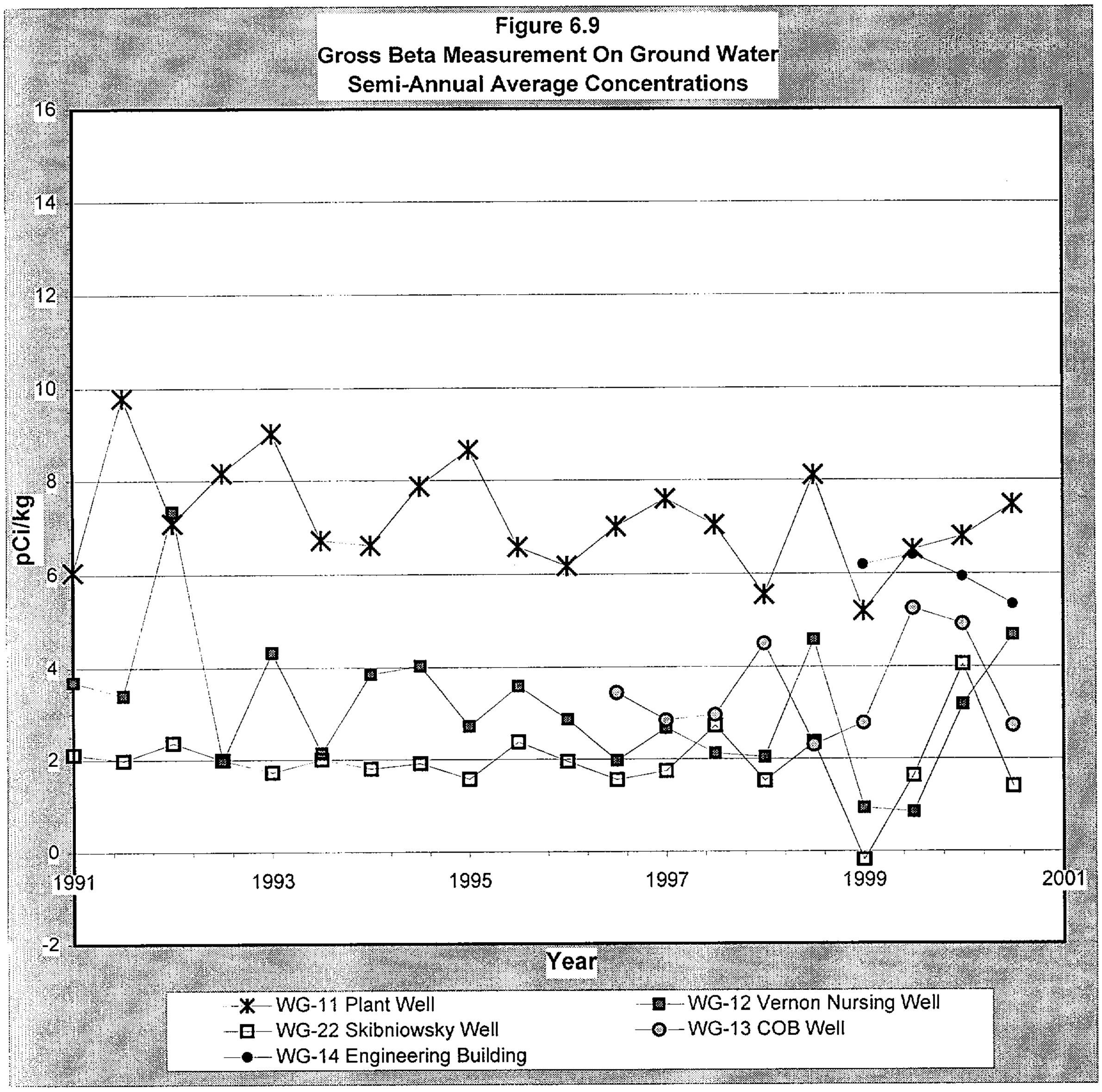


Figure 6.9
Gross Beta Measurement On Ground Water
Semi-Annual Average Concentrations
pCi/kg
16
14
12
10
8
6
4
2
0
-2
1991
1993
1995
1997
1999
2001
Year
WG-11 Plant Well
WG-12 Vernon Nursing Well
WG-22 Skibniowsky Well
WG-13 COB Well
WG-14 Engineering Building

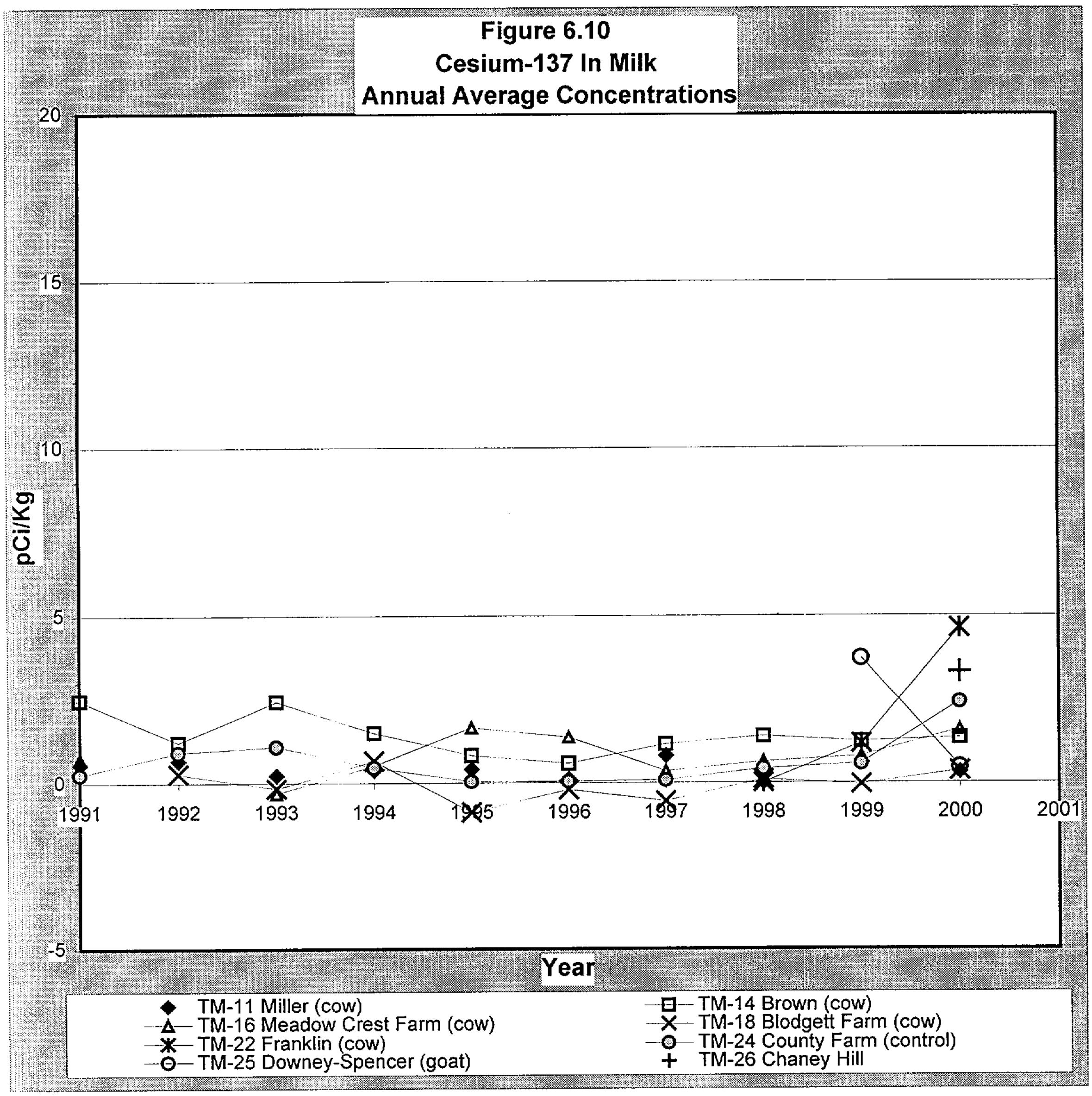


Figure 6.10
Cesium-137 In Milk
Annual Average Concentrations
pCi/Kg
20
15
10
5
0
-5
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
Year
TM-11 Miller (cow)
TM-14 Brown (cow)
TM-16 Meadow Crest Farm (cow)
TM-18 Blodgett Farm (cow)
TM-22 Franklin (cow)
TM-24 County Farm (control)
TM-25 Downey-Spencer (goat)
TM-26 Chaney Hill

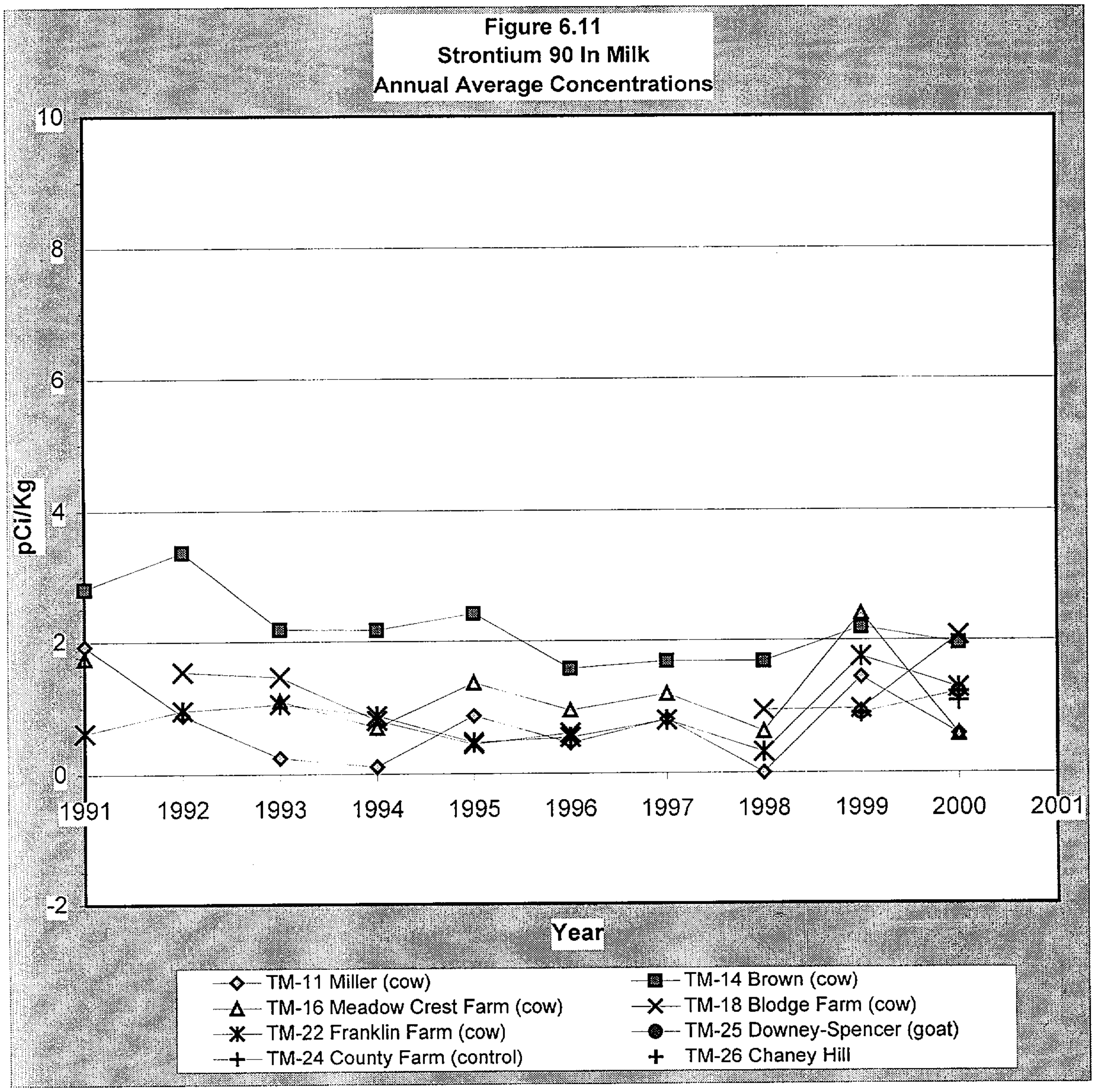


Figure 6.11
Strontium 90 In Milk
Annual Average Concentrations
pCi/Kg
10
8
6
4
2
0
-2
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
Year
TM-11 Miller (cow)
TM-14 Brown (cow)
TM-16 Meadow Crest Farm (cow)
TM-18 Blodge Farm (cow)
TM-22 Franklin Farm (cow)
TM-25 Downey-Spencer (goat)
TM-24 County Farm (control)
TM-26 Chaney Hill

