

VERMONT YANKEE NUCLEAR POWER CORPORATION  
ANNUAL RADIOLOGICAL ENVIRONMENTAL  
MONITORING REPORT

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## 1.0 INTRODUCTION

The radiological environmental surveillance program at Vermont Yankee has been designed and carried out with specific objectives in mind. They are as follows:

- To provide an early indication of the appearance or accumulation of any radioactive material in the environment caused by the operation of the nuclear power 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 an estimate of actual radiation exposure to the surrounding population.
- 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.

During 1983, as in the past, Aquatec, Inc. collected all of the aquatic environmental samples, while the Chemistry and Health Physics staff collected the bulk of the terrestrial environmental samples and processed all environmental thermoluminescent dosimeters (TLDs) for direct radiation measurements. After the initial processing, all non-TLD samples were sent to the Yankee Atomic Environmental Laboratory in Westboro, Massachusetts for further processing and radionuclide analysis. This report presents a summary of the findings of the radiological environmental surveillance program for 1983.

## 2.0 ENVIRONMENTAL SURVEILLANCE PROGRAM

In this section, Table 2.1 outlines the surveillance program as required by the plant Technical Specifications. Table 2.2 lists the sampling stations and their specific locations (distances are measured from the center of the Containment Building). The monitoring locations are shown on maps in Figures 2.1 through 2.3.

Below are listed the two-letter media codes and what they represent:

AP	Air Particulate
CF	Charcoal Filter
TM	Milk
WG	Ground Water
WR	River Water
TG	Mixed Vegetation
TC	Silage
TF	Food Crop
TZ	Meat, Poultry, Eggs
TS	Soil
SE	Sediment
FH	Finfish
AV	Aquatic Vegetation
GM	Direct Radiation (TLD)

Table 2.1

Vermont Yankee  
Radiological Environmental Surveillance Program

<u>Media</u>	<u>Sampling Frequency</u>	<u>Required Analyses</u>
Air Particulate (AP)	- Weekly	Gross beta, Sr-89/90 (2)
	- Quarterly Composite	Gamma spectroscopy
Charcoal Filter (CF)	- Weekly	I-131
Milk (TM)	- Monthly	Gamma spectroscopy, I-131
	- Quarterly Composite	Sr-89/90
Mixed Vegetation (TG)	- Quarterly (1)	Gamma spectroscopy
Food Crop (TF)	- Annually (5)	Gamma spectroscopy, I-131 on green leafy portions of vegetables
Meat, Poultry, Eggs (TZ)	- Annually (4)	Gamma spectroscopy
Silage (TC)	- Annually (5)	Gamma spectroscopy
Ground Water (WG)	- Quarterly	Gross beta, H-3, gamma spectroscopy, Sr-89/90 (2)
	- Once Per 3 Years (3)	Ra-226
River Water (WR)	- Monthly (1)	Gross beta, gamma spectroscopy
	- Quarterly Composite	H-3, Sr-89/90 (2)
Aquatic Vegetation (AV)	- Semiannually	Gamma spectroscopy, Sr-89/90 (2)
Soil (TS)	- Once Per 3 Years (3)	Gamma spectroscopy, SR-89/90 (2)
Sediment (SE)	- Semiannually	Gamma spectroscopy, Sr-89/90 (2)
Finfish (FH)	- Semiannually (1)	Gamma spectroscopy, Sr-89/90 (2)
Direct Radiation (GM)	- Monthly	Integrated gamma dose

- (1) Collection frequency dependent upon availability of samples during winter.  
 (2) Performed whenever plant-related Cs-137 concentration is 10X non-plant-related Cs-137 concentration.  
 (3) Not due in 1983.  
 (4) Subject to availability at end of grazing season.  
 (5) Collected at harvest time in reasonable proximity to specified location; subject to availability.

Table 2.2

Vermont Yankee  
Radiological Environmental Surveillance Locations

<u>Station Code</u> <u>(Media - Sta. No.)</u>	<u>Station Description</u>	<u>Zone*</u>	<u>Distance</u> <u>From Plant</u> <u>(km)</u>	<u>Direction</u> <u>From Plant</u>
AP/CF/TG-10	Hinsdale, NH	1	1.2	NE
AP/CF/TG-11	N. Hinsdale, NH	1	3.6	NNW
AP/CF/TG-12	Hinsdale Substation	1	3.1	E
AP/CF/TG-13	River Station No. 3.3	1	1.9	SSE
AP/CF/TG-14	Fairman Road	1	2.4	SW
AP/CF/TG-15	Tyler Hill	1	3.4	WNW
AP/CF/TG-21	Hogback Mountain	2	25.0	WNW
AP/CF/TG-22	Spofford Lake, NH	2	16.1	NNE
AP/CF/TG-23	Northfield, MA	2	11.3	SSE
TM/TC-11	Miller Farm	1	0.8	WNW
TM/TC-12	Whitaker Farm	1	2.6	S
TM/TC-13	Newton Farm	1	5.1	SSE
TM/TC-21	Brattleboro Dairy	2	15.0	N
TF-11	Miller Farm	1	0.8	WNW
TF-21	Northfield, MA	2	8.0	SE
TZ-99	Miller Farm	1	0.8	WNW
WG-11	VY Plant Well	1	0.0	On-Site
WG-12	Vernon Nursing Well	1	2.0	SSE
WG-13	VT No. 32 Well	1	1.8	SE
WG-21	Brattleboro Well	2	12.1	NNW
WR/SE/FH-11	River Station No. 3.3	1	1.9	Down River
WR/SE/FH-12	Plant Discharge	1	0.0	On-Site
WR/SE/FH-21	Route 9 Bridge	2	12.8	Up River
AV-11	Downstream Swamp	1	0.8	Down River
AV-21	Upstream Swamp	2	0.8	Up River



Table 2.2  
(continued)

Vermont Yankee  
Radiological Environmental Surveillance Locations

<u>Station Code</u> <u>(Media - Sta. No.)</u>	<u>Station Description</u>	<u>Zone*</u>	<u>Distance</u> <u>From Plant</u> <u>(km)</u>	<u>Direction</u> <u>From Plant</u>
GM-1.0	Hinsdale, NH	1	1.2	NE
GM-1.1	N. Hinsdale, NH	1	3.6	NNW
GM-1.2	Hinsdale Substation	1	3.1	E
GM-1.3	River Station No. 3.3	1	1.9	SSE
GM-1.4	Fairman Road	1	2.4	SW
GM-1.5	Tyler Hill	1	3.4	WNW
GM-1.6	Site Boundary	1	0.160	NNW
GM-1.7	Site Boundary	1	0.315	WNW
GM-1.8	Site Boundary	1	0.315	SSW
GM-1.9	Site Boundary	1	0.450	S
GM-1.10	Site Boundary	1	0.630	S
GM-1.11	Site Boundary	1	0.920	S
GM-1.12	Site Boundary	1	0.760	SSE
GM-1.13	Site Boundary	1	0.480	SSE
GM-1.14	Site Boundary	1	0.315	SE
GM-1.15	Site Boundary	1	0.027	N
GM-1.16	Site Boundary	1	0.395	NW
GM-1.17	Vernon School	1	0.575	SSW
GM-2.1	Hogback Mountain	2	25.0	WNW
GM-2.2	Spofford Lake	2	16.1	NNE
GM-2.3	Northfield, MA	2	11.3	SSE

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\*Zone 1 = Indicator Stations; Zone 2 = Control Stations

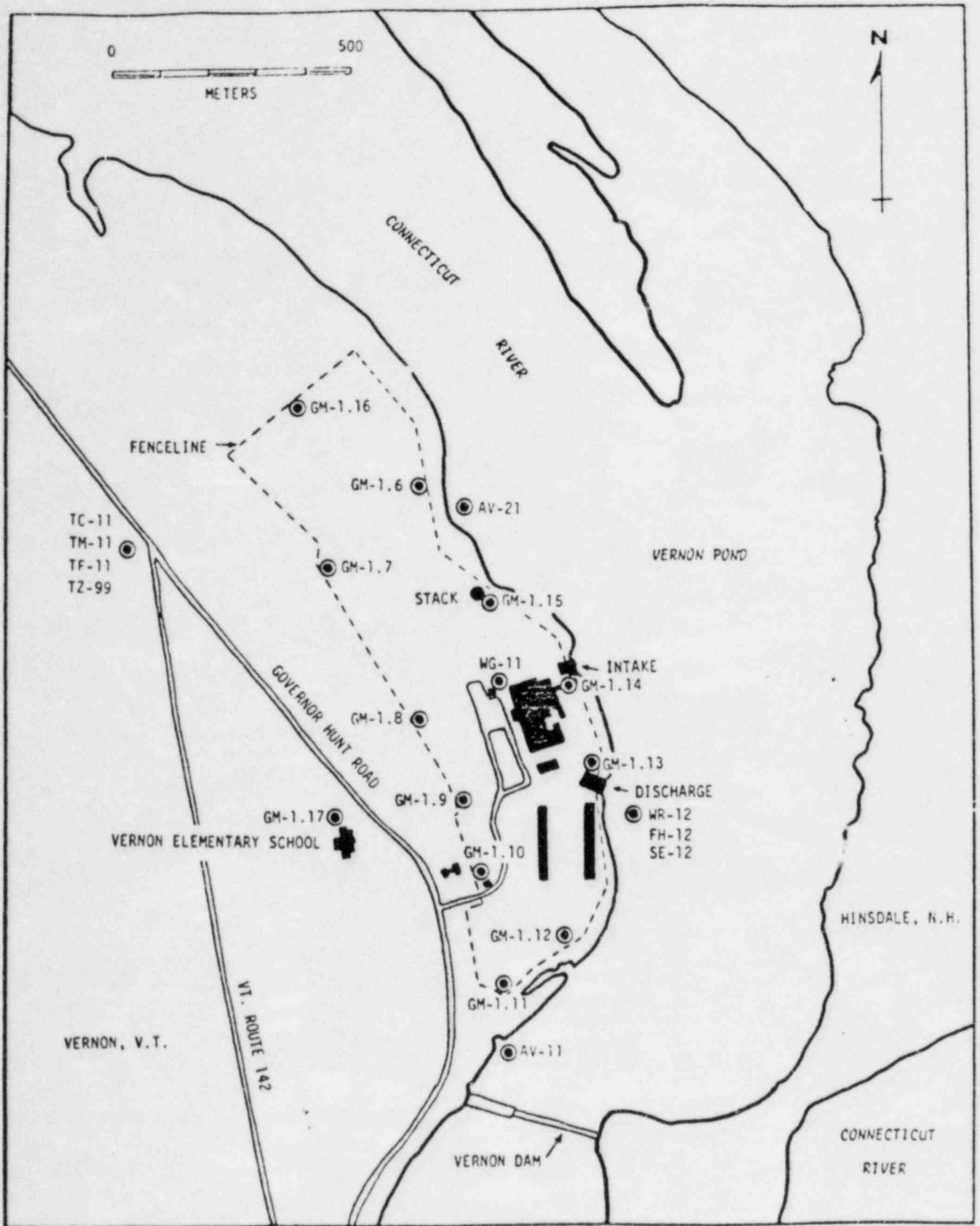


Figure 2.1 Environmental Radiological Monitoring Locations in Close Proximity to Vermont Yankee

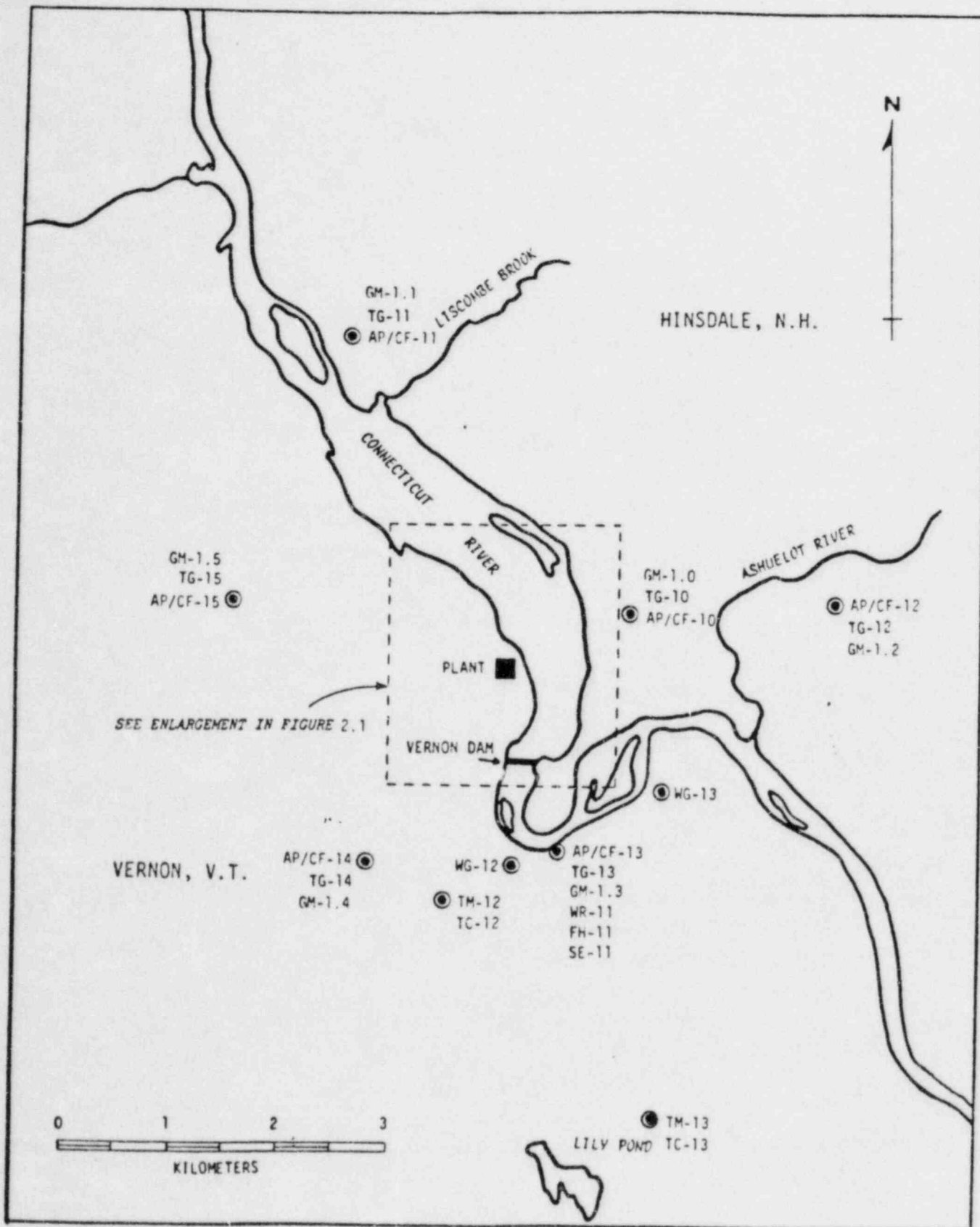


Figure 2.2 Environmental Radiological Monitoring Locations within 5 Kilometers of Vermont Yankee

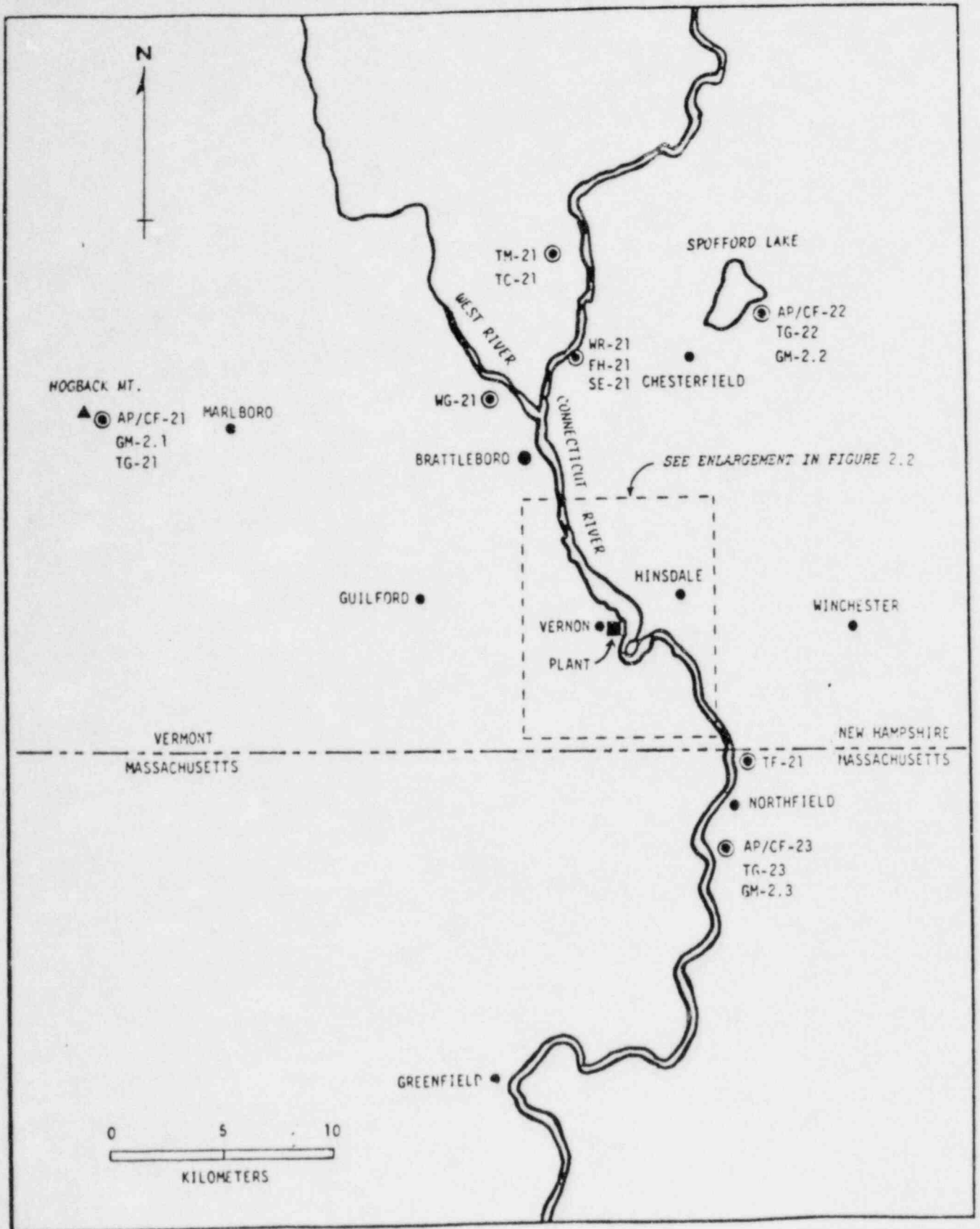


Figure 2.3 Environmental Radiological Monitoring Locations Greater Than 5 Kilometers from Vermont Yankee

### 3.0. SUMMARY OF 1983 ENVIRONMENTAL DATA

The following pages summarize the analytical results of all the environmental samples which were collected during 1983. Each environmental media category is presented as a separate subsection. A discussion of the sampling program and results is followed by a table which summarizes the year's data for each category. The tables were generated by the computer program, ERMMap. At the top of each table, ERMMap lists the units of measurement for each medium. The left hand column contains the radionuclide which is being reported, total number of analyses of that radionuclide, and the number of measurements which exceeds ten times the yearly average background value. The latter are classified as "non-routine" measurements. The next column lists the Lower Limit of Detection (LLD) for those radionuclides which have detection capability requirements as specified in the USNRC's Branch Technical Position (Rev. 1, 1979). (Guidance is not given for many of the radionuclides routinely measured and reported herein.) LLDs equal to or less than these values are achieved greater than 95 percent of the time.

Those sampling stations which are adjacent to the plant and which could conceivably be affected by the operation of Vermont Yankee are called "Indicator" or "Zone 1" stations. Distant stations, which are beyond plant influence are called "Control" or "Zone 2" stations.

ERMMap calculates a set of statistical parameters for each radionuclide. This set of statistical parameters includes separate analyses for (1) the indicator stations, (2) the control stations, and (3) the station having the highest annual mean concentration. For each of these three groups of data, ERMMap calculates:

- o The mean value of all concentrations including negative values and values below LLD.
- o The square root of the mean square deviation. This is an estimate of the sample variance.
- o The lowest and highest calculated concentration.

- o The number of positive measurements (activity which is three times greater than the standard deviation) divided by the total number of measurements.

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 quoted uncertainty term 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. Radioactivity is considered to be present in a sample when the concentration exceeds three times its associated standard deviation. Expressed in another way, the measurement is considered to be statistically different than normal instrument background when the plus or minus three standard deviation range surrounding the measurement does not include zero.

Direct radiation measurements from thermoluminescent dosimeters are discussed in Section 3.M.

A) Air Particulate

Air monitoring stations are established at a total of nine locations. Six of these locations are indicators, while the remaining three are control stations. Airborne particulates are collected by passing the air through a fiberglass filter. These filters are collected weekly and held for at least 100 hours before being analyzed for gross beta activity (indicated as GR-B in tables) to allow for the decay of radon and thoron daughter products. Weekly composite air filters from each location are analyzed quarterly for gamma emitting radionuclides.

Gross-beta counts (Figure 3.1) generally showed the same fluctuations at indicator stations as at controls, thereby indicating that any plant contribution was negligible. Cobalt-60 was detected, however, on the second quarter composite sample from station AP-13. A conservative dose analysis showed that an individual exposed to the detected concentration would have received a dose of less than 0.01 mrem to the lung (critical organ). No other gamma-emitting radionuclides were detected on the quarterly composite filters.

During the week ending April 12, 1983, a sample was not collected from Station AP/CF-13 due to the incorrect installation of a sampling line following pump maintenance (Licensee Event Report 83-13/3L).