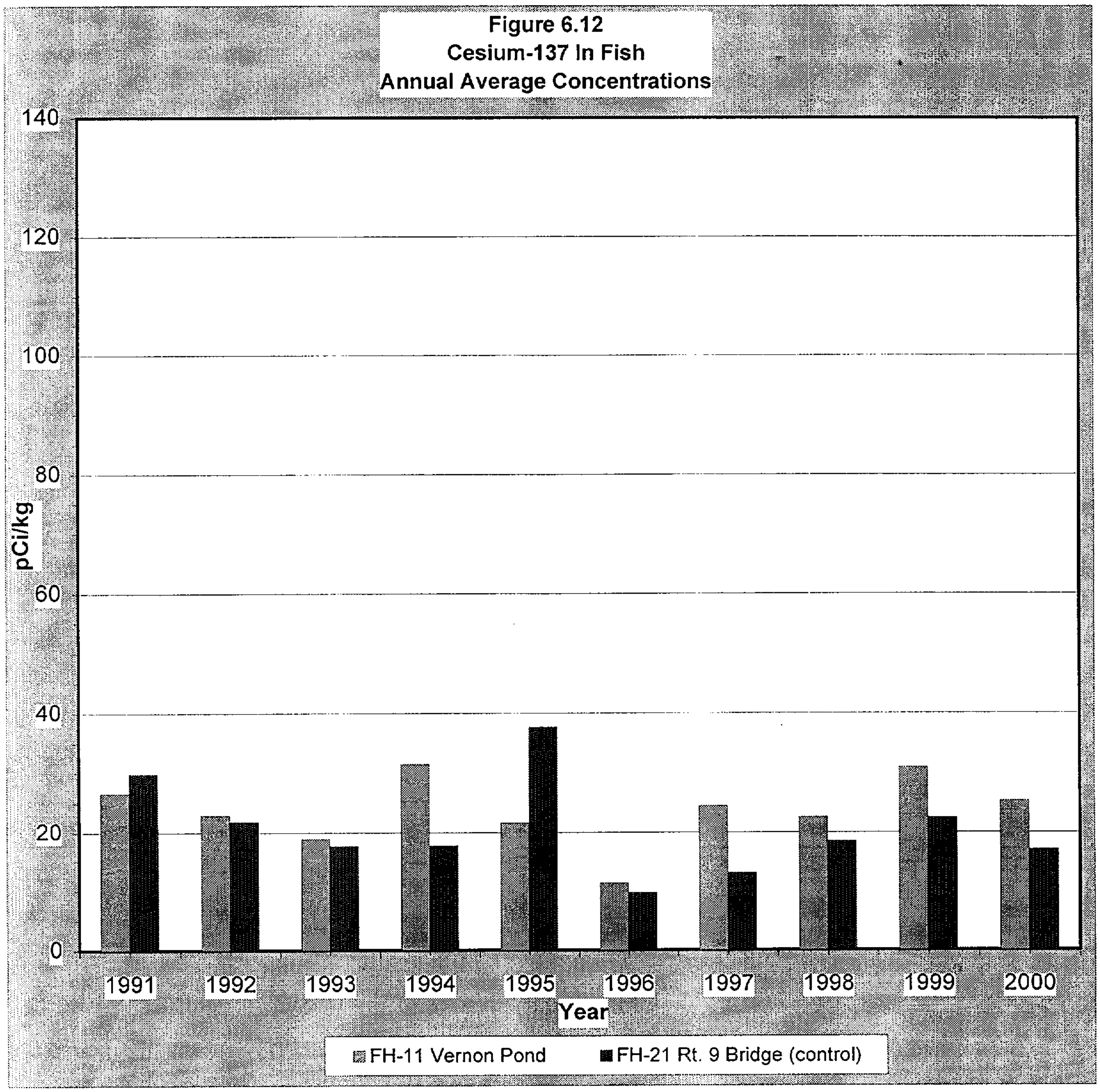
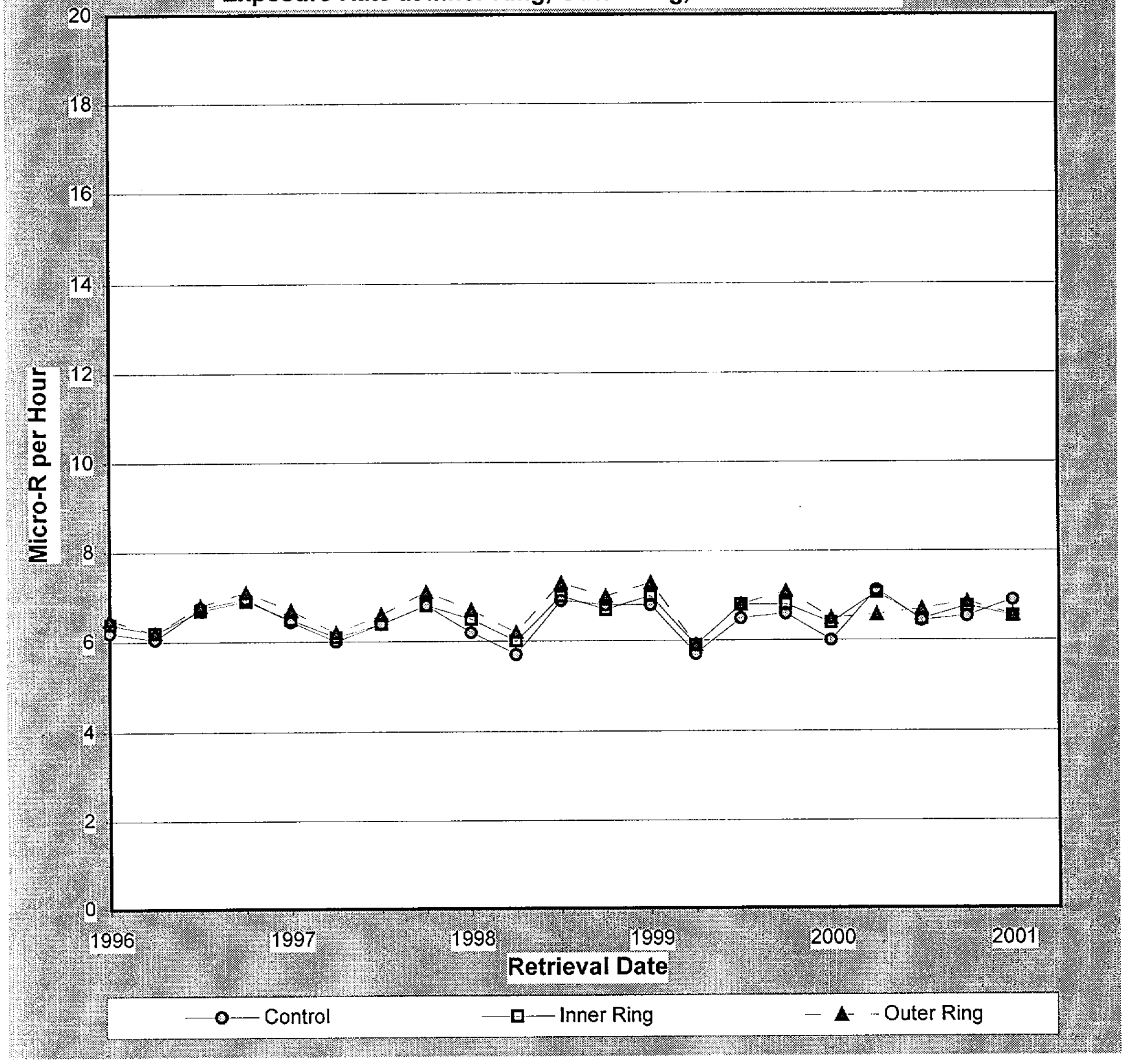


Figure 6.12
Cesium-137 In Fish
Annual Average Concentrations
pCi/kg
140
120
100
80
60
40
20
0
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
Year
FH-11 Vernon Pond
FH-21 Rt. 9 Bridge (control)

Figure 6.13
Exposure Rate at Inner Ring, Outer Ring, and Control TLDS



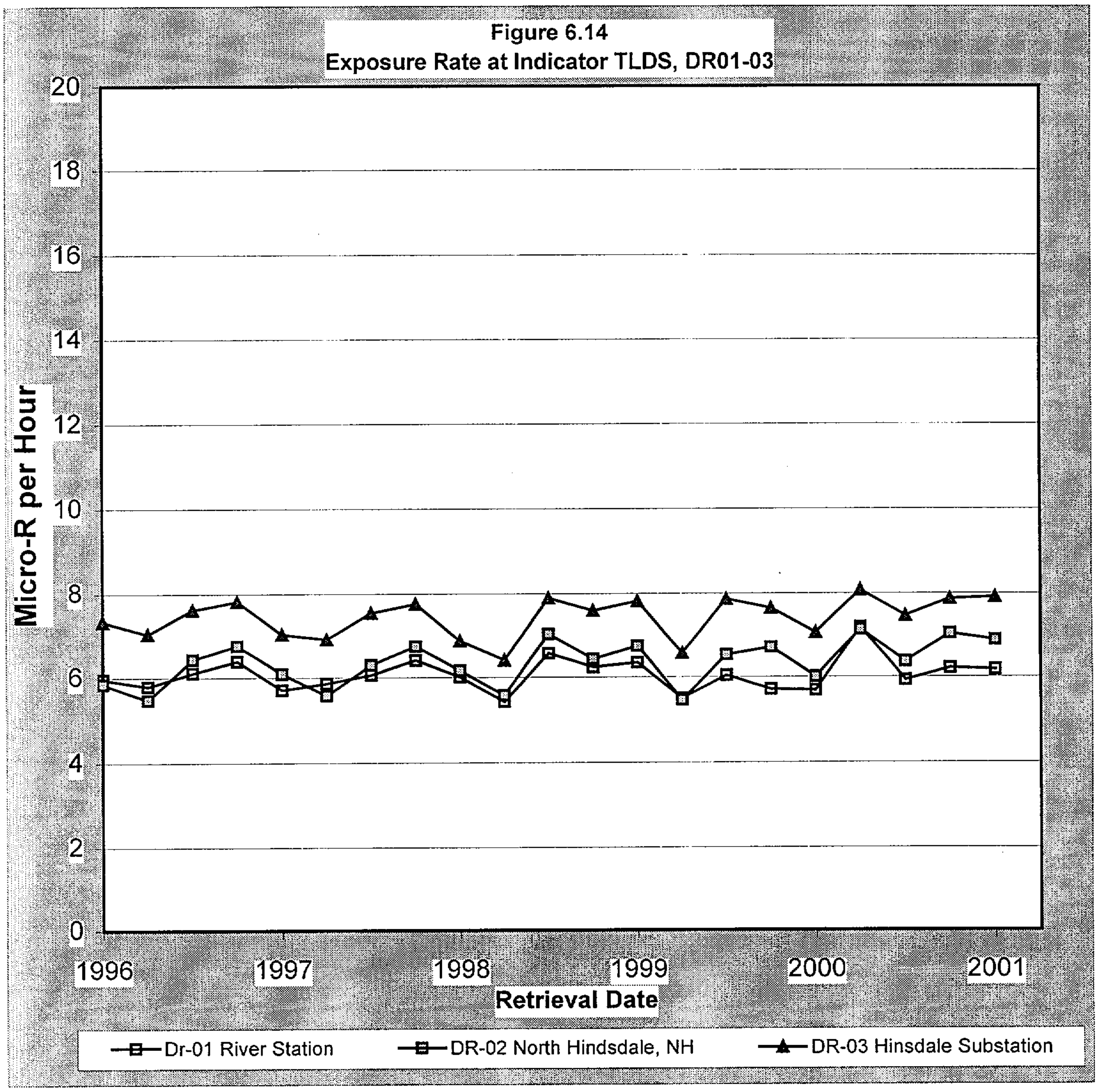


Figure 6.14
Exposure Rate at Indicator TLDS, DR01-03
Micro-R per Hour
20
18
16
14
12
10
8
6
4
2
0
1996
1997
1998
1999
2000
2001
Retrieval Date
Dr-01 River Station
DR-02 North Hindsdale, NH
DR-03 Hinsdale Substation

Figure 6.15
Exposure Rate at Indicator TLDS, DR 06,50

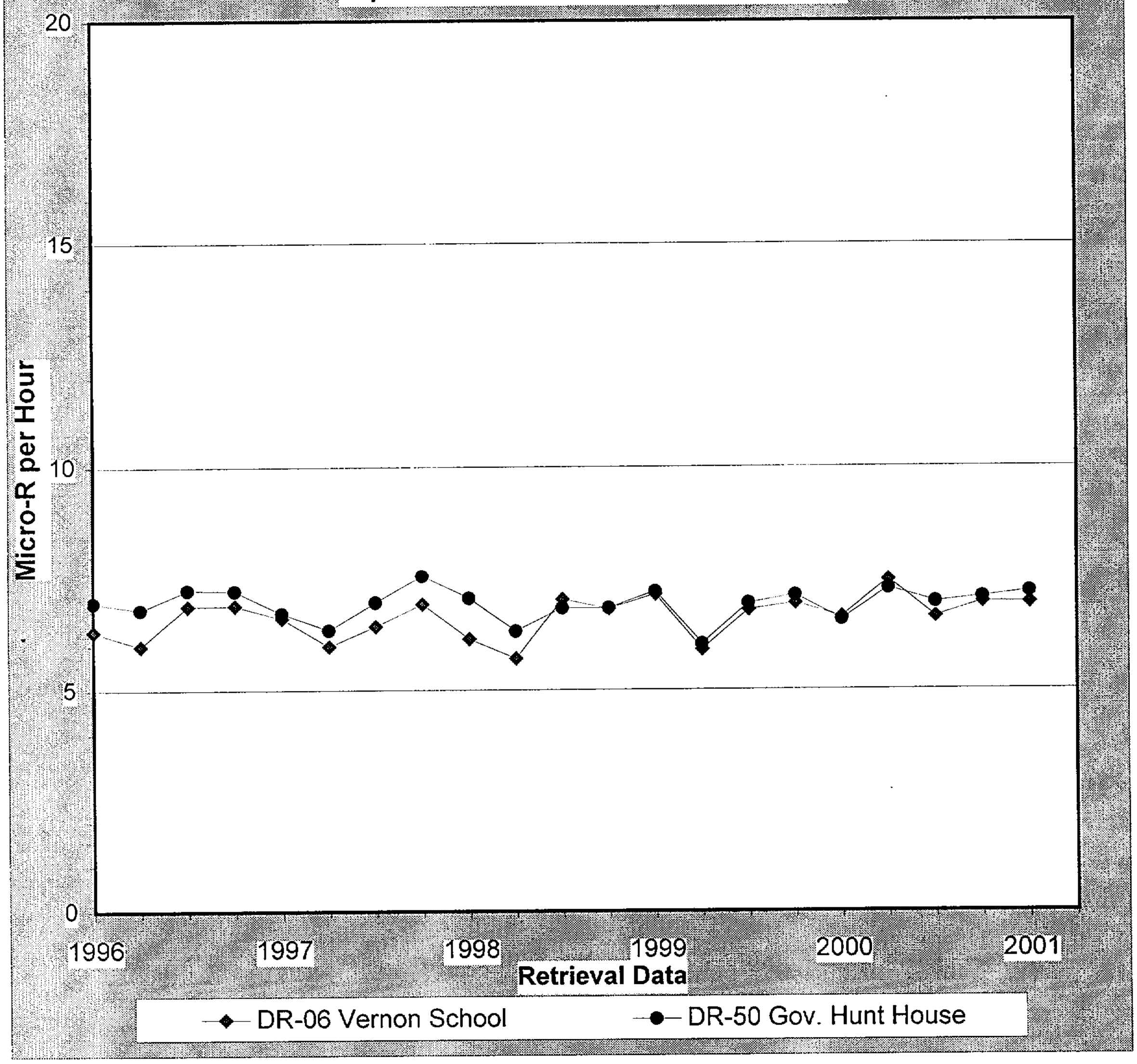
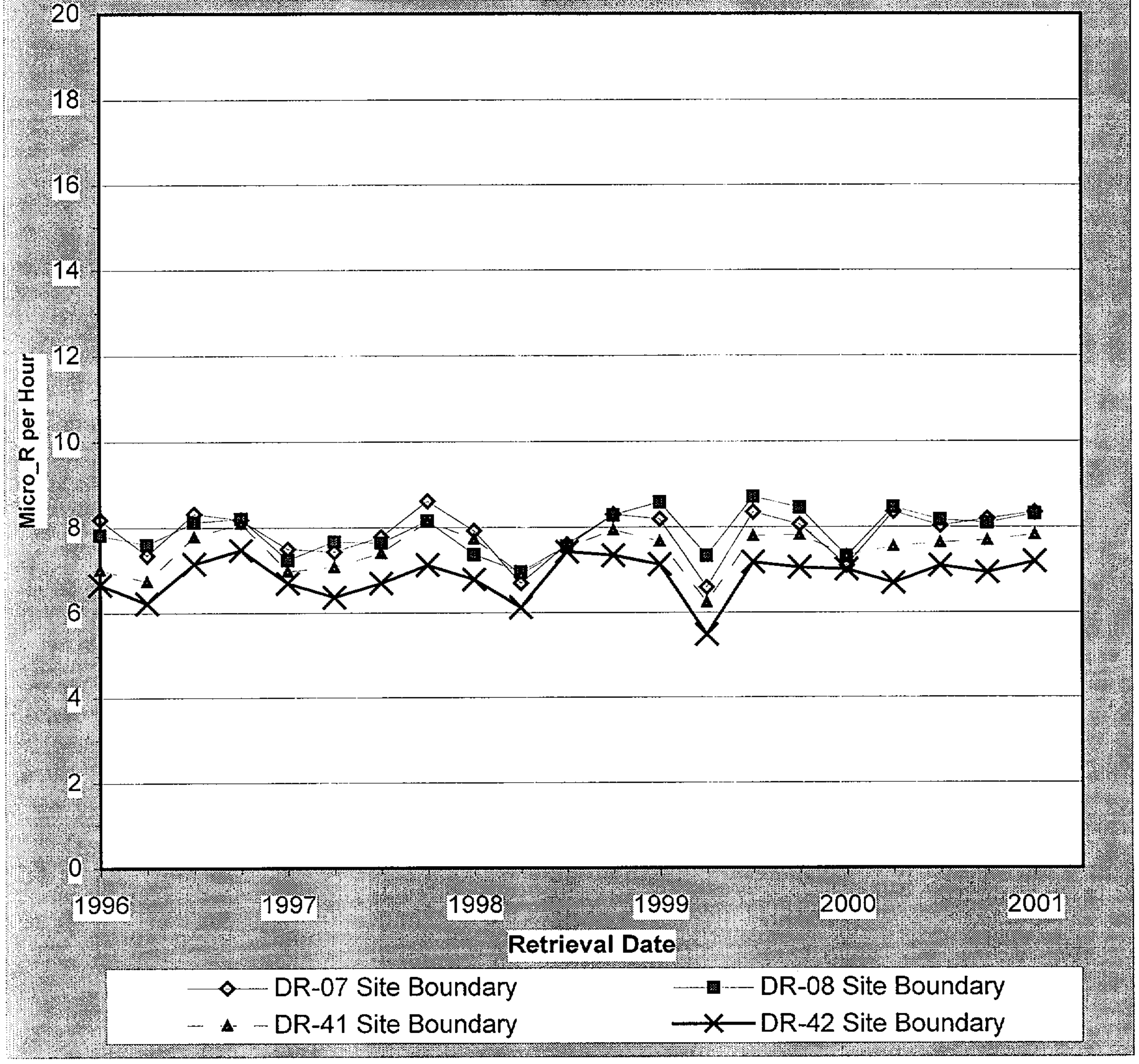


Figure 6.16
Exposure Rate at Site Boundry TLDS,DR 07 - 08, 41 - 42



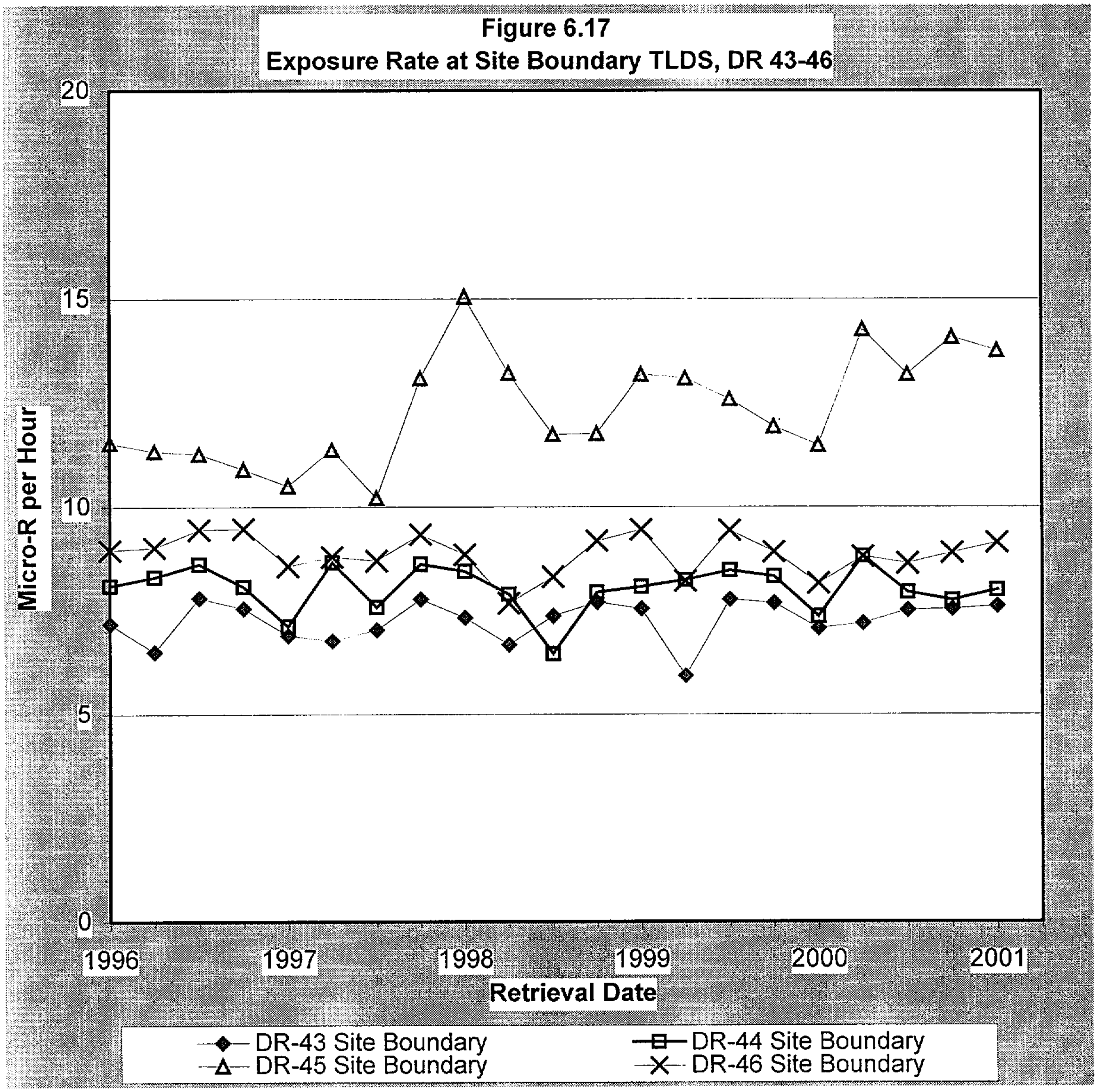


Figure 6.17
Exposure Rate at Site Boundary TLDS, DR 43-46
Micro-R per Hour
20
15
10
5
0
1996
1997
1998
1999
2000
2001
Retrieval Date
DR-43 Site Boundary
DR-44 Site Boundary
DR-45 Site Boundary
DR-46 Site Boundary

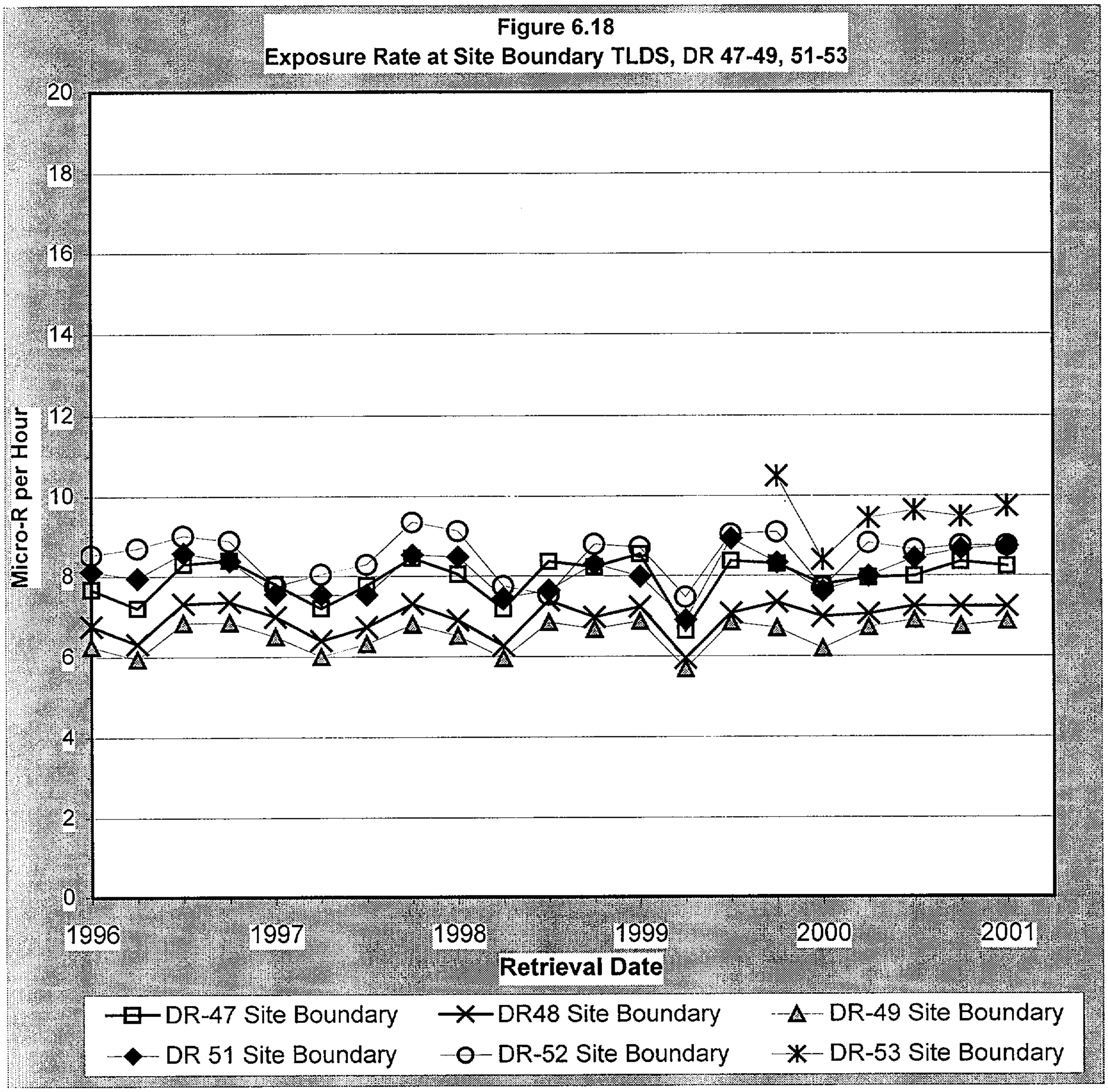
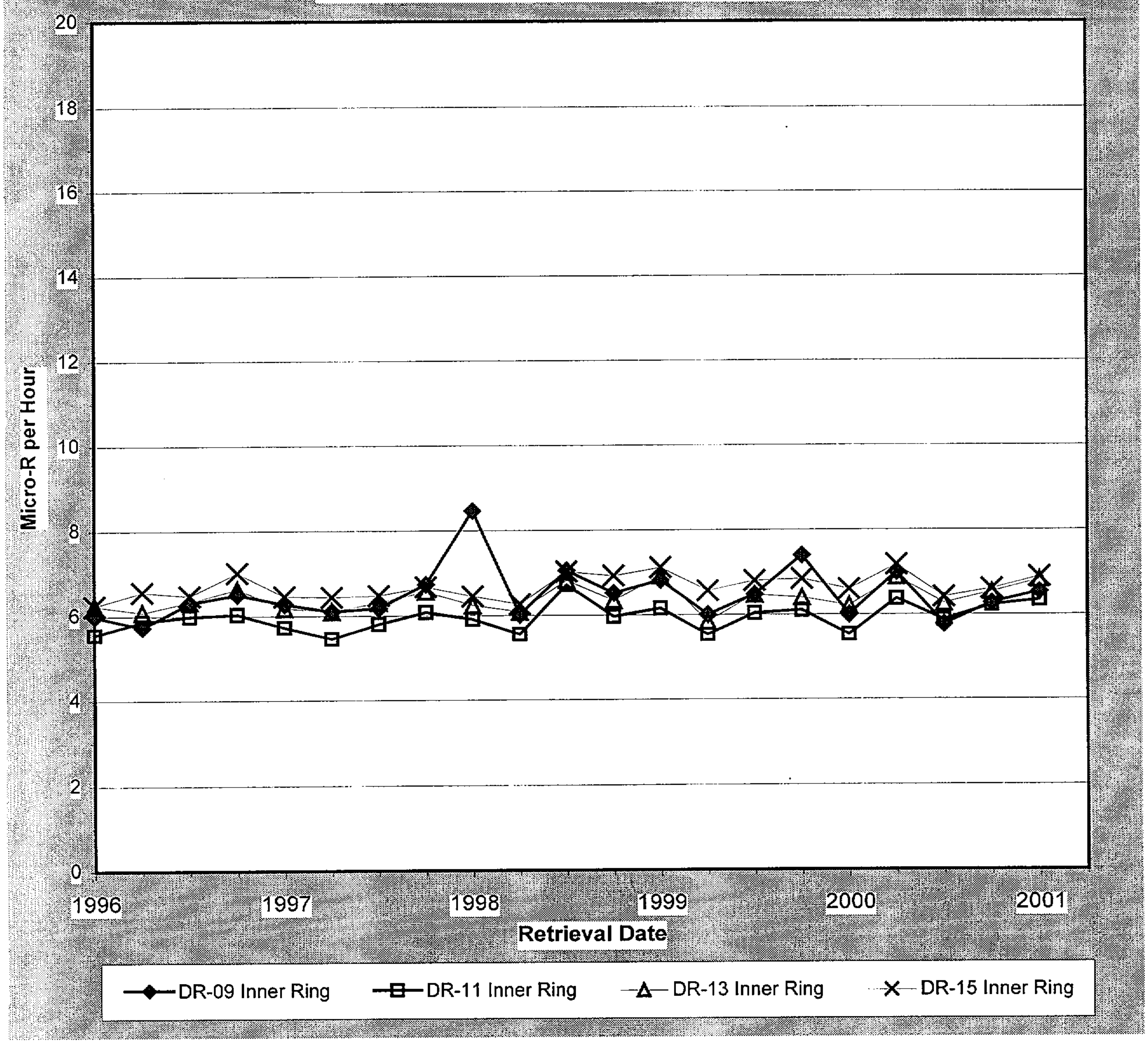