□ = STATION 10  
 ○ = STATION 11  
 △ = STATION 12  
 + = STATION 13  
 X = STATION 14

X = STATION 15  
 Z = STATION 21  
 \* = STATION 22  
 \* = STATION 23

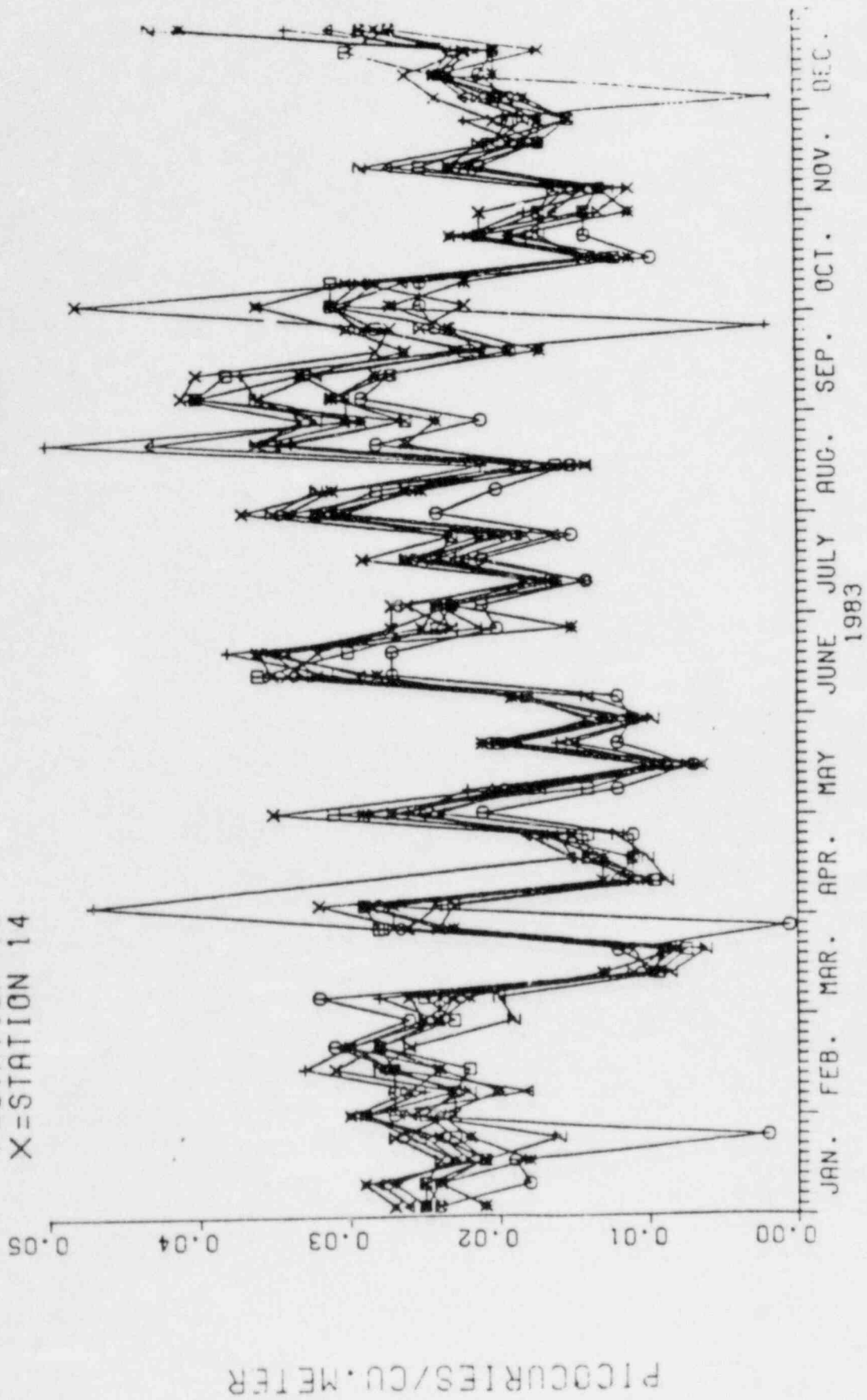


Figure 3.1 Gross-Beta Measurements of Air Particulate Filters at Vermont Yankee



ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: AIR PARTICULATE

UNITS: PCI/CCU, M

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****		STATION WITH HIGHEST MEAN *****		CONTROL STATIONS *****	
		MEAN RANGE NO. DETECTED**		STA. NO.	MEAN RANGE NO. DETECTED**	MEAN RANGE NO. DETECTED**	
OR-B (467) ( 0)	.01	( 2.2 ± .0)E -2 ( 5.5 - 495.0)E -4 *(307/311)*		14	( 2.5 ± .1)E -2 ( 1.0 - 4.8)E -2 *( 52/ 52)*	( 2.2 ± .1)E -2 ( 6.1 - 43.3)E -3 *(156/156)*	
BE-7 ( 36) ( 0)		( 4.8 ± .2)E -2 ( 2.8 - 6.6)E -2 *( 24/ 24)*		21	( 5.3 ± .5)E -2 ( 4.1 - 6.3)E -2 *( 4/ 4)*	( 4.8 ± .3)E -2 ( 3.4 - 6.3)E -2 *( 12/ 12)*	
K-40 ( 36) ( 0)		( 4.7 ± 1.0)E -3 (-6.6 - 13.3)E -3 *( 2/ 24)*		10	( 6.9 ± .9)E -3 ( 4.7 - 8.6)E -3 *( 1/ 4)*	( 4.4 ± .9)E -3 ( 1.2 - 114.0)E -4 *( 3/ 12)*	
OR-51 ( 36) ( 0)		( 8.1 ± 55.5)E -5 (-4.9 - 6.7)E -3 *( 0/ 24)*		11	( 2.9 ± 1.6)E -3 (-1.1 - 6.7)E -3 *( 0/ 4)*	(-7.2 ± 6.3)E -4 (-5.1 - 1.8)E -3 *( 0/ 12)*	
MN-54 ( 36) ( 0)		( 2.4 ± 4.4)E -5 (-4.6 - 4.0)E -4 *( 0/ 24)*		10	( 1.3 ± 1.5)E -4 (-3.0 - 4.0)E -4 *( 0/ 4)*	(-1.1 ± 4.1)E -5 (-3.3 - 2.3)E -4 *( 0/ 12)*	
CO-58 ( 36) ( 0)		(-3.5 ± 5.4)E -5 (-5.7 - 4.0)E -4 *( 0/ 24)*		13	( 1.4 ± 1.3)E -4 (-2.2 - 4.0)E -4 *( 0/ 4)*	(-7.6 ± 7.4)E -5 (-5.0 - 3.2)E -4 *( 0/ 12)*	
FE-59 ( 36) ( 0)		( 3.5 ± 108.3)E -6 (-1.1 - 1.0)E -3 *( 0/ 24)*		14	( 2.1 ± 2.9)E -4 (-3.3 - 9.8)E -4 *( 0/ 4)*	( 5.0 ± 8.7)E -5 (-3.8 - 6.1)E -4 *( 0/ 12)*	
CO-60 ( 36) ( 0)		( 1.3 ± .9)E -4 (-7.0 - 17.9)E -4 *( 1/ 24)*		13	( 3.6 ± 5.0)E -4 (-3.5 - 17.9)E -4 *( 1/ 4)*	(-4.3 ± 4.9)E -5 (-2.3 - 4.3)E -4 *( 0/ 12)*	
ZN-65 ( 36) ( 0)		(-1.7 ± .8)E -4 (-9.2 - 7.0)E -4 *( 0/ 24)*		21	( 1.2 ± 2.5)E -4 (-3.4 - 7.8)E -4 *( 0/ 4)*	(-2.0 ± 1.3)E -4 (-1.0 - .8)E -3 *( 0/ 12)*	

- \* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.
- \*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERMONT, VT  
JANUARY - DECEMBER 1983

MEDIUM: AIR PARTICULATE

UNITS: PCI/CU. M

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****	STATION WITH HIGHEST MEAN *****	CONTROL STATIONS *****
		MEAN RANGE NO. DETECTED**	MEAN RANGE STA. NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
ZR-95 (36) ( 0)		(-6.9 ± 9.7)E -5 (-1.1 - .8)E -3 *( 0/ 24)*	13 ( 3.3 ± 1.5)E -4 ( 7.1 - 76.8)E -5 *( 0/ 4)*	( 1.5 ± .7)E -4 (-3.4 - 5.9)E -4 *( 0/ 12)*
RU-103 (36) ( 0)		(-4.7 ± 6.1)E -5 (-5.4 - 4.8)E -4 *( 0/ 24)*	13 ( 1.3 ± 2.0)E -4 (-4.4 - 4.8)E -4 *( 0/ 4)*	( 4.4 ± 7.0)E -5 (-2.2 - 5.7)E -4 *( 0/ 12)*
RU-106 (36) ( 0)		(-6.9 ± 403.7)E -6 (-3.4 - 4.9)E -3 *( 0/ 24)*	11 ( 6.7 ± 11.2)E -4 (-1.9 - 3.6)E -3 *( 0/ 4)*	(-5.0 ± 5.2)E -4 (-3.4 - 2.5)E -3 *( 0/ 12)*
I-131 (36) ( 0)		(-1.9 ± 2.0)E -4 (-2.2 - 1.9)E -3 *( 0/ 24)*	14 ( 1.0 ± .4)E -3 ( 3.4 - 18.7)E -4 *( 0/ 4)*	(-1.0 ± 3.1)E -4 (-2.0 - 1.7)E -3 *( 0/ 12)*
CS-134 (36) ( 0)	.05	(-5.4 ± 5.1)E -5 (-4.9 - 4.4)E -4 *( 0/ 24)*	11 ( 1.1 ± 1.7)E -4 (-2.7 - 4.4)E -4 *( 0/ 4)*	(-6.2 ± 1.9)E -5 (-1.9 - .3)E -4 *( 0/ 12)*
CS-137 (36) ( 0)	.06	( 3.2 ± 46.5)E -6 (-6.0 - 3.2)E -4 *( 0/ 24)*	22 ( 2.2 ± 1.4)E -4 (-4.7 - 51.3)E -5 *( 0/ 4)*	( 1.6 ± .5)E -4 (-6.4 - 51.3)E -5 *( 0/ 12)*
BA-140 (36) ( 0)		( 2.4 ± 2.3)E -4 (-1.6 - 2.8)E -3 *( 0/ 24)*	11 ( 9.5 ± 10.0)E -4 (-1.6 - 2.8)E -3 *( 0/ 4)*	( 7.4 ± 15.3)E -5 (-6.3 - 8.8)E -4 *( 0/ 12)*
CE-141 (36) ( 0)		( 8.4 ± 6.3)E -5 (-4.4 - 7.5)E -4 *( 0/ 24)*	12 ( 1.7 ± 1.3)E -4 (-1.7 - 4.5)E -4 *( 0/ 4)*	(-5.0 ± 5.1)E -5 (-3.6 - 2.5)E -4 *( 0/ 12)*
CE-144 (36) ( 0)		(-2.1 ± 2.4)E -4 (-3.1 - 1.9)E -3 *( 0/ 24)*	22 ( 1.0 ± .3)E -3 ( 3.8 - 16.6)E -4 *( 0/ 4)*	( 1.9 ± 2.3)E -4 (-9.3 - 16.6)E -4 *( 0/ 12)*
AC-228 (36) ( 0)		( 2.3 ± 1.5)E -4 (-1.3 - 1.5)E -3 *( 0/ 24)*	14 ( 8.5 ± 3.8)E -4 (-1.5 - 15.0)E -4 *( 0/ 4)*	( 1.8 ± 2.1)E -4 (-9.7 - 13.8)E -4 *( 0/ 12)*

- \* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.  
\*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

B) Charcoal Filters

Charcoal filter cartridges are situated in series with the air particulate fiber filters. Monitoring stations are located at a total of nine stations, six of which are indicators and three of which are controls. Charcoal filters from the nine air sampling stations were collected and analyzed weekly for I-131 activity. No radioactive I-131 was detected on any 1983 charcoal filter sample.

During the week ending April 12, 1983, a sample was not collected from Station AP/CF-13 due to the incorrect installation of a sampling line following pump maintenance (Licensee Event Report 83-13/3L).

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
 VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
 JANUARY - DECEMBER 1983

MEDIUM: CHARCOAL FILTER

UNITS: PCI/CU. M

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****	STATION WITH HIGHEST MEAN *****	CONTROL STATIONS *****
		MEAN RANGE NO. DETECTED**	MEAN RANGE STA. NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
I-131 (467) ( 0)	.07	(-2.7 ± .5)E -3 (-3.6 - 1.9)E -2 *( 0/311)*	11 (-9.5 ± 11.9)E -4 (-3.6 - 1.2)E -2 *( 0/ 52)*	(-1.7 ± .5)E -3 (-2.0 - 1.9)E -2 *( 0/156)*

- \* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.
- \*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

C) Milk

Milk samples were collected and analyzed monthly for low level I-131 and gamma-emitting radionuclides. Monthly samples were composited quarterly and analyzed for Sr-89 and Sr-90.