Figure 6.18
Exposure Rate at Site Boundary TLDS, DR 47-49, 51-53
Micro-R per Hour
20
18
16
14
12
10
8
6
4
2
0
1996
1997
1998
1999
2000
2001
Retrieval Date
DR-47 Site Boundary
DR48 Site Boundary
DR-49 Site Boundary
DR 51 Site Boundary
DR-52 Site Boundary
DR-53 Site Boundary

Figure 6.19
Exposure Rate at Inner Ring TLDS, DR 09-15(odd)



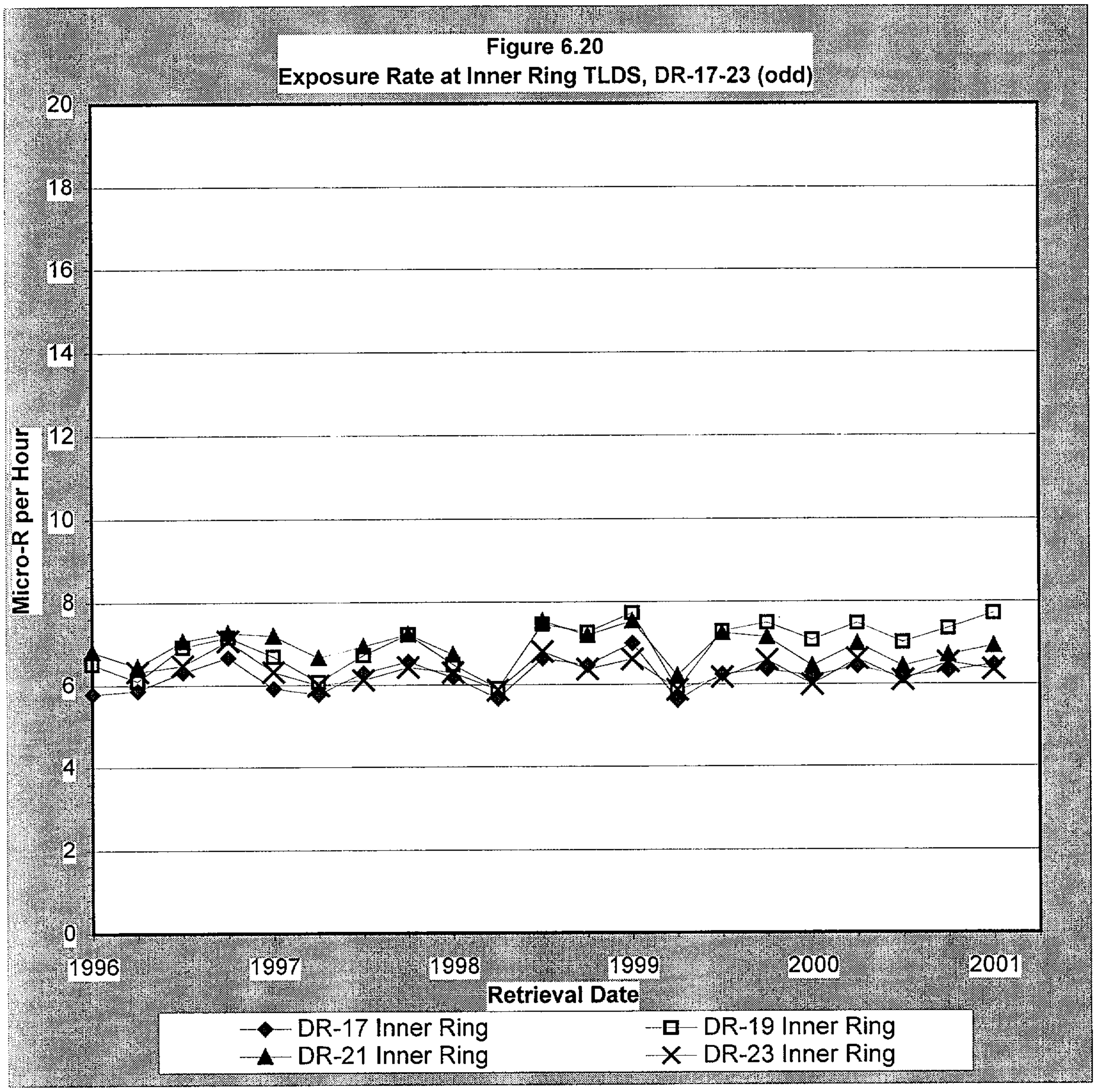
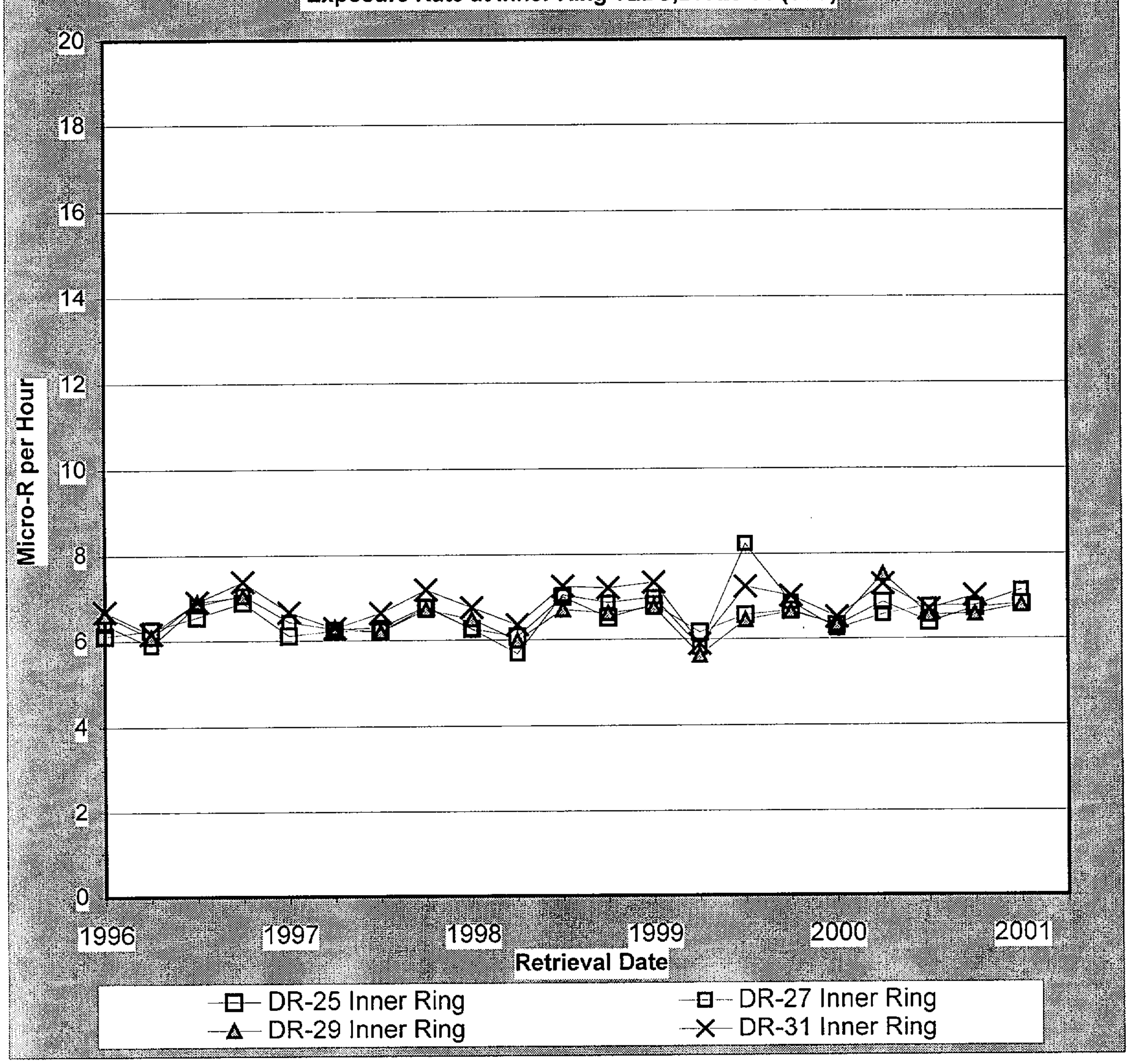


Figure 6.20
Exposure Rate at Inner Ring TLDS, DR-17-23 (odd)
Micro-R per Hour
0
2
4
6
8
10
12
14
16
18
20
1996
1997
1998
1999
2000
2001
Retrieval Date
DR-17 Inner Ring
DR-19 Inner Ring
DR-21 Inner Ring
DR-23 Inner Ring

Figure 6.21
Exposure Rate at Inner Ring TLDS,DR 25-31 (odd)