Detectable concentrations of Cs-137 and Sr-90 were measured in milk samples submitted from the indicator and control locations. Concentrations were similar to those detected in 1982. In both years, the control station concentrations were higher than those at the indicator stations, indicating that the radioactivity was not due to plant operations, but to nuclear weapons testing fallout.

O=STATION 11  
 ▲=STATION 12  
 +=STATION 13  
 Z=STATION 21

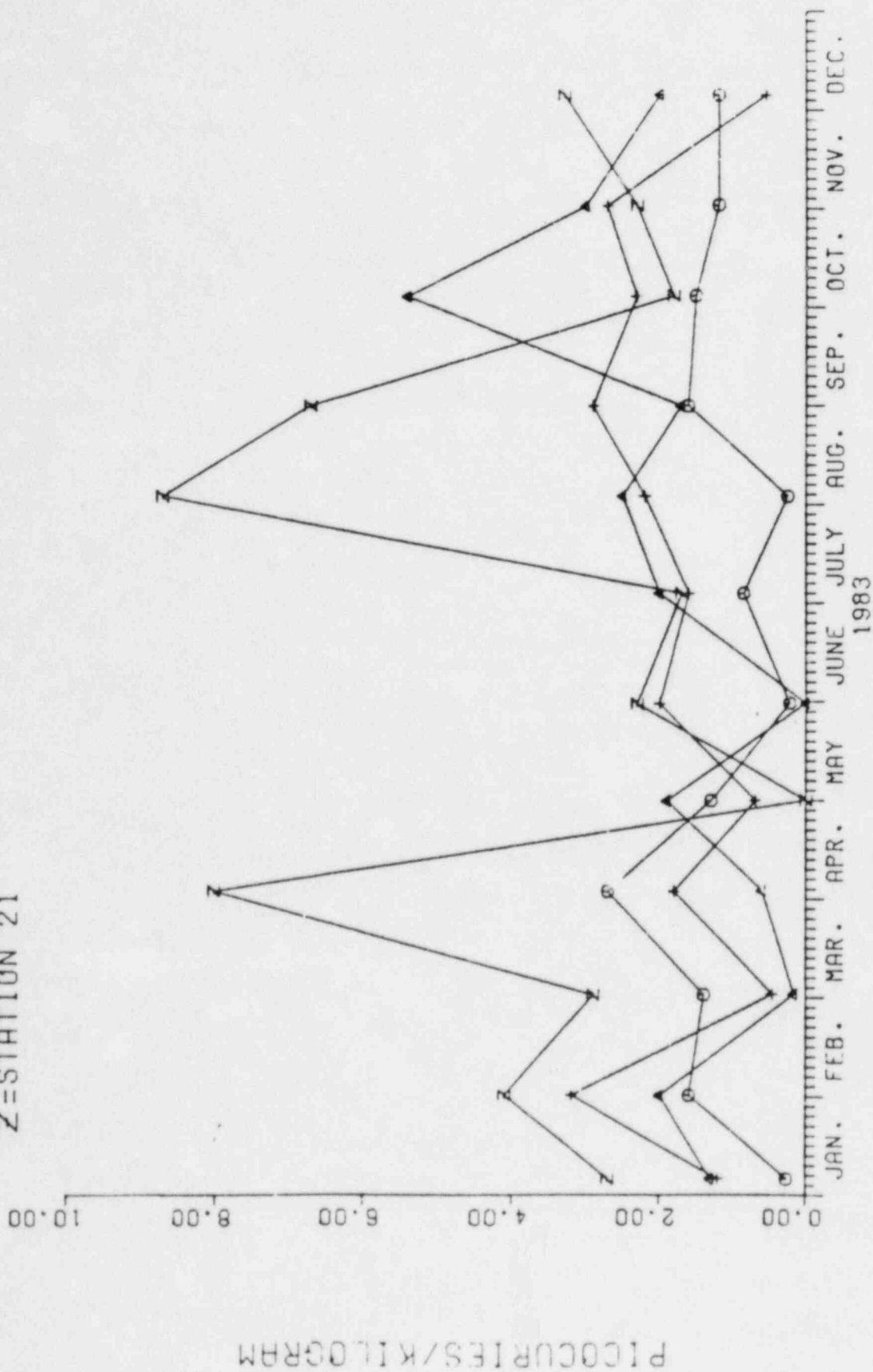


Figure 3.2 Cesium-137 in Cow Milk at Vermont Yankee

O = STATION 11  
 Δ = STATION 12  
 + = STATION 13  
 Z = STATION 21

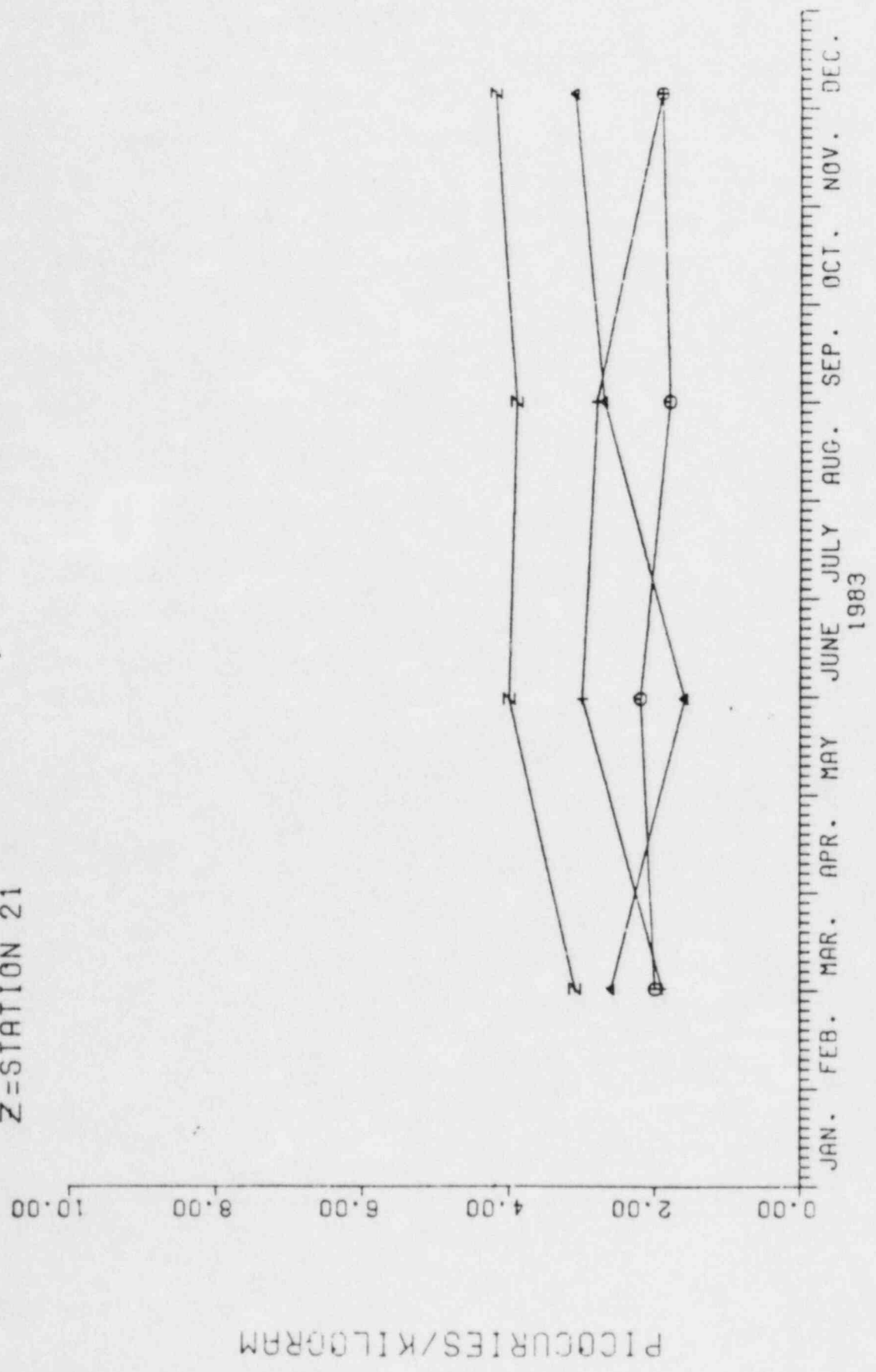


Figure 3.3 Strontium-90 in Cow Milk at Vermont Yankee

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERMONT, VT  
JANUARY - DECEMBER 1983

MEDIUM: MILK

UNITS: PCI/KG

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****	STATION WITH HIGHEST MEAN *****	CONTROL STATIONS *****
		MEAN RANGE NO. DETECTED**	MEAN STA. RANGE NO. DETECTED**	MEAN RANGE NO. DETECTED**
SR-89 ( 16) ( 0)		( 4.0 ± 2.7)E -1 (-1.2 - 2.2)E 0 *( 0/ 12)*	13 ( 6.2 ± 2.4)E -1 (-4.9 - 101.0)E -2 *( 0/ 4)*	( 2.3 ± 30.7)E -2 (-5.2 - 8.9)E -1 *( 0/ 4)*
SR-90 ( 16) ( 0)		( 2.3 ± .1)E 0 ( 1.6 - 3.1)E 0 *( 12/ 12)*	21 ( 3.8 ± .3)E 0 ( 3.1 - 4.2)E 0 *( 4/ 4)*	( 3.8 ± .3)E 0 ( 3.1 - 4.2)E 0 *( 4/ 4)*
BE-7 ( 48) ( 0)		(-1.2 ± .9)E 0 (-9.5 - 9.7)E 0 *( 0/ 36)*	12 (-1.6 ± 14.5)E -1 (-7.8 - 6.0)E 0 *( 0/ 12)*	(-1.9 ± 3.3)E 0 (-2.0 - 1.3)E 1 *( 0/ 12)*
K-40 ( 48) ( 0)		( 1.3 ± .0)E 3 ( 1.2 - 1.4)E 3 *( 36/ 36)*	13 ( 1.3 ± .0)E 3 ( 1.3 - 1.4)E 3 *( 12/ 12)*	( 1.3 ± .0)E 3 ( 1.2 - 1.5)E 3 *( 12/ 12)*
CR-51 ( 48) ( 0)		(-2.9 ± 1.5)E 0 (-3.2 - 1.0)E 1 *( 0/ 36)*	21 ( 1.4 ± 4.2)E 0 (-2.4 - 2.5)E 1 *( 0/ 12)*	( 1.4 ± 4.2)E 0 (-2.4 - 2.5)E 1 *( 0/ 12)*
MN-54 ( 48) ( 0)		(-6.9 ± 17.2)E -2 (-2.7 - 2.6)E 0 *( 0/ 36)*	11 ( 3.1 ± 15.0)E -2 (-8.5 - 7.4)E -1 *( 0/ 12)*	(-9.6 ± 28.3)E -2 (-1.5 - 1.1)E 0 *( 0/ 12)*
CO-58 ( 48) ( 0)		(-4.6 ± 1.5)E -1 (-3.0 - 1.4)E 0 *( 0/ 36)*	21 ( 1.2 ± 3.4)E -1 (-1.6 - 2.9)E 0 *( 0/ 12)*	( 1.2 ± 3.4)E -1 (-1.6 - 2.9)E 0 *( 0/ 12)*
FE-59 ( 48) ( 0)		( 7.9 ± 4.2)E -1 (-4.4 - 7.4)E 0 *( 0/ 36)*	12 ( 1.2 ± .5)E 0 (-1.5 - 4.0)E 0 *( 0/ 12)*	( 4.4 ± 6.9)E -1 (-4.7 - 3.9)E 0 *( 0/ 12)*
CO-60 ( 48) ( 0)		(-1.6 ± 195.6)E -3 (-2.5 - 2.4)E 0 *( 0/ 36)*	12 ( 4.0 ± 3.0)E -1 (-9.1 - 24.1)E -1 *( 0/ 12)*	(-7.5 ± 2.8)E -1 (-2.3 - .7)E 0 *( 0/ 12)*

- \* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.
- \*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )#.



ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: MILK

UNITS: PCI/KG

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****	STATION WITH HIGHEST MEAN *****	CONTROL STATIONS *****
		MEAN RANGE NO. DETECTED**	MEAN STA. RANGE NO. DETECTED**	MEAN RANGE NO. DETECTED**
ZN-65 ( 48) ( 0)		(-4.6 ± 4.1)E -1 (-5.1 - 5.1)E 0 *( 0/ 36)*	12 ( 1.2 ± 5.9)E -1 (-1.9 - 5.1)E 0 *( 0/ 12)*	(-4.8 ± 9.2)E -1 (-5.3 - 6.9)E 0 *( 0/ 12)*
ZR-95 ( 48) ( 0)		( 1.8 ± 3.2)E -1 (-5.7 - 3.7)E 0 *( 0/ 36)*	12 ( 3.5 ± 7.6)E -1 (-5.7 - 3.7)E 0 *( 0/ 12)*	(-8.6 ± 54.9)E -2 (-3.3 - 3.3)E 0 *( 0/ 12)*
RU-103 ( 48) ( 0)		(-9.0 ± 1.5)E -1 (-2.5 - 1.3)E 0 *( 0/ 36)*	12 (-7.4 ± 3.2)E -1 (-2.2 - 1.3)E 0 *( 0/ 12)*	(-8.5 ± 3.5)E -1 (-2.7 - .9)E 0 *( 0/ 12)*
RU-106 ( 48) ( 0)		( 8.6 ± 19.7)E -1 (-3.6 - 1.9)E 1 *( 0/ 36)*	11 ( 4.5 ± 2.6)E 0 (-1.1 - 1.9)E 1 *( 0/ 12)*	(-3.7 ± 34.0)E -1 (-3.3 - 1.3)E 1 *( 0/ 12)*
I-131 ( 48) ( 0)	1.	(-1.4 ± 11.1)E -3 (-1.9 - 2.5)E -1 *( 0/ 36)*	11 ( 7.8 ± 29.2)E -3 (-1.9 - 2.5)E -1 *( 0/ 12)*	( 1.4 ± 24.0)E -3 (-1.0 - 2.0)E -1 *( 0/ 12)*
CS-134 ( 48) ( 0)	15.	(-4.4 ± 1.4)E -1 (-3.3 - 1.4)E 0 *( 0/ 36)*	12 (-2.6 ± 2.3)E -1 (-1.6 - 1.4)E 0 *( 0/ 12)*	(-6.8 ± 3.1)E -1 (-2.0 - 1.3)E 0 *( 0/ 12)*
CS-137 ( 48) ( 0)	18.	( 1.6 ± .2)E 0 (-1.4 - 54.4)E -1 *( 3/ 36)*	21 ( 3.7 ± .8)E 0 (-3.6 - 87.2)E -1 *( 7/ 12)*	( 3.7 ± .8)E 0 (-3.6 - 87.2)E -1 *( 7/ 12)*
BA-140 ( 48) ( 0)	60.	(-3.1 ± 228.3)E -3 (-2.6 - 3.1)E 0 *( 0/ 36)*	13 ( 3.7 ± 4.1)E -1 (-1.5 - 3.1)E 0 *( 0/ 12)*	(-2.7 ± 5.1)E -1 (-3.7 - 2.3)E 0 *( 0/ 12)*
CE-141 ( 48) ( 0)		( 4.8 ± 3.1)E -1 (-5.0 - 4.2)E 0 *( 0/ 36)*	11 ( 1.2 ± .4)E 0 (-1.9 - 3.3)E 0 *( 0/ 12)*	( 6.8 ± 3.7)E -1 (-1.8 - 2.5)E 0 *( 0/ 12)*
CE-144 ( 48) ( 0)		( 4.7 ± 11.7)E -1 (-1.4 - 2.1)E 1 *( 0/ 36)*	13 ( 2.5 ± 2.4)E 0 (-7.2 - 20.5)E 0 *( 0/ 12)*	( 3.5 ± 17.3)E -1 (-1.5 - .9)E 1 *( 0/ 12)*

\* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.

\*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

D) Mixed Vegetation

Mixed vegetation samples were collected during May, July, and October from the nine air sampling locations. The vegetation consisted of various types of grasses and were analyzed for gamma emitting nuclides. The results of the gamma spectroscopy analysis on each sample showed that in addition to naturally occurring Be-7, K-40, and Ac-228, Cs-137 was detected on most samples. A conservative dispersion and deposition model (References 1 and 2) and actual measured plant releases, indicated that the measured off-site levels could not be due to plant operations. This, along with the absence of Cs-134, strongly indicates that the measured Cs-137 was due to nuclear weapons testing fallout.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: MIXED VEGETATION

UNITS: PCI/KG WET

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS	STATION WITH HIGHEST MEAN	CONTROL STATIONS
		MEAN RANGE NO. DETECTED**	MEAN RANGE STA. NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
BE-7 ( 27) ( 0)		( 1.1 ± .2)E 3 ( 2.2 - 36.4)E 2 *( 18/ 18)*	15 ( 1.6 ± 1.0)E 3 ( 3.2 - 36.4)E 2 *( 3/ 3)*	( 7.9 ± 2.0)E 2 ( 2.5 - 20.4)E 2 *( 9/ 9)*
K-40 ( 27) ( 0)		( 4.6 ± .2)E 3 ( 3.1 - 6.4)E 3 *( 18/ 18)*	23 ( 6.5 ± .2)E 3 ( 6.0 - 6.8)E 3 *( 3/ 3)*	( 5.8 ± .3)E 3 ( 4.4 - 6.9)E 3 *( 9/ 9)*
CR-51 ( 27) ( 0)		( 6.4 ± 17.0)E 0 (-1.3 - 2.0)E 2 *( 0/ 18)*	15 ( 6.7 ± 7.0)E 1 (-3.5 - 20.2)E 1 *( 0/ 3)*	(-2.9 ± 3.0)E 1 (-1.9 - 1.5)E 2 *( 0/ 9)*
MN-54 ( 27) ( 0)		(-8.9 ± 20.6)E -1 (-2.5 - 1.0)E 1 *( 0/ 18)*	22 ( 8.9 ± 7.4)E 0 (-5.8 - 17.2)E 0 *( 0/ 3)*	( 3.0 ± 3.3)E 0 (-1.1 - 1.7)E 1 *( 0/ 9)*
CO-58 ( 27) ( 0)		( 4.5 ± 156.1)E -2 (-1.1 - 1.4)E 1 *( 0/ 18)*	14 ( 6.2 ± 4.3)E 0 (-8.4 - 141.0)E -1 *( 0/ 3)*	( 2.0 ± 2.3)E 0 (-9.4 - 13.4)E 0 *( 0/ 9)*
FE-59 ( 27) ( 0)		( 3.8 ± 4.8)E 0 (-3.4 - 4.4)E 1 *( 0/ 18)*	14 ( 3.2 ± 1.1)E 1 ( 1.1 - 4.4)E 1 *( 0/ 3)*	( 1.2 ± 48.8)E -1 (-3.0 - 2.2)E 1 *( 0/ 9)*
CO-60 ( 27) ( 0)		( 6.5 ± 26.2)E -1 (-1.8 - 1.9)E 1 *( 0/ 18)*	15 ( 1.2 ± .6)E 1 ( 3.8 - 192.0)E -1 *( 0/ 3)*	( 5.0 ± 2.2)E 0 (-6.6 - 11.6)E 0 *( 0/ 9)*
ZN-65 ( 27) ( 0)		( 5.7 ± 5.8)E 0 (-4.3 - 4.7)E 1 *( 0/ 18)*	11 ( 3.0 ± 1.3)E 1 ( 4.5 - 47.4)E 0 *( 0/ 3)*	(-5.8 ± 5.1)E 0 (-3.5 - 1.0)E 1 *( 0/ 9)*
ZR-95 ( 27) ( 0)		(-1.5 ± 4.3)E 0 (-3.2 - 3.8)E 1 *( 0/ 18)*	15 ( 1.4 ± 1.2)E 1 ( 8.4 - 378.0)E -1 *( 0/ 3)*	(-4.9 ± 67.2)E -1 (-4.6 - 2.0)E 1 *( 0/ 9)*

- \* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.
- \*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: MIXED VEGETATION

UNITS: PCI/KG WET

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****	STATION WITH HIGHEST MEAN *****	CONTROL STATIONS *****
		MEAN RANGE NO. DETECTED**	STA. NO. MEAN RANGE NO. DETECTED**	MEAN RANGE NO. DETECTED**
RU-103 ( 27) ( 0)		( 2.0 ± 3.3)E 0 (-2.0 - 3.6)E 1 *( 0/ 18)*	23 ( 1.6 ± .9)E 1 ( 5.7 - 33.8)E 0 *( 0/ 3)*	( 2.0 ± 6.4)E 0 (-3.6 - 3.4)E 1 *( 0/ 9)*
RU-106 ( 27) ( 0)		(-3.0 ± 1.8)E 1 (-2.9 - .6)E 2 *( 0/ 18)*	10 ( 1.2 ± 2.5)E 1 (-2.6 - 6.0)E 1 *( 0/ 3)*	(-4.4 ± 2.2)E 1 (-1.7 - .3)E 2 *( 0/ 9)*
I-131 ( 27) ( .0)		(-3.8 ± 17.5)E 0 (-1.7 - 2.1)E 2 *( 0/ 18)*	15 ( 6.3 ± 7.2)E 1 (-1.4 - 20.7)E 1 *( 0/ 3)*	(-4.4 ± 9.8)E 0 (-3.6 - 6.5)E 1 *( 0/ 9)*
CS-134 ( 27) ( 0)		(-7.8 ± 2.9)E 0 (-3.6 - .8)E 1 *( 0/ 18)*	13 ( 1.5 ± 4.1)E 0 (-6.1 - 8.2)E 0 *( 0/ 3)*	(-4.4 ± 3.9)E 0 (-2.4 - 1.3)E 1 *( 0/ 9)*
CS-137 ( 27) ( 2)		( 6.9 ± 1.8)E 1 (-7.3 - 2930.0)E -1 *( 13/ 18)*	15 ( 2.1 ± .5)E 2 ( 1.3 - 2.9)E 2 *( 3/ 3)*	( 2.1 ± .8)E 1 (-9.8 - 74.1)E 0 *( 4/ 9)*
BA-140 ( 27) ( 0)		( 1.3 ± 10.1)E 0 (-4.1 - 15.4)E 1 *( 0/ 18)*	15 ( 4.8 ± 5.3)E 1 (-1.6 - 15.4)E 1 *( 0/ 3)*	(-1.7 ± 6.3)E 0 (-3.4 - 3.3)E 1 *( 0/ 9)*
CE-141 ( 27) ( 0)		( 1.5 ± .6)E 1 (-4.3 - 7.0)E 1 *( 0/ 18)*	13 ( 3.5 ± 1.7)E 1 ( 1.6 - 7.0)E 1 *( 0/ 3)*	( 8.1 ± 5.6)E 0 (-2.4 - 3.1)E 1 *( 0/ 9)*
CE-144 ( 27) ( 0)		( 1.8 ± 1.3)E 1 (-1.1 - 1.3)E 2 *( 0/ 18)*	12 ( 6.3 ± 3.5)E 1 ( 8.2 - 128.0)E 0 *( 0/ 3)*	(-7.9 ± 11.4)E 0 (-6.8 - 3.6)E 1 *( 0/ 9)*
AC-228 ( 27) ( 0)		( 6.9 ± 1.9)E 1 ( 1.1 - 37.2)E 1 *( 4/ 18)*	10 ( 1.9 ± .9)E 2 ( 8.8 - 37.2)E 1 *( 3/ 3)*	( 7.1 ± 2.5)E 1 (-3.8 - 18.4)E 1 *( 4/ 9)*

\* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.  
\*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

E) Food Crop

Samples of cabbage were collected in October at Stations TF-11 and TF-21 and were analyzed for gamma emitting radionuclides and low-level I-131. Other than naturally occurring K-40, no radionuclides were detected in the samples.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: FOOD CROP

UNITS: PCI/KG WET

RADIONUCLIDES (NO. ANALYSES) %NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS	STATION WITH HIGHEST MEAN	CONTROL STATIONS
		MEAN RANGE NO. DETECTED**	MEAN RANGE STA. NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
BE-7 ( 2) ( 0)		(-8.4 ± 4.2)E 1 *( 0/ 1)*	21 ( 3.4 ± 36.5)E 0 *( 0/ 1)*	( 3.4 ± 36.5)E 0 *( 0/ 1)*
K-40 ( 2) ( 0)		( 9.1 ± 1.2)E 2 *( 1/ 1)*	21 ( 1.9 ± .1)E 3 *( 1/ 1)*	( 1.9 ± .1)E 3 *( 1/ 1)*
CR-51 ( 2) ( 0)		(-3.8 ± 5.1)E 1 *( 0/ 1)*	21 (-3.8 ± 4.8)E 1 *( 0/ 1)*	(-3.8 ± 4.8)E 1 *( 0/ 1)*
MN-54 ( 2) ( 0)		( 1.3 ± 5.0)E 0 *( 0/ 1)*	11 ( 1.3 ± 5.0)E 0 *( 0/ 1)*	(-1.5 ± 4.3)E 0 *( 0/ 1)*
CO-58 ( 2) ( 0)		(-5.9 ± 6.1)E 0 *( 0/ 1)*	21 (-2.6 ± 47.4)E -1 *( 0/ 1)*	(-2.6 ± 47.4)E -1 *( 0/ 1)*
FE-59 ( 2) ( 0)		(-7.9 ± 12.5)E 0 *( 0/ 1)*	21 (-7.6 ± 12.0)E 0 *( 0/ 1)*	(-7.6 ± 12.0)E 0 *( 0/ 1)*
CO-60 ( 2) ( 0)		(-3.9 ± 8.6)E 0 *( 0/ 1)*	21 ( 4.2 ± 6.5)E 0 *( 0/ 1)*	( 4.2 ± 6.5)E 0 *( 0/ 1)*
ZN-65 ( 2) ( 0)		( 1.4 ± 1.0)E 1 *( 0/ 1)*	11 ( 1.4 ± 1.0)E 1 *( 0/ 1)*	(-8.8 ± 93.6)E -1 *( 0/ 1)*
ZR-95 ( 2) ( 0)		( 1.1 ± .9)E 1 *( 0/ 1)*	11 ( 1.1 ± .9)E 1 *( 0/ 1)*	( 9.2 ± 7.8)E 0 *( 0/ 1)*

\* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.  
\*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
 VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
 JANUARY - DECEMBER 1983

MEDIUM: FOOD CROP

UNITS: PCI/KG WET

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS	STATION WITH HIGHEST MEAN	CONTROL STATIONS
		***** MEAN RANGE NO. DETECTED**	***** MEAN RANGE STA. NO. NO. DETECTED**	***** MEAN RANGE NO. DETECTED**
RU-103 ( 2) ( 0)		( 5.2 ± 54.7)E -1 *( 0/ 1)*	11 ( 5.2 ± 54.7)E -1 *( 0/ 1)*	(-3.6 ± 5.2)E 0 *( 0/ 1)*
RU-106 ( 2) ( 0)		(-4.5 ± 4.4)E 1 *( 0/ 1)*	21 ( 4.0 ± 3.3)E 1 *( 0/ 1)*	( 4.0 ± 3.3)E 1 *( 0/ 1)*
I-131 ( 2) ( 0)	60.	( 8.1 ± 11.7)E -1 *( 0/ 1)*	11 ( 8.1 ± 11.7)E -1 *( 0/ 1)*	( 5.9 ± 12.5)E -1 *( 0/ 1)*
CS-134 ( 2) ( 0)	60.	(-1.1 ± .5)E 1 *( 0/ 1)*	21 (-5.1 ± 4.2)E 0 *( 0/ 1)*	(-5.1 ± 4.2)E 0 *( 0/ 1)*
CS-137 ( 2) ( 0)	80.	(-1.2 ± 49.6)E -1 *( 0/ 1)*	21 ( 2.8 ± 4.7)E 0 *( 0/ 1)*	( 2.8 ± 4.7)E 0 *( 0/ 1)*
BA-140 ( 2) ( 0)		( 6.9 ± 9.7)E 0 *( 0/ 1)*	21 ( 1.3 ± 1.0)E 1 *( 0/ 1)*	( 1.3 ± 1.0)E 1 *( 0/ 1)*
CE-141 ( 2) ( 0)		(-1.2 ± .8)E 1 *( 0/ 1)*	21 ( 1.4 ± .8)E 1 *( 0/ 1)*	( 1.4 ± .8)E 1 *( 0/ 1)*
CE-144 ( 2) ( 0)		(-3.2 ± 2.5)E 1 *( 0/ 1)*	11 (-3.2 ± 2.5)E 1 *( 0/ 1)*	(-5.8 ± 2.5)E 1 *( 0/ 1)*
AC-228 ( 2) ( 0)		( 2.5 ± 22.0)E 0 *( 0/ 1)*	11 ( 2.5 ± 22.0)E 0 *( 0/ 1)*	(-5.4 ± 19.8)E 0 *( 0/ 1)*

\* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.

\*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

F) Meat, Poultry, Eggs

The only meat, poultry, or egg sample available during 1983 was an egg sample from Station TZ-11. It was analyzed for gamma-emitting radionuclides. Only naturally-occurring K-40 was detected.



ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: MEAT, POULTRY, EGGS

UNITS: PCI/KG WET

RADIOISOTOPES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****		STATION WITH HIGHEST MEAN *****		CONTROL STATIONS *****
		MEAN RANGE NO. DETECTED**		MEAN RANGE STA. NO.		MEAN RANGE NO. DETECTED**
BE-7 ( 1) ( 0)		( 1.6 ± 1.0)E 2	2	99 ( 1.6 ± 1.0)E 2	2	NO DATA
		*( 0/ 1)*		*( 0/ 1)*		
K-40 ( 1) ( 0)		( 1.5 ± .2)E 3	3	99 ( 1.5 ± .2)E 3	3	NO DATA
		*( 1/ 1)*		*( 1/ 1)*		
CR-51 ( 1) ( 0)		(-2.2 ± 1.0)E 2	2	99 (-2.2 ± 1.0)E 2	2	NO DATA
		*( 0/ 1)*		*( 0/ 1)*		
MN-54 ( 1) ( 0)		( 1.0 ± 9.8)E 0	0	99 ( 1.0 ± 9.8)E 0	0	NO DATA
		*( 0/ 1)*		*( 0/ 1)*		
CO-58 ( 1) ( 0)		(-1.2 ± 10.9)E 0	0	99 (-1.2 ± 10.9)E 0	0	NO DATA
		*( 0/ 1)*		*( 0/ 1)*		
FE-59 ( 1) ( 0)		(-3.8 ± 2.7)E 1	1	99 (-3.8 ± 2.7)E 1	1	NO DATA
		*( 0/ 1)*		*( 0/ 1)*		
CO-60 ( 1) ( 0)		(-2.3 ± 1.5)E 1	1	99 (-2.3 ± 1.5)E 1	1	NO DATA
		*( 0/ 1)*		*( 0/ 1)*		
ZN-65 ( 1) ( 0)		( 1.0 ± 2.2)E 1	1	99 ( 1.0 ± 2.2)E 1	1	NO DATA
		*( 0/ 1)*		*( 0/ 1)*		
ZR-95 ( 1) ( 0)		(-2.0 ± 1.9)E 1	1	99 (-2.0 ± 1.9)E 1	1	NO DATA
		*( 0/ 1)*		*( 0/ 1)*		

- \* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.
- \*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: MEAT, POULTRY, EGGS

UNITS: PCI/KG WET

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS	STATION WITH HIGHEST MEAN	CONTROL STATIONS
		***** MEAN RANGE NO. DETECTED**	***** MEAN RANGE STA. NO. NO. DETECTED**	***** MEAN RANGE NO. DETECTED**
RU-103 ( 1) ( 0)		(-2.4 ± 1.3)E 1 *( 0/ 1)*	95 (-2.4 ± 1.3)E 1 *( 0/ 1)*	NO DATA
RU-106 ( 1) ( 0)		(-6.1 ± 9.3)E 1 *( 0/ 1)*	99 (-6.1 ± 9.3)E 1 *( 0/ 1)*	NO DATA
I-131 ( 1) ( 0)	60.	(-6.3 ± 4.3)E 1 *( 0/ 1)*	99 (-6.3 ± 4.3)E 1 *( 0/ 1)*	NO DATA
CS-134 ( 1) ( 0)	60.	(-2.3 ± 10.5)E 0 *( 0/ 1)*	99 (-2.3 ± 10.5)E 0 *( 0/ 1)*	NO DATA
CS-137 ( 1) ( 0)	80.	( 1.7 ± 9.4)E 0 *( 0/ 1)*	99 ( 1.7 ± 9.4)E 0 *( 0/ 1)*	NO DATA
BA-140 ( 1) ( 0)		(-3.8 ± 29.0)E 0 *( 0/ 1)*	99 (-3.8 ± 29.0)E 0 *( 0/ 1)*	NO DATA
CE-141 ( 1) ( 0)		( 1.8 ± 1.7)E 1 *( 0/ 1)*	99 ( 1.8 ± 1.7)E 1 *( 0/ 1)*	NO DATA
CE-144 ( 1) ( 0)		( 3.2 ± 50.5)E 0 *( 0/ 1)*	99 ( 3.2 ± 50.5)E 0 *( 0/ 1)*	NO DATA
AC-228 ( 1) ( 0)		( 6.9 ± 5.0)E 1 *( 0/ 1)*	99 ( 6.9 ± 5.0)E 1 *( 0/ 1)*	NO DATA

\* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.