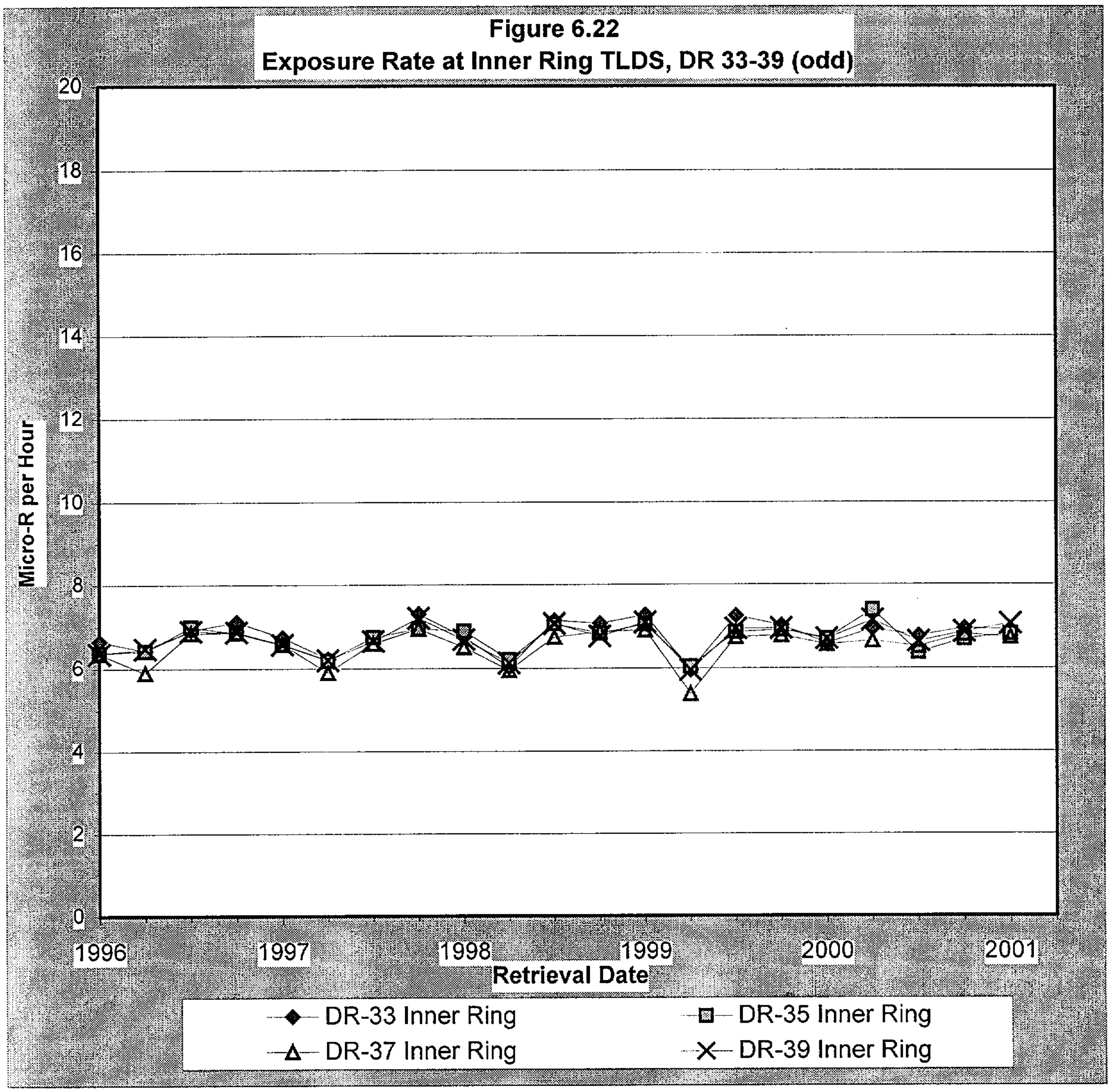


Figure 6.22
Exposure Rate at Inner Ring TLDS, DR 33-39 (odd)
Micro-R per Hour
20
18
16
14
12
10
8
6
4
2
0
1996
1997
1998
1999
2000
2001
Retrieval Date
DR-33 Inner Ring
DR-35 Inner Ring
DR-37 Inner Ring
DR-39 Inner Ring

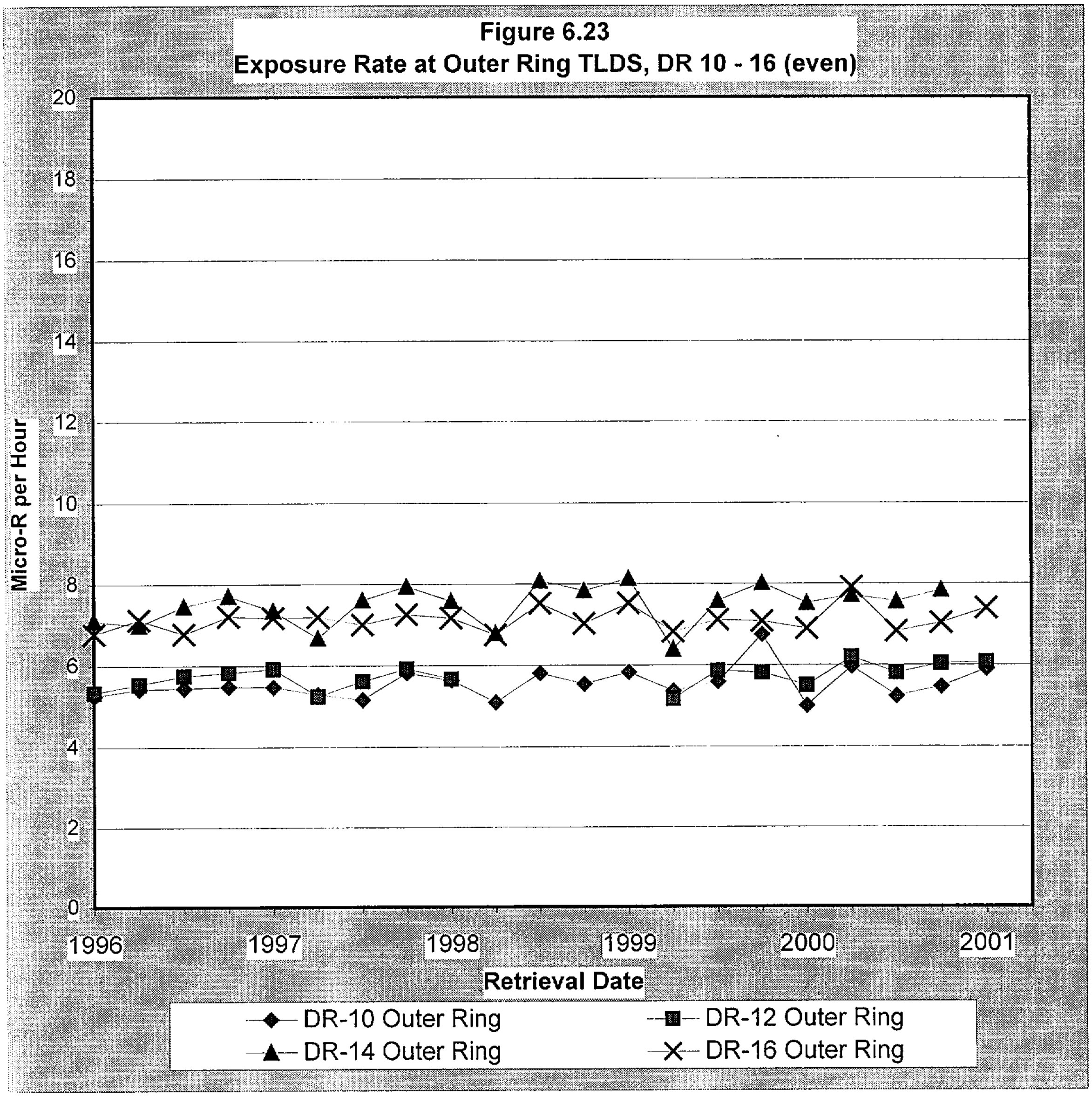


Figure 6.23
Exposure Rate at Outer Ring TLDS, DR 10 - 16 (even)
20
18
16
14
12
10
8
6
4
2
0
Micro-R per Hour
1996
1997
1998
1999
2000
2001
Retrieval Date
DR-10 Outer Ring
DR-12 Outer Ring
DR-14 Outer Ring
DR-16 Outer Ring

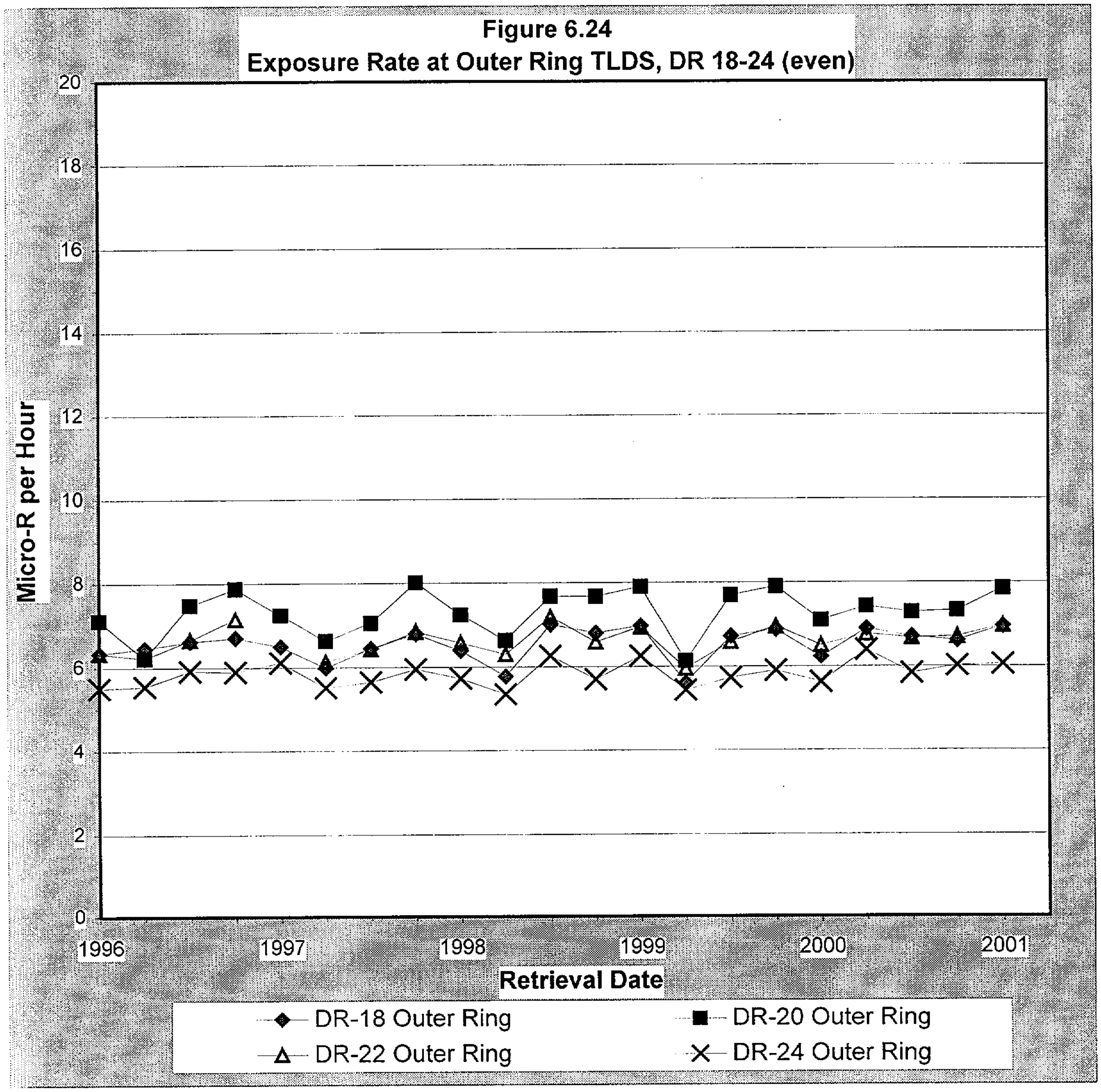


Figure 6.24
Exposure Rate at Outer Ring TLDS, DR 18-24 (even)
Micro-R per Hour
0
2
4
6
8
10
12
14
16
18
20
1996
1997
1998
1999
2000
2001
Retrieval Date
DR-18 Outer Ring
DR-20 Outer Ring
DR-22 Outer Ring
DR-24 Outer Ring