\*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

G) Silage

Silage samples were collected at the four milk sampling stations during 1983. Each sample was analyzed for gamma-emitting radionuclides. Other than naturally-occurring K-40 and Be-7, none were found.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: SILAGE

UNITS: PCI/KG WET

RADIOISOTOPES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****	STATION WITH HIGHEST MEAN *****	CONTROL STATIONS *****
		MEAN RANGE NO. DETECTED**	MEAN RANGE STA. NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
BE-7 ( 4) ( 0)		( 3.2 ± .8)E 2 ( 2.2 - 4.8)E 2 *( 1/ 3)*	12 ( 4.8 ± 1.2)E 2 *( 1/ 1)*	( 4.7 ± 1.0)E 2 *( 1/ 1)*
K-40 ( 4) ( 0)		( 3.1 ± .6)E 3 ( 2.2 - 4.2)E 3 *( 3/ 3)*	11 ( 4.2 ± .3)E 3 *( 1/ 1)*	( 2.6 ± .3)E 3 *( 1/ 1)*
CS-137 ( 4) ( 0)		( 3.3 ± 2.9)E 1 (-7.7 - 88.5)E 0 *( 0/ 3)*	11 ( 8.8 ± 14.2)E 1 *( 0/ 1)*	( 1.0 ± 12.1)E 1 *( 0/ 1)*
MN-54 ( 4) ( 0)		( 7.8 ± 3.8)E 0 ( 1.8 - 14.7)E 0 *( 0/ 3)*	11 ( 1.5 ± 1.2)E 1 *( 0/ 1)*	(-1.2 ± 1.0)E 1 *( 0/ 1)*
CO-58 ( 4) ( 0)		( 7.0 ± 15.5)E 0 (-2.4 - 2.3)E 1 *( 0/ 3)*	13 ( 2.3 ± 1.1)E 1 *( 0/ 1)*	(-5.2 ± 11.4)E 0 *( 0/ 1)*
FE-59 ( 4) ( 0)		(-1.8 ± 1.3)E 1 (-3.7 - .5)E 1 *( 0/ 3)*	13 ( 5.4 ± 24.1)E 0 *( 0/ 1)*	(-8.5 ± 3.1)E 1 *( 0/ 1)*
CO-60 ( 4) ( 0)		(-1.7 ± .7)E 1 (-2.8 - -.6)E 1 *( 0/ 3)*	12 (-5.6 ± 19.7)E 0 *( 0/ 1)*	(-10. ± 14.5)E 0 *( 0/ 1)*
ZN-65 ( 4) ( 0)		(-1.5 ± .8)E 1 (-3.1 - -.3)E 1 *( 0/ 3)*	21 ( 3.4 ± 2.3)E 1 *( 0/ 1)*	( 3.4 ± 2.3)E 1 *( 0/ 1)*
ZR-95 ( 4) ( 0)		(-2.6 ± 1.5)E 1 (-5.5 - -.3)E 1 *( 0/ 3)*	13 (-3.0 ± 19.1)E 0 *( 0/ 1)*	(-1.1 ± 2.3)E 1 *( 0/ 1)*

\* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.

\*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
 VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
 JANUARY - DECEMBER 1983

MEDIUM: SILAGE

UNITS: PCI/KG WET

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLI	INDICATOR STATIONS	STATION WITH HIGHEST MEAN	CONTROL STATIONS
		***** MEAN RANGE NO. DETECTED**	***** MEAN RANGE STA. NO. NO. DETECTED**	***** MEAN RANGE NO. DETECTED**
RU-103 ( 4) ( 0)		( 2.0 ± 1.2)E 1 ( 7.7 - 42.6)E 0 *( 0/ 3)*	11 ( 4.3 ± 1.6)E 1 *( 0/ 1)*	( 6.9 ± 12.1)E 0 *( 0/ 1)*
RU-106 ( 4) ( 0)		( 6.4 ± 1.7)E 1 ( 3.5 - 9.3)E 1 *( 0/ 3)*	13 ( 9.3 ± 7.0)E 1 *( 0/ 1)*	( 2.9 ± 8.0)E 1 *( 0/ 1)*
I-131 ( 4) ( 0)		( 1.4 ± 4.4)E 1 (-6.0 - 9.4)E 1 *( 0/ 3)*	13 ( 9.4 ± 7.7)E 1 *( 0/ 1)*	(-10. ± 8.8)E 1 *( 0/ 1)*
CS-134 ( 4) ( 0)		(-1.1 ± .6)E 1 (-2.2 - -.1)E 1 *( 0/ 3)*	11 (-1.5 ± 11.4)E 0 *( 0/ 1)*	(-2.6 ± 8.9)E 0 *( 0/ 1)*
CS-137 ( 4) ( 0)		(-4.7 ± 7.5)E 0 (-1.8 - .8)E 1 *( 0/ 3)*	13 ( 8.5 ± 9.5)E 0 *( 0/ 1)*	( 6.1 ± 10.5)E 0 *( 0/ 1)*
BA-140 ( 4) ( 0)		(-5.8 ± 25.4)E 0 (-4.1 - 4.3)E 1 *( 0/ 3)*	21 ( 4.9 ± 3.8)E 1 *( 0/ 1)*	( 4.9 ± 3.8)E 1 *( 0/ 1)*
CE-141 ( 4) ( 0)		( 3.5 ± 14.2)E 0 (-2.0 - 2.6)E 1 *( 0/ 3)*	11 ( 2.6 ± 2.2)E 1 *( 0/ 1)*	(-1.3 ± 1.9)E 1 *( 0/ 1)*
CE-144 ( 4) ( 0)		( 3.1 ± 5.0)E 1 (-6.5 - 10.1)E 1 *( 0/ 3)*	12 ( 1.0 ± .5)E 2 *( 0/ 1)*	( 5.6 ± 4.6)E 1 *( 0/ 1)*
AC-228 ( 4) ( 0)		( 3.8 ± 1.5)E 1 ( 1.2 - 6.2)E 1 *( 0/ 3)*	11 ( 6.2 ± 5.0)E 1 *( 0/ 1)*	( 2.0 ± 4.7)E 1 *( 0/ 1)*

\* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.  
 \*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

#### H) Ground Water

Ground water grab samples were collected from three indicator and one control station on a quarterly basis. These samples were analyzed for H-3, gross-beta, and gamma-emitting radionuclides. Gross-beta radioactivity was detected in indicator and control stations during 1983 and the concentrations are typical of those made over the past few years.

Manganese-54 was detected in the February 15, 1983 sample from Station WG-11 ( $4.9 \pm 1.2$  pCi/kg). It is likely that this radioactivity was caused by cross-contamination from some other in-plant source because: 1) the three subsequent samples from that location had no Mn-54; and 2) the sample was taken from a tap inside the plant and was consequently handled inside the plant. In any case, the calculated critical organ dose to an adult who consumed 370 liters/year of water at the above level of Mn-54 would be approximately 0.025 mrem, based on USNRC Regulatory Guide 1.109 methodology (Reference 1).

No other radionuclides were detected in the 1983 ground water samples.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT Yankee NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1988

MEDIUM: GROUND WATER

UNITS: PCI/KG

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****		STATION WITH HIGHEST MEAN *****		CONTROL STATIONS *****		
		MEAN RANGE	NO. DETECTED**	STA. NO.	MEAN RANGE	NO. DETECTED**	MEAN RANGE	NO. DETECTED**
GR-B (16) ( 3)	4.	( 5.9 ± 2.0)E 0 ( 6.0 - 194.0)E -1	*( 9/ 12)*	13	( 1.3 ± .4)E 1 ( 2.0 - 19.4)E 0	*( 4/ 4)*	( 1.2 ± .4)E 0 ( 4.0 - 190.0)E -2	*( 2/ 4)*
BE-7 (16) ( 0)		(-2.2 ± 1.6)E 0 (-1.1 - .8)E 1	*( 0/ 12)*	21	( 2.9 ± 2.4)E 0 (-1.3 - 9.7)E 0	*( 0/ 4)*	( 2.9 ± 2.4)E 0 (-1.3 - 9.7)E 0	*( 0/ 4)*
K-40 (16) ( 0)		(-1.6 ± 2.4)E 0 (-1.9 - 1.3)E 1	*( 0/ 12)*	21	( 3.0 ± 4.9)E 0 (-9.2 - 14.6)E 0	*( 0/ 4)*	( 3.0 ± 4.9)E 0 (-9.2 - 14.6)E 0	*( 0/ 4)*
CR-51 (16) ( 0)		( 1.5 ± 24.6)E -1 (-1.3 - 1.4)E 1	*( 0/ 12)*	12	( 1.7 ± 4.8)E 0 (-9.2 - 13.9)E 0	*( 0/ 4)*	(-1.5 ± 2.9)E 0 (-6.3 - 6.7)E 0	*( 0/ 4)*
MN-54 (16) ( 1)	15.	( 5.6 ± 4.6)E -1 (-9.6 - 49.0)E -1	*( 1/ 12)*	11	( 1.6 ± 1.2)E 0 (-7.6 - 49.0)E -1	*( 1/ 4)*	(-2.0 ± 2.7)E -1 (-9.2 - 3.9)E -1	*( 0/ 4)*
CO-58 (16) ( 0)	15.	(-2.0 ± 27.3)E -2 (-1.6 - 1.4)E 0	*( 0/ 12)*	21	( 2.2 ± 5.9)E -1 (-1.4 - 1.2)E 0	*( 0/ 4)*	( 2.2 ± 5.9)E -1 (-1.4 - 1.2)E 0	*( 0/ 4)*
FE-59 (16) ( 0)	30.	( 6.6 ± 5.2)E -1 (-2.1 - 4.7)E 0	*( 0/ 12)*	12	( 9.9 ± 5.4)E -1 (-6.0 - 18.0)E -1	*( 0/ 4)*	(-8.0 ± 10.7)E -1 (-3.0 - 1.9)E 0	*( 0/ 4)*
CO-60 (16) ( 0)	15.	(-4.6 ± 2.0)E -1 (-1.3 - .9)E 0	*( 0/ 12)*	21	(-2.7 ± 1.7)E -1 (-7.4 - -.0)E -1	*( 0/ 4)*	(-2.7 ± 1.7)E -1 (-7.4 - -.0)E -1	*( 0/ 4)*
ZN-65 (16) ( 0)	30.	( 1.5 ± .6)E 0 (-2.1 - 5.3)E 0	*( 0/ 12)*	11	( 1.9 ± 1.0)E 0 (-4.9 - 39.4)E -1	*( 0/ 4)*	( 1.8 ± 1.2)E 0 (-8.3 - 48.1)E -1	*( 0/ 4)*

\* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.