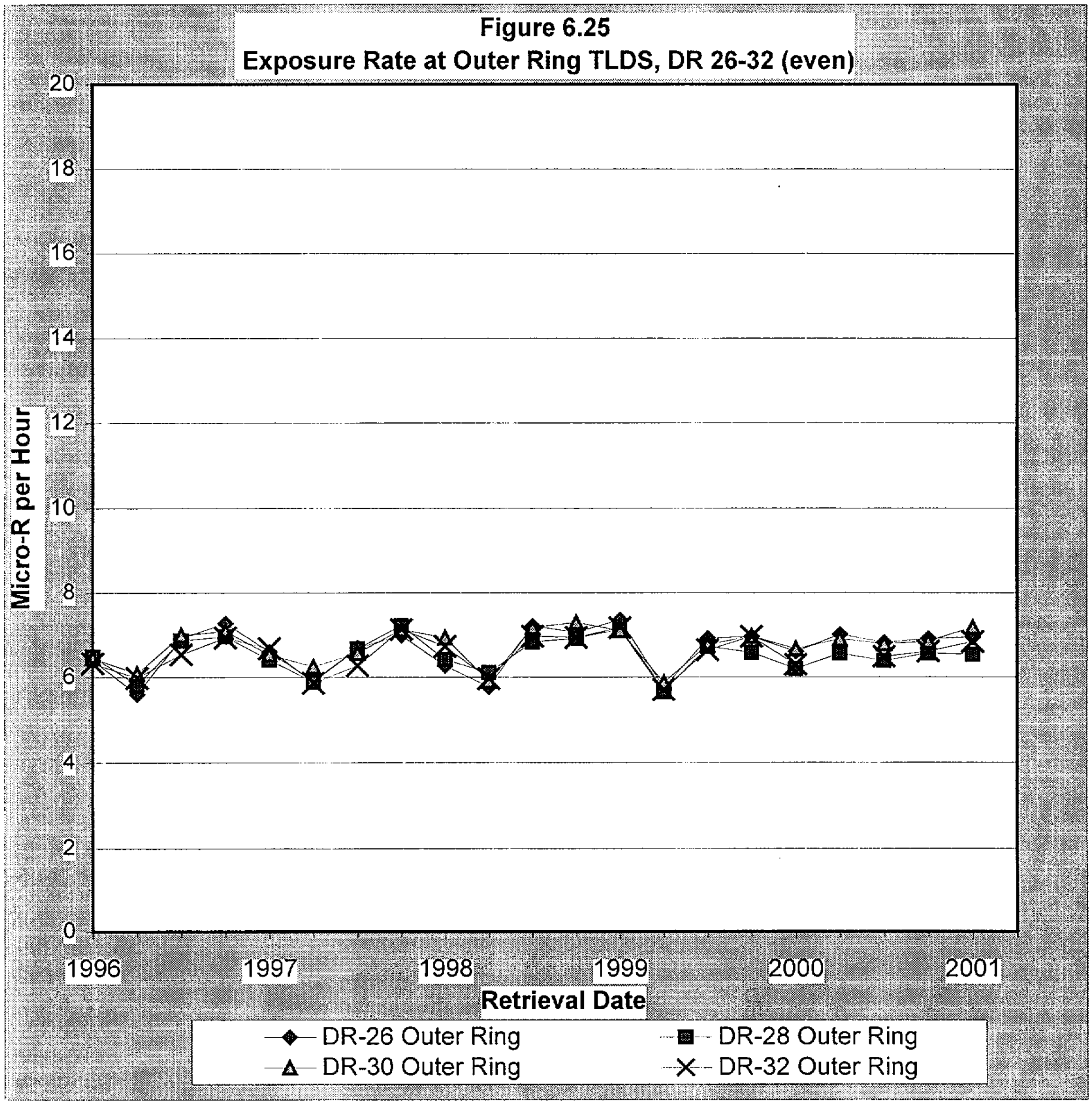
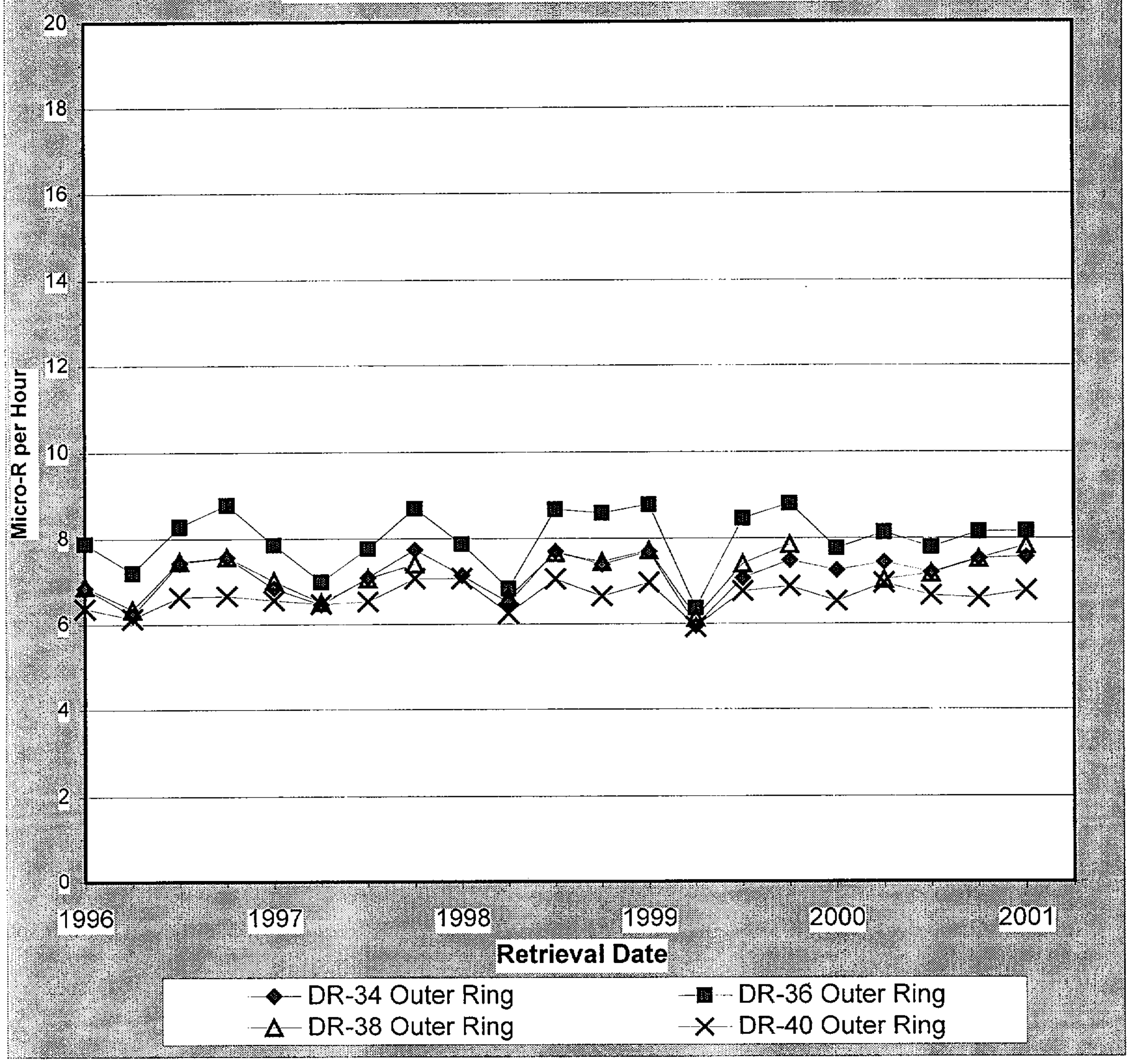


Figure 6.25
Exposure Rate at Outer Ring TLDS, DR 26-32 (even)
Micro-R per Hour
20
18
16
14
12
10
8
6
4
2
0
1996
1997
1998
1999
2000
2001
Retrieval Date
DR-26 Outer Ring
DR-28 Outer Ring
DR-30 Outer Ring
DR-32 Outer Ring

Figure 6.26
Exposure Rate at Outer Ring TLDS, DR 34-40 (even)



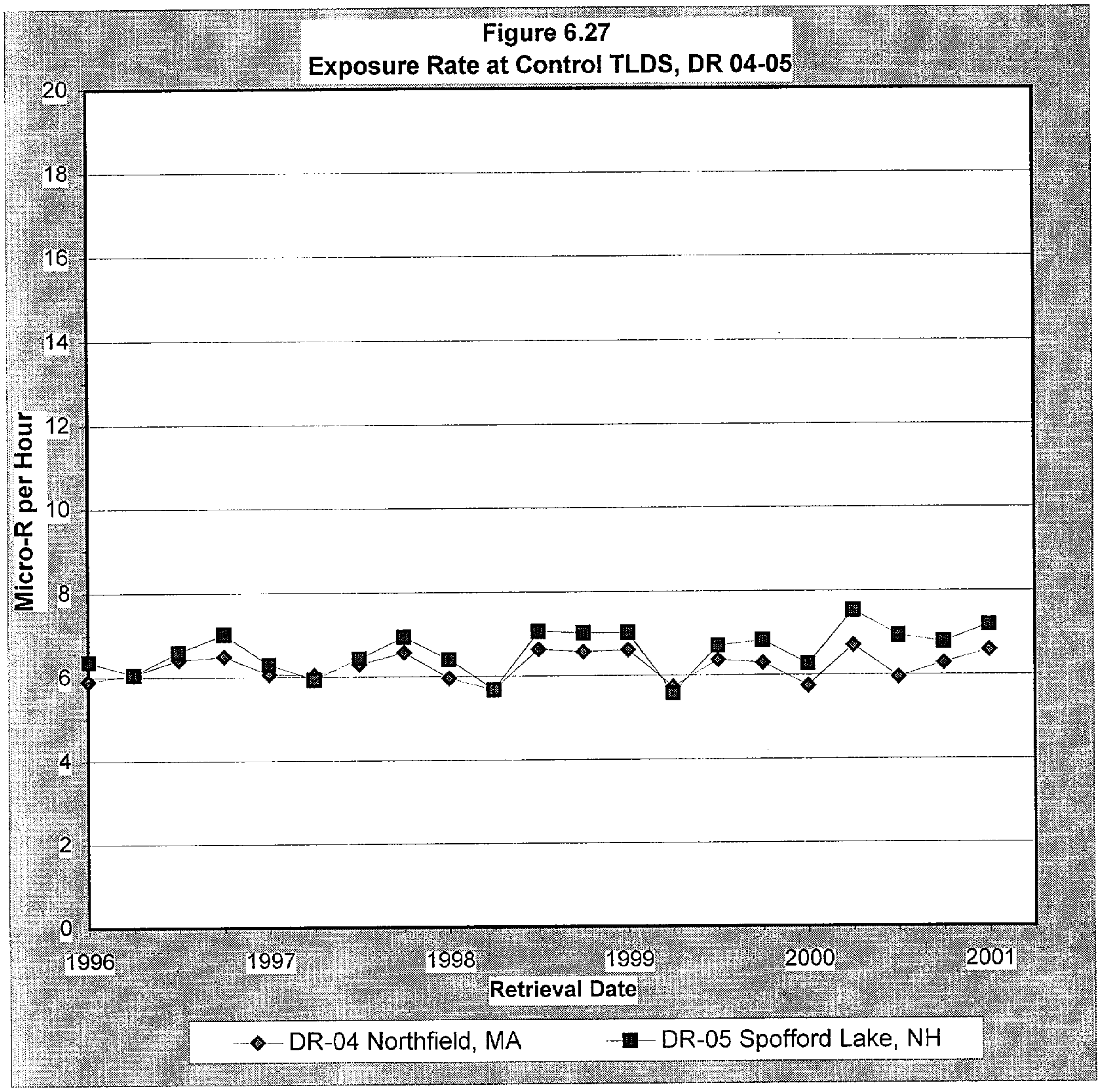


Figure 6.27
Exposure Rate at Control TLDS, DR 04-05
Micro-R per Hour
20
18
16
14
12
10
8
6
4
2
0
1996
1997
1998
1999
2000
2001
Retrieval Date
DR-04 Northfield, MA
DR-05 Spofford Lake, NH

7 QUALITY ASSURANCE PROGRAM

7.1 Duke Engineering and Services Laboratory (DE&S)

The quality assurance program at the Duke Engineering & Services Environmental Laboratory (DESEL) is designed to serve two overall purposes: 1) Establish a measure of confidence in the measurement process to assure the licensee, regulatory agencies and the public that analytical results are accurate and precise; and 2) Identify deficiencies in the sampling and/or measurement process to those responsible for these operations so that corrective action can be taken. Quality assurance is applied to all steps of the measurement process, including the collection, measurement and reporting of data, as well as the record keeping of the final results. Quality control, as part of the quality assurance program, provides a means to control and measure the characteristics of the measurement equipment and processes, relative to established requirements.

The DESEL employs a comprehensive quality assurance program designed to monitor the quality of analytical processing to ensure reliable environmental monitoring data. The program includes the use of controlled procedures for all work activities, a nonconformance and corrective action tracking system, systematic internal audits, audits by external groups, a laboratory quality control program, and a staff training program. Monitoring programs include the Intralaboratory Quality Control Program administered by the Laboratory QA Officer (used in conjunction with the National Institute of Standards and Technology Measurement Assurance Program, NIST MAP) and a third party interlaboratory program administered by Analytics, Inc. Together these programs are targeted to supply QC/QA sources at 5% of the client sample analysis load. In addition the Laboratory Quality Control Audit Committee administers a blind duplicate program conducted through client environmental monitoring programs.

This summary reports all interlaboratory known values or intralaboratory results received by DESEL on or before December 31, 2000.

7.1.1 Intralaboratory Quality Control Program

The DESEL QA Officer administers an extensive intralaboratory quality control program in which process check samples are submitted for analysis. These samples are submitted either in duplicate to evaluate the precision of a measurement process or are "spiked" with a known amount of radioactive material to assess the bias in the measurement. Table 7.1 contains the summary of the process check results for January to December 2000. Of the analyses, 99% passed the bias criteria and 100% of the results evaluated for precision were acceptable.

7.1.2 Third Party Intercomparison Program

The DESEL participates in a third party intercomparison program managed by Analytics Inc. to satisfy the requirement of the Environmental Technical Specification/ODCM. The DESEL Analytics program was originally used to augment the EPA Intercomparison Program that it now replaces. The current program is designed to be comparable to the pre-1996 EPA PE Program in terms of the number of samples, matrices and nuclides. The results for the 4th quarter 1999 through the 3rd quarter 2000 are *summarized in Table 7.2. Each sample is analyzed in triplicate and the results are evaluated against the acceptance criteria described in the DESEL Manual 100-Laboratory Quality Assurance Plan. The DESEL acceptance criteria is summarized at the end of Table 7.2. This acceptance protocol is used for all interlaboratory programs with no pre-set acceptance criteria. When results fall outside of the acceptance criteria, an investigation is initiated to determine the cause of the problem and if appropriate, corrective measures are taken.*

Four Analytics results fell in the 'non-agreement' category and were under investigation for their failure at the time of this report.

7.1.3 *Blind Duplicate Program*

The Laboratory Quality Control Audit Committee (LQCAC) is comprised of representatives from several New England DESEL clients. Two of the primary functions of the LQCAC have been to conduct an annual audit of Laboratory operations and to coordinate the Blind Duplicate Quality Assurance Program. Under the Blind Duplicate Quality Assurance Program, samples are split from homogeneous environmental media by the client and sent to the DESEL for analysis. They are "blind" in that the identification of the matching sample is not identified to the Laboratory. The LQCAC analyses the results of the paired analyses to evaluate the precision of the Laboratory measurements.

Participating clients submitted a total of 36 paired samples in 2000. The measurements evaluated include twenty-five gamma emitting radionuclides, H-3, Sr-89, Sr-90, I-131 and gross-beta. All measurements are evaluated, whether the results are statistically positive or not, and whether the net concentration is positive or negative. During 2000, 99.9% of the results passed the acceptance criteria.

The samples submitted as part of this program are listed in Table 7.3.

7.1.4 *Environmental TLD Quality Assurance Program*

Performance documentation of the routine processing of the Panasonic environmental TLDs (thermoluminescent dosimeter) program at the DESEL is provided by the dosimetry quality assurance testing program. This program includes the National Voluntary Laboratory Accreditation Program, independent third party performance testing by Battelle Pacific Northwest Labs and internal performance testing conducted by the Laboratory QA Officer. Under these programs, dosimeters are irradiated to ANSI specified testing criteria and submitted for processing to the Dosimetry Services Group as "unknowns". The bias and precision of TLD processing is measured against this standard and is used to indicate trends and changes in performance. Instrumentation checks, although routinely performed by the Dosimetry Services Group and representing between 5-10% of the TLDs processed, are not presented in this report because they do not represent a true process check sample since the doses are known to the processor.

Seventy-eight performance tests were conducted in 2000 by DESEL and the third party tester. Of these, 100% of the dosimeter evaluations met the acceptance criteria for bias (± 20.1%) and precision (±12.8%). Third Party QC results are summarized below.

Dosimeter Type	*Number Tested*	*Shallow (7mg/cm²)*	
		% passed bias criteria	*% passed precision criteria*
Panasonic Environmental	*78*	***100***	***100***

Summary of Third Party Testing

Dosimeter Type	***Exposure Period***	***NVLAB Category***	***Shallow (7mg/cm²)***	
			% (Bias ± SD)	***|B| + S****
Panasonic Environmental	***Q4/1999***	***IV, high energy***	***-15.3 ± 2.5***	***0.173***
"	***Q1/2000***	***IV, high energy***	***0.3 ± 7.3***	***0.076***
"	***Q2/2000***	***IV, high energy***	***4.5 ± 1.2***	***0.058***
"	***Q3/2000***	***IV, high energy***	***-0.3 ± 0.4***	***0.007***

Note: ***Results are expressed as the delivered exposure for environmental TLD. NVLAB Category IV, High energy photons (Cs-137 or Co-60).***

* ***American National Standards Institute (ANSI) Performance Statistic as referenced in the Dosimetry Services Semi-Annual QA Status Report.***

TABLE 7.1

DESEL RESULTS IN THE INTRALABORATORY PROCESS CONTROL PROGRAM

January - December 2000

Media Analysis	Bias Criteria (1) 1	2	3	4	Precision Criteria (2) 1	2	3	4
I. Air Charcoal								
Gamma	47	2	1	0	0	0	0	0
II. Air Filter								
Alpha	1	5	0	0	6	0	0	0
Beta	105	0	0	0	0	0	0	0
Gamma								
III. Milk								
Gamma	3	0	0	0	3	0	0	0
Iodine-LL	3	0	0	0	3	0	0	0
IV. Water								
Gross Alpha	6	2	0	0	5	0	0	0
Gross Beta	5	1	3	4	3	2	0	0
Gamma	7	2	0	0	15	6	6	0
Iodine-LL	4	2	2	0	5	2	1	0
Radium 226	3	2	0	0	3	0	0	0
Radium-228	1	9	2	0	10	0	2	0
Tritium	8	5	0	0	13	0	0	0
Strontium-89	0	0	3	0	1	1	1	0
Strontium-90	1	1	1	0	3	0	0	0
Am-241	0	4	3	0	7	0	0	0
V. Sediment/Soil								
Gamma	0	0	0	0	10	4	0	0
Radium-226	4	2	0	0	3	2	0	0
VI. Vegetation								
Gamma	0	0	0	0	4	0	0	0
Total Number in Range	198	37	15	4	94	17	10	0
% of Total Processed	78	15	6	1	78	14	8	0
Sum of Analyses	254				121			

(1) *Percent Bias Criteria by Bias Category*
Bias Category = 1 > 0% and < = 5%
Bias Category = 2 > 5% and < = 10%
Bias Category = 3 > 10% and < = 15%, or within 2 sigma of known
Gross alpha and beta, Sr 89/90 > 10% and < = 25%
Transuranics > 10% and < = 20%
Bias Category = 4 Outside Criteria

(2) *Percent Precision Criteria by Precision Category*
Precision Category = 1 > 0% and < = 5%
Precision Category = 2 > 5% and < = 10%
Precision Category = 3 > 10% and < = 15%, or within 2 sigma of mean
Precision Category = 4 Outside Criteria

TABLE 7.2

DESEL RESULTS IN THE ANALYTICS INC. CROSS CHECK PROGRAM

Quarter 4, 1999 - Quarter 3, 2000

Sample	Quarter Year	Sample Media	Nuclide	Reported Value *	Known Value *	Ratio DESEL/ Analytics	Evaluation
E1994-162	4th/99	Filter	Sr-89	107	114	0.94	Agreement
			Sr-90	52	54	0.96	Agreement
E1995-162	4th/99	Filter	Gross alpha	19	20	0.95	Agreement
			Gross beta	134	123	1.09	Agreement
E1996-162	4th/99	Water	H-3	6940	8015	0.87	Agreement
E1997-162	4th/99	Milk	I-131LL	77	77	1.00	Agreement
			I-131	76	77	0.99	Agreement
			Ce-141	127	117	1.09	Agreement
			Cr-51	268	322	0.83	Non-agreement
			Cs-134	136	138	0.99	Agreement
			Cs-137	112	106	1.06	Agreement
			Co-58	117	121	0.97	Agreement
			Mn-54	109	111	0.98	Agreement
			Fe-59	113	104	1.09	Agreement
			Zn-65	214	206	1.04	Agreement
			Co-60	155	146	1.06	Agreement
E2127-62	1st/00	Water	I-131LL	77	74	1.04	Agreement
			I-131	70	74	0.95	Agreement
			Ce-141	426	427	1.00	Agreement
			Cr-51	205	238	0.86	Agreement
			Cs-134	135	139	0.97	Agreement
			Cs-137	126	128	0.98	Agreement
			Co-58	46	44	1.05	Agreement
			Mn-54	165	159	1.04	Agreement
			Fe-59	94	92	1.02	Agreement
			Zn-65	191	196	0.97	Agreement
			Co-60	117	116	1.01	Agreement
E2128-162	1st/00	Water	Gross alpha	60	82	0.73	Non-agreement
			Gross beta	223	210	1.06	Agreement
E2129-162	1st/00	Water	U-234	62	57	1.09	Agreement
			U-235	2.5	2.7	0.93	Agreement
			U-238	64	59	1.08	Agreement
			Pu-238	80	73	1.10	Agreement
			Pu-239	69	62	1.11	Agreement
			Ra-226	87	89	0.98	Agreement
			Ra-228	77	66	1.17	Non-agreement

* pCi/Liter (Filters in pCi)

TABLE 7.2

DESEL RESULTS IN THE ANALYTICS INC. CROSS CHECK PROGRAM

Quarter 4, 1999 - Quarter 3, 2000

Sample	Quarter Year	Sample Media	Nuclide	Reported Value *	Known Value *	Ratio DESEL/ Analytics	Evaluation
E2130-162	1st/00	Milk	I-131LL	86	84	1.02	Agreement
			I-131	84	84	1.00	Agreement
			Ce-141	483	460	1.05	Agreement
			Cr-51	279	256	1.09	Agreement
			Cs-134	145	150	0.97	Agreement
			Cs-137	138	138	1.00	Agreement
			Co-58	43	47	0.91	Agreement
			Mn-54	166	171	0.97	Agreement
			Fe-59	103	99	1.04	Agreement
			Zn-65	197	208	0.95	Agreement
			Co-60	124	125	0.99	Agreement
E2131-162	1st/00	Milk	Sr-89	90	90	1.00	Agreement
			Sr-90	57	59	0.97	Agreement
E2214-162	2nd/00	Filter	Ce-141	75	80	0.94	Agreement
E2214-162			Cr-51	242	243	1.00	Agreement
E2214-162			Cs-134	89	105	0.85	Agreement
E2214-162			Cs-137	230	219	1.05	Agreement
E2214-162			Co-58	119	120	0.99	Agreement
E2214-162			Mn-54	143	136	1.05	Agreement
E2214-162			Fe-59	63	58	1.09	Agreement
E2214-162			Zn-65	182	170	1.07	Agreement
E2214-162			Co-60	159	163	0.98	Agreement
E2215-162	2nd/00	Filter	Sr-89	87	109	0.80	Agreement
E2215-162			Sr-90	62	66	0.94	Agreement
E2216-162	2nd/00	Filter	Gross Alpha	25	24	1.04	Agreement
E2216-162			Gross Beta	97	93	1.04	Agreement
E2217-162	2nd/00	Water	H-3	10627	11400	0.93	Agreement
E2218-162	2nd/00	Milk	I-131LL	81	81	1.00	Agreement
E2218-162			I-131	86	81	1.06	Agreement
E2218-162			Ce-141	75	69	1.09	Agreement
E2218-162			Cr-51	236	211	1.12	Agreement
E2218-162			Cs-134	85	91	0.93	Agreement
E2218-162			Cs-137	199	190	1.05	Agreement
E2218-162			Co-58	98	104	0.94	Agreement
E2218-162			Mn-54	122	118	1.03	Agreement

*Units in pCi/Liter

TABLE 7.2

DESEL RESULTS IN THE ANALYTICS INC. CROSS CHECK PROGRAM

Quarter 4, 1999 - Quarter 3, 2000

Sample	Quarter Year	Sample Media	Nuclide	Reported Value *	Known Value *	Ratio DESEL/ Analytics	Evaluation
E2218-162	2nd/00	Milk	Fe-59	52	50	1.04	Agreement
			Zn-65	136	148	0.92	Agreement
			Co-60	151	142	1.06	Agreement
E2359-162	3rd/00	Water	I-131LL	72	75	0.95	Agreement
			I-131	79	75	1.05	Agreement
			Ce-141	192	191	1.00	Agreement
			Cr-51	219	230	0.95	Agreement
			Cs-134	121	128	0.95	Agreement
			Cs-137	225	218	1.03	Agreement
			Co-58	58	60	0.97	Agreement
			Mn-54	92	89	1.04	Agreement
			Fe-59	56	54	1.03	Agreement
			Zn-65	129	134	0.97	Agreement
			Co-60	247	246	1.01	Agreement
E2361-162	3rd/00	Water	Sr-89	90	85	1.06	Agreement
			Sr-90	52	54	0.97	Agreement
E2360-162	3rd/00	Water	Gross Alpha	55	50	1.10	Agreement
			Gross Beta	228	205	1.11	Agreement
E2363-162	3rd/00	Milk	Sr-89	65	74	0.88	Agreement
			Sr-90	41	39	1.06	Agreement
E2362-162	3rd/00	Milk	I-131LL	66	58	1.14	Agreement
			I-131	69	58	1.20	Non-Agreement
			Ce-141	176	164	1.07	Agreement
			Cr-51	195	198	0.99	Agreement
			Cs-134	108	110	0.98	Agreement
			Cs-137	193	188	1.02	Agreement
			Co-58	50	51	0.99	Agreement
			Mn-54	81	77	1.05	Agreement
			Fe-59	50	47	1.06	Agreement
			Zn-65	117	115	1.02	Agreement
			Co-60	212	212	1.00	Agreement

**Units in pCi/Liter*

Bias Acceptance Criteria ± 15%, or as noted below:
Gross alpha and beta, Sr 89/90 ± 25%
Transuranics and Radium ± 20% or,
If known value falls within 2 sigma range acceptance criteria is met

Precision Acceptance Criteria ± 15%, or as noted below:
Gross alpha and beta, Sr 89/90 ± 25%
Transuranics and Radium ± 20%

TABLE 7.3

SUMMARY OF BLIND DUPLICATE SAMPLES SUBMITTED TO THE DESEL

January - December 2000

TYPE OF SAMPLE	NUMBER OF PAIRED SAMPLES SUBMITTED
Milk	10
Ground Water	4
Surface Water	15
Irish Moss	2
Mussels	4
Food Product	1
TOTAL	36

ANALYSIS TYPE	FAILURES / TOTAL ANALYSES
Gamma	1 / 900
Gross Beta	0 / 8
I-131 low level	0 / 10
Sr-89	0 / 4
Sr-90	0 / 4
H-3	0 / 8
TOTAL	1 / 934

7.2 Teledyne Brown Engineering Laboratory (TBE)

The REMP is designed to meet the quality assurance and quality control criteria of Regulatory Guide 4.1.5. To accomplish this, the REMP requires that its analytical contractors meet these criteria also. In-depth audits are performed of the REMP records and activities and the records and activities of its support organizations at least annually by the Supply System Quality Assurance group.

Quality assurance and technical audits of the analytical contractor (Teledyne Brown Engineering) are also conducted periodically to verify their compliance to regulatory and contractual requirements. The adequacy of their quality assurance program is also assessed during the audits.

Intercomparison programs, which involve the comparison of Supply System analytical results of samples containing known concentrations of various radionuclides, to the known values and also with the results reported by other monitoring programs, are a major component of the quality Assurance activities of the REMP. The program participates in the Mixed Analyte Performance Evaluation Program (MAPEP) and Environmental Measurements Laboratory (EML) intercomparison programs. The following sections summarize the quality assurance and quality control aspects of the TLD and analytical components for the year 2000.

7.2.1 Quality Control for the Analytical Program

Quality control for the analytical program involves two components: the quality control activities performed by agencies and the quality control program of Teledyne Brown Engineering. Both of these components are described in the following sections.

7.2.2 Agency Quality Control Activities

TBE has participated in the U.S. Department of Energy's Environmental Measurement Laboratory (EML) Quality Assessment Program since 1987. Since the relocation of our laboratory from Westwood, New Jersey to Knoxville, Tennessee, TBE has had the opportunity to participate in one round of intercomparison studies. Samples of air, water, vegetation, and soil were analyzed. All the results were evaluated, and all were in agreement.

7.2.3 Teledyne Brown Engineering Quality Control Program

The goal of the quality control program at Teledyne Brown Engineering - Environmental Services is to produce analytical results which are accurate, precise and supported by adequate documentation. The program is based on the requirements of IOCFR50, Appendix B, Nuclear

Regulatory Guide 4.15 and the program, as described in Teledyne's Quality Assurance Manual (IWL-0032-395) and Quality Control Manual (IWL-0032-365).

All measuring equipment is calibrated for efficiency at least annually using standard reference material traceable to the National Institute of Standards and Technology (NIST). For alpha and beta counting, check sources are prepared and counted each weekday the counter is in use. Control charts are maintained with three-sigma limits specified. Backgrounds are usually measured at least once per week.

The gamma spectrometers are calibrated annually with an NIST-traceable standard reference material selected to cover the energy range of the nuclides to be monitored for all of the geometries measured. Backgrounds are determined every other week and check sources are counted weekly. The energy resolution and efficiency are plotted at two energy levels (59.5 and 1332 KeV) and held within three-sigma control limits.

The efficiency of the liquid scintillation counters is determined at least annually by counting NIST traceable standards that have been diluted in a known amount of distilled water and various amounts of quenching agent. The background of each counter is measured with each batch of samples. A control chart is maintained for the background and check source measurements as a stability check.

Results are reviewed before being entered into the data system by the Quality Assurance and/or the Department Manager for reasonableness of the parameters (background, efficiency, decay, etc.). Any results that are suspect, being higher or lower than results in the past, are returned to the laboratory for recount. If a longer count, decay check, recount on another system or recalculation does not give acceptable results based on experience, a new aliquot is analyzed. The complete information about the sample is contained on the worksheets accompanying the sample results, and is filed with the project records at the TBE facility in Knoxville.

Teledyne Brown also participates in the Analytics and Environmental Resource Associates (ERA) Inter-laboratory Comparison Program to the fullest extent possible. Teledyne purchases comparable spiked samples from each of these suppliers. Due to the relocation, delays in scheduling some of the analysis of these samples were experienced. This is due to having some of these samples subcontracted to our support services laboratories. All possible efforts have been made to make all data available.

Teledyne Brown quality control data results have been transmitted electronically. No deviations from written procedures occurred during 2000 as related to the analysis of these samples. A summary of the quality control blank and spiked sample results follows.

Iodine-131 Cartridges

A blank charcoal filter was analyzed with each group of samples assayed. Twenty-two blanks were analyzed in 2000. The average activity was less than 2.3 ± E 00 total pCi. Activities were calculates without considering detection limits. These are acceptable results.

Gross-Beta - Filters

One blank filter was measured with each set of Filters assayed. Forty- one blanks were counted for2000. The average activity was 1.0 ± 0.2 E-1 total pCi, which indicated a relatively stable background for the filter and the gross beta proportional counters. These are acceptable results.

1-131 - Milk

A blank milk was analyzed with each group of these type samples assayed. The results showed that there was no contamination in the laboratory or counting area. The measurements of the blank samples indicated that there was no bias on the low background counters. The average activity for fifty-one samples in 2000 was less than 2 ± 9.8 E-00 pCi/liter without considering detection limits. These results are consistent with historic values, and are determined to be acceptable.

Sr-90 - Milk and Water

Thirty-five blank water samples were analyzed during 2000. The average result, without considering the detection limits, was less than 2 ± 1.9 E-1 pCi/liter. Eleven spiked water samples were analyzed during 2000. The average value of the samples was 3.4 ± 0.4 E+1 pCi/l compared with a spike level of 3.5 ± 0.6 E+1 pCi/l. During 2000, a total of thirty-six spiked milk samples were analyzed. The average value of the samples was 3.2 ± 0.9 E+1 pCi/l compared with a spike value of 3.5 ± 0.6 E+1 pCi/l. These results were within the limits as specified by the TBE QA program criteria. Ten blank milk samples were analyzed with an average activity of 6.6 ± 2.9 E-1 pCi/l of Sr-90, which is consistent with the natural content of milk.

Gross Beta - Water

Forty-one blanks were prepared from distilled water. The average result without considering detection limits for 2000 was 1.3 ± 3.7 E-1 pCi/l. Thirty-seven gross beta samples with a spike level of 2.2 ± 0.7 E+1 pCi/l were analyzed during 2000. The average result was 2.1 ± 0.3 E+1 pCi/l. The results were well within the guidelines outlined in Table 2 of the document, "Environmental Radioactivity Laboratory Intercomparison Studies Program," EPA-600/4-81-004.

Tritium in Water

Thirteen blank samples were analyzed during 2000. The average result, without considering detection levels, was 1.0 ± 6.9 E+1 pCi/l. Thirteen tritium samples with a spike level of 1.7±0.5E+03 pCi/l were analyzed by liquid scintillation counting during 2000. The average result was 1.5 ± 0.2 E+03 pCi/l. The results were well within the guidelines outlined in Table 2 of the document, "Environmental Radioactivity Laboratory Intercomparison Studies Program," EPA-600/4-81-004.

Miscellaneous Quality Control Samples

In the year 2000, blanks and spikes have analyzed for americium-241, carbon- 14, iron-55, gross alpha, nickel-59/63, neptunium-237, lead-210, plutonium-238/239/240 and 41, radium-226/228, technetium -99, thorium- 228/229 and 230, and uranium -234, 235 and 238. Over 875 blanks and 693 spikes were analyzed for these parameters as well. A QC review of these results indicated that the data was consistent with historic levels, and that no corrective action initiation was warranted.

TABLE 7.4
TBE Results in the Analytics Inc. Cross Check Program

Sample Date	Media	Nuclide	Teledyne Brown Engineering Result (a)	Analytics Result	Ratio (b)
03/20/00	Milk	I-131	18 ± 1	20 ± 1	0.90
		Cr-51	381± 38	387 ± 19	0.98
		Cs-134	132 ± 13	143 ± 7	0.92
		Cs-137	128 ± 13	114 ± 6	1.12
		Co-58	89 ± 9	79 ± 4	1.13
		Mn-54	195 ± 20	176 ± 9	1.11
		Fe-59	161 ± 16	144 ± 7	1.12
		Zn-65	171 ± 17	165 ± 8	1.04
		CO-60	179 ± 18	176 ± 9	1.02
03/20/00	Milk	Sr-89	13 ± 3	25 ± 1	0.52 (c)
		Sr-90	16 ± 1	19 ± 1	0.84
06/19/00	Air Filter	Ce-141	143 ± 8	132 ± 7	1.08
		Cr-51	229 ± 17	198 ± 10	1.16
		Cs-134	74 ± 4	81 ± 4	0.91
		Cs-137	143 ± 8	115 ± 6	1.24
		Co-58	89 ± 5	77 ± 4	1.16
		Mn-54	102 ± 6	84 ± 4	1.21
		Fe-59	98 ± 6	75 ± 4	1.31
		Zn-65	188 ± 11	139 ± 7	1.35
		Co-60	113 ± 7	104 ± 5	1.09
06/19/00	Cartridge	I-131	106 ± 6	88 ± 4	1.20
06/19/00	Air Filter	Sr-90	88 ± 5	96 ± 5	0.92
06/19/00	Air Filter	Gross Alpha	103 ± 6	93 ± 5	1.11
		Gross Beta	210 ± 6	193 ± 10	1.09
09/18/00	Milk	I-131	97 ± 10	87 ± 4	1.11
		Ce-141	83 ± 8	77 ± 4	1.08
		Cr-51	323 ± 40	304 ± 15	1.06
		Cs-134	98 ± 10	102 ± 5	0.96
		Cs-137	117 ± 12	107 ± 5	1.09
		Co-58	64 ± 6	60 ± 3	1.07
		Mn-54	99 ± 10	88 ± 4	1.13
		Fe-59	132 ± 13	119 ± 6	1.11
		Zn-65	218 ± 22	196 ± 10	1.11
		Co-60	209 ± 21	197 ± 10	1.06

ANALYTICS CROSS CHECK COMPARISON PROGRAM 2000 (cont.)

Sample Date	Media	Nuclide	Teledyne Brown Engineering Result (a)	Analytics Result	Ratio (b)
09/18/00	Milk	Sr-89	14 ± 1	15 ± 1	0.93
		Sr-90	18 ± 1	14 ± 1	1.29

Footnotes:

(a) Teledyne Results - counting error is two standard deviations. Units are pCi/liter for water and milk. For gamma results, if two standard deviations are less than 10%, then a 10% error is reported. Units are total pCi for air particulate filters.

(b) Ratio of Teledyne Brown Engineering to Analytics results.

(c) Caused by incorrect rinsing of the strontium extraction column. Additional training was conducted and was documented in the analyst's training file. Subsequent tests on two milk samples spiked with Sr-89 produced correct results.

8. Land Use Census

VYNPS Off-site Dose Calculation Manual 3/4.5.2 requires that a Land Use Census be conducted annually between the dates of June 1 and October 1. The Census identifies the locations of the nearest milk animal and the nearest residence in each of the 16 meteorological sectors within a distance of five miles of the plant. It also identifies the nearest milk animal (within three miles of the plant) to the point of predicted highest annual average D/Q value due to elevated releases from the plant stack in each of the three major meteorological sectors. The 2000 Land Use Census was conducted in June of 2000 in accordance with the ODCM.

Following the collection of field data and in compliance with Off-site Dose Calculation Manual (ODCM) Section 10.1, a dosimetric analysis is performed to compare the census locations to the "critical receptor" identified in the ODCM. This critical receptor is the location that is used in the Method 1 screening dose calculations found in the ODCM (i.e. the dose calculations done in compliance with ODCM Surveillance 4.3.3). If a Census location has a 20% greater potential dose than that of the critical receptor, this fact must be announced in the annual Radioactive Effluent Release Report for that period. A re-evaluation of the critical receptor would also be done at that time. For the 2000 Census, no such locations were identified.

Pursuant to ODCM 3.5.2.a, a dosimetric analysis is performed, using site specific meteorological data, to determine which milk animal locations would provide the optimal sampling locations. If any location has a 20% greater potential dose commitment than at a currently sampled location, the new location is added to the routine environmental sampling program in replacement of the location with the lowest calculated dose (which is eliminated from the program). The 2000 Land Use Census did not identify any locations, meeting the criteria of ODCM Table 3.5.1, with a greater potential dose commitment than at currently sampled locations. No changes to the Radiological Environmental Monitoring Program (REMP) were required based on the Land Use Census.

Subsequent to the Land Use Census, one change was made to the REMP based on a farm location going out of business near the end of 2000. This location, the Meadow Crest Farm, had to be replaced with one already in the program but had not been a required location. This other location, the Miller Farm, replaced Meadow Crest Farm as a required location that complies with the criteria of ODCM Table 3.5.1.

The results of the 2000 Land Use Census are included in this report in compliance with ODCM 4.5.2 and ODCM 10.2. The locations identified during the Census may be found in Table 8.1.

TABLE 8.1

2000 LAND USE CENSUS LOCATIONS*

SECTOR	NEAREST RESIDENCE Km (Mi)	NEAREST MILK ANIMAL Km (Mi)
N	1.5 (0.9)	----
NNE	1.4 (0.9)	5.5 (3.4) Cows
NE	1.3 (0.8)	----
ENE	1.0 (0.6)	----
E	0.9 (0.6)	----
ESE	2.8 (1.8)	----
SE	2.0 (1.2)	3.6 (2.2) Cows**
SSE	2.1 (1.3)	5.2 (3.3) Cows
S	0.5 (0.3)	2.2 (1.4) Cows**
SSW	0.5 (0.3)	----
SW	0.4 (0.3)	8.2 (5.1) Cows
WSW	0.5 (0.3)	9.6 (6.0) Goats
W	0.6 (0.4)	0.8 (0.5) Cows
WNW	1.1 (0.7)	7.5 (4.7) Cows
NW	2.6 (1.6)	4.3 (2.7) Cows**
NNW	2.6 (1.6)	----

* Sectors and distances are relative to the plant stack as determined by a Global Positioning System survey conducted in 1997.

** Location of nearest milk animal within 3 miles of the plant to the point of predicted highest annual average D/Q value in each of the three major meteorological sectors.

9. SUMMARY

During 2000 as in all previous years of plant operation, a program was conducted to assess the levels of radiation or radioactivity in the Vermont Yankee Nuclear Power Station environment. Over 800 samples were collected (including TLDs) over the course of the year, with a total of over 2700 radionuclide or exposure rate analyses being performed on them. The samples included ground water, river water, sediment, fish, milk, silage, mixed grass, storm drain sediment, and storm drain water. In addition to these samples, the air surrounding the plant was sampled continuously and the radiation levels were measured continuously with environmental TLDs.

Three of the objectives of the Radiological Environmental Monitoring Program (REMP) 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.

For a part of the year, the REMP suffered a decline in quality due to a portion of analyses obtained from a new vendor laboratory. For these specific samples, the REMP did not adequately meet its objectives. The results of this portion of the data were excluded from the summary table of the various sample media. Corrective actions are in place to prevent a recurrence of problems with the environmental sample analyses.

Low levels of radioactivity from three sources (discussed below) were detected in samples collected off-site as a part of the radiological environmental monitoring program. Most samples had measurable levels of K-40, Be-7, Th-232 or radon daughter products. These are the most common of the naturally-occurring radionuclides. Many samples (particularly milk, river water, mixed grass, and sediment) had fallout radioactivity from atmospheric nuclear weapons tests conducted primarily from the late 1950s through 1980. Several samples from onsite locations (from the plant storm drain system) had low levels of radioactivity resulting from emissions from the Vermont Yankee plant. In all cases, the possible radiological impact was negligible with respect to exposure from natural background radiation. In no case did the detected levels exceed the most restrictive federal regulatory or plant license limits for radionuclides in the environment.

10. REFERENCES

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