\*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: GROUND WATER

UNITS: PCI/KG

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS	STATION WITH HIGHEST MEAN	CONTROL STATIONS
		MEAN RANGE NO. DETECTED**	MEAN RANGE STA. NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
ZR-95 ( 16) ( 0)	30.	( 1.0 ± .4)E 0 (-1.2 - 2.8)E 0 *( 0/ 12)*	12 ( 1.7 ± .3)E 0 ( 1.0 - 2.5)E 0 *( 0/ 4)*	( 8.7 ± 8.9)E -1 (-6.1 - 30.8)E -1 *( 0/ 4)*
RU-103 ( 16) ( 0)		(-6.4 ± 1.5)E -1 (-1.6 - .2)E 0 *( 0/ 12)*	13 (-2.8 ± 1.7)E -1 (-5.8 - 2.2)E -1 *( 0/ 4)*	(-6.8 ± 4.7)E -1 (-1.6 - .4)E 0 *( 0/ 4)*
RU-106 ( 16) ( 0)		(-2.5 ± 18.5)E -1 (-1.1 - .6)E 1 *( 0/ 12)*	13 ( 2.5 ± 1.4)E 0 (-1.1 - 5.3)E 0 *( 0/ 4)*	(-1.4 ± 1.6)E 0 (-3.8 - 3.2)E 0 *( 0/ 4)*
I-131 ( 16) ( 0)	1.	( 2.7 ± 6.3)E -1 (-3.7 - 3.9)E 0 *( 0/ 12)*	12 ( 9.4 ± 9.6)E -1 (-1.2 - 2.6)E 0 *( 0/ 4)*	( 5.8 ± 13.0)E -1 (-2.2 - 3.9)E 0 *( 0/ 4)*
CS-134 ( 16) ( 0)	15.	( 7.0 ± 266.7)E -3 (-1.6 - 1.7)E 0 *( 0/ 12)*	12 ( 2.1 ± 2.5)E -1 (-4.6 - 6.9)E -1 *( 0/ 4)*	(-1.0 ± 21.9)E -2 (-4.0 - 5.7)E -1 *( 0/ 4)*
CS-137 ( 16) ( 0)	18.	(-2.1 ± 2.9)E -1 (-1.9 - 1.3)E 0 *( 0/ 12)*	21 ( 3.5 ± 2.9)E -1 (-2.6 - 8.9)E -1 *( 0/ 4)*	( 3.5 ± 2.9)E -1 (-2.6 - 8.9)E -1 *( 0/ 4)*
BA-140 ( 16) ( 0)	60.	(-3.2 ± 2.8)E -1 (-2.2 - .9)E 0 *( 0/ 12)*	12 (-3.7 ± 20.1)E -2 (-6.4 - 2.1)E -1 *( 0/ 4)*	(-1.8 ± 1.1)E 0 (-3.9 - 1.4)E 0 *( 0/ 4)*
CE-141 ( 16) ( 0)		( 1.4 ± .4)E 0 (-7.1 - 31.5)E -1 *( 0/ 12)*	12 ( 1.9 ± .6)E 0 ( 2.9 - 31.5)E -1 *( 0/ 4)*	( 1.3 ± .9)E 0 (-1.2 - 3.1)E 0 *( 0/ 4)*
CE-144 ( 16) ( 0)		(-1.6 ± 1.6)E 0 (-1.1 - .8)E 1 *( 0/ 12)*	13 ( 8.5 ± 33.5)E -1 (-6.5 - 8.4)E 0 *( 0/ 4)*	(-2.4 ± 2.2)E 0 (-7.2 - 3.1)E 0 *( 0/ 4)*
H-3 ( 16) ( 0)	2000.	( 1.1 ± .3)E 2 (-2.4 - 26.3)E 1 *( 0/ 12)*	11 ( 1.6 ± .3)E 2 ( 1.3 - 2.6)E 2 *( 0/ 4)*	( 4.1 ± 6.9)E 1 (-1.4 - 1.9)E 2 *( 0/ 4)*

\* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.

\*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.



1) River Water

River water is analyzed monthly for gross-beta and gamma-emitting radionuclides. The monthly samples are composited and analyzed for H-3 on a quarterly basis. A composite sampler is used at Station WR-11 and grab samples are taken at the other two stations.

Gross-beta radioactivity was detected in all but one sample during 1983. The mean value, as well as the range of values, for the indicator stations was similar to that of the control station, indicating that those radionuclides detected are not due to plant operations.

Tritium (H-3) was detected in one sample from Station WR-21 ( $298 \pm 92$  pCi/kg). Since this sample is from a control location and, since the measurement was marginally positive, it is likely that the measurement is either a false positive or due to nuclear weapons testing fallout.

No other radionuclides were detected in the 1983 river water samples.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT Yankee NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: RIVER WATER

UNITS: PCI/KG

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS	STATION WITH HIGHEST MEAN	CONTROL STATIONS
		***** MEAN RANGE NO. DETECTED**	***** MEAN STA. RANGE NO. NO. DETECTED**	***** MEAN RANGE NO. DETECTED**
GR-B (36) ( 0)	4.	( 1.9 ± .1)E 0 ( 9.4 - 30.9)E -1 *( 23/ 24)*	21 ( 2.0 ± .1)E 0 ( 1.3 - 2.9)E 0 *( 12/ 12)*	( 2.0 ± .1)E 0 ( 1.3 - 2.9)E 0 *( 12/ 12)*
BE-7 (36) ( 0)		( 2.9 ± 14.6)E -1 (-1.2 - 1.5)E 1 *( 0/ 24)*	12 ( 1.8 ± 2.2)E 0 (-9.4 - 15.1)E 0 *( 0/ 12)*	(-9.8 ± 14.9)E -1 (-9.2 - 5.9)E 0 *( 0/ 12)*
K-40 (36) ( 0)		(-5.5 ± 2.3)E 0 (-3.6 - 1.5)E 1 *( 0/ 24)*	11 (-3.8 ± 3.1)E 0 (-2.0 - 1.5)E 1 *( 0/ 12)*	(-4.7 ± 5.2)E 0 (-3.3 - 1.7)E 1 *( 0/ 12)*
CR-51 (36) ( 0)		(-2.8 ± 15.7)E -1 (-1.4 - 1.6)E 1 *( 0/ 24)*	12 ( 2.5 ± 2.3)E 0 (-9.0 - 15.5)E 0 *( 0/ 12)*	(-1.1 ± 2.5)E 0 (-2.3 - 1.2)E 1 *( 0/ 12)*
MN-54 (36) ( 0)	15.	( 2.2 ± 14.9)E -2 (-1.4 - 1.6)E 0 *( 0/ 24)*	12 ( 4.2 ± 12.6)E -2 (-8.5 - 10.1)E -1 *( 0/ 12)*	(-9.3 ± 18.4)E -2 (-1.0 - .7)E 0 *( 0/ 12)*
CO-58 (36) ( 0)	15.	(-5.2 ± 16.8)E -2 (-1.8 - 1.5)E 0 *( 0/ 24)*	21 (-1.4 ± 30.7)E -2 (-2.8 - 1.2)E 0 *( 0/ 12)*	(-1.4 ± 30.7)E -2 (-2.8 - 1.2)E 0 *( 0/ 12)*
FE-59 (36) ( 0)	30.	( 2.0 ± 3.2)E -1 (-3.0 - 3.2)E 0 *( 0/ 24)*	11 ( 2.1 ± 5.2)E -1 (-3.0 - 3.1)E 0 *( 0/ 12)*	(-6.8 ± 78.9)E -2 (-4.6 - 4.9)E 0 *( 0/ 12)*
CO-60 (36) ( 0)	15.	(-4.7 ± 1.7)E -1 (-3.1 - 1.0)E 0 *( 0/ 24)*	12 (-3.4 ± 1.6)E -1 (-1.4 - .3)E 0 *( 0/ 12)*	(-6.3 ± 3.4)E -1 (-3.4 - .9)E 0 *( 0/ 12)*
ZN-65 (36) ( 0)	30.	(-3.7 ± 3.9)E -1 (-3.4 - 4.1)E 0 *( 0/ 24)*	12 (-3.6 ± 6.1)E -1 (-3.4 - 3.6)E 0 *( 0/ 12)*	(-1.1 ± .5)E 0 (-3.9 - 1.6)E 0 *( 0/ 12)*

- \* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.
- \*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1993

MEDIUM: RIVER WATER

UNITS: PCI/KG

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****	STATION WITH HIGHEST MEAN *****	CONTROL STATIONS *****
		MEAN RANGE NO. DETECTED**	MEAN RANGE STA. NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
ZR-95 ( 36) ( 0)	30.	( 2.8 ± 22.7)E -2 (-2.0 - 2.7)E 0 *( 0/ 24)*	11 ( 3.9 ± 28.2)E -2 (-1.3 - 2.7)E 0 *( 0/ 12)*	(-4.8 ± 6.5)E -1 (-4.1 - 2.7)E 0 *( 0/ 12)*
RU-103 ( 36) ( 0)		(-1.1 ± .2)E 0 (-3.1 - .5)E 0 *( 0/ 24)*	21 (-1.1 ± .2)E 0 (-1.8 - .4)E 0 *( 0/ 12)*	(-1.1 ± .2)E 0 (-1.8 - .4)E 0 *( 0/ 12)*
RU-106 ( 36) ( 0)		(-1.3 ± 1.5)E 0 (-1.3 - 2.0)E 1 *( 0/ 24)*	21 ( 3.6 ± 2.2)E 0 (-1.0 - 1.3)E 1 *( 0/ 12)*	( 3.6 ± 2.2)E 0 (-1.0 - 1.3)E 1 *( 0/ 12)*
I-131 ( 36) ( 0)		(-3.4 ± 4.8)E -1 (-5.1 - 5.4)E 0 *( 0/ 24)*	11 ( 3.3 ± 7.4)E -1 (-3.4 - 5.4)E 0 *( 0/ 12)*	(-7.8 ± 82.4)E -2 (-5.5 - 5.8)E 0 *( 0/ 12)*
CS-134 ( 36) ( 0)	15.	(-2.7 ± 1.2)E -1 (-1.6 - 1.0)E 0 *( 0/ 24)*	21 (-1.8 ± 2.8)E -1 (-1.7 - 1.3)E 0 *( 0/ 12)*	(-1.8 ± 2.8)E -1 (-1.7 - 1.3)E 0 *( 0/ 12)*
CS-137 ( 36) ( 0)	18.	(-5.2 ± 18.8)E -2 (-1.3 - 2.0)E 0 *( 0/ 24)*	11 ( 5.8 ± 28.2)E -2 (-1.3 - 2.0)E 0 *( 0/ 12)*	(-4.4 ± 2.4)E -1 (-1.8 - 1.2)E 0 *( 0/ 12)*
BA-140 ( 36) ( 0)	60.	(-5.6 ± 3.2)E -1 (-3.8 - 2.4)E 0 *( 0/ 24)*	11 (-5.1 ± 4.1)E -1 (-3.3 - 1.8)E 0 *( 0/ 12)*	(-8.5 ± 5.6)E -1 (-3.9 - 2.9)E 0 *( 0/ 12)*
CE-141 ( 36) ( 0)		( 1.1 ± 219.3)E -3 (-1.9 - 2.4)E 0 *( 0/ 24)*	11 ( 2.9 ± 2.9)E -1 (-1.6 - 1.3)E 0 *( 0/ 12)*	(-1.2 ± 2.9)E -1 (-1.6 - 1.8)E 0 *( 0/ 12)*
CE-144 ( 36) ( 0)		(-1.0 ± 1.2)E 0 (-1.6 - .9)E 1 *( 0/ 24)*	11 (-1.0 ± 1.6)E 0 (-1.1 - .7)E 1 *( 0/ 12)*	(-2.6 ± 1.6)E 0 (-1.4 - .6)E 1 *( 0/ 12)*
H-3 ( 12) ( 0)	2000.	( 1.0 ± .5)E 2 (-9.3 - 27.5)E 1 *( 0/ 8)*	12 ( 1.0 ± .8)E 2 (-7.0 - 25.5)E 1 *( 0/ 4)*	( 7.1 ± 9.9)E 1 (-1.9 - 3.0)E 2 *( 1/ 4)*

\* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.

\*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

J) Aquatic Vegetation

Twice during 1983, cattail samples were collected from one indicator and one control location. Each sample was analyzed for gamma-emitting radionuclides. Other than naturally-occurring K-40, no radionuclides were detected.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: AQUATIC VEGETATION

UNITS: PCI/KG WET

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS	STATION WITH HIGHEST MEAN	CONTROL STATIONS
		MEAN RANGE NO. DETECTED**	MEAN RANGE STA. NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
BE-7 ( 4) ( 0)		( 1.4 ± .2)E 2 ( 1.2 - 1.6)E 2 *( 0/ 2)*	11 ( 1.4 ± .2)E 2 ( 1.2 - 1.6)E 2 *( 0/ 2)*	( 7.6 ± 5.5)E 1 ( 2.1 - 13.1)E 1 *( 0/ 2)*
K-40 ( 4) ( 0)		( 3.1 ± .2)E 3 ( 3.0 - 3.3)E 3 *( 2/ 2)*	11 ( 3.1 ± .2)E 3 ( 3.0 - 3.3)E 3 *( 2/ 2)*	( 2.8 ± .7)E 3 ( 2.1 - 3.6)E 3 *( 2/ 2)*
CR-51 ( 4) ( 0)		(-2.0 ± 4.7)E 1 (-6.7 - 2.6)E 1 *( 0/ 2)*	21 (-6.0 ± 27.5)E 0 (-3.3 - 2.2)E 1 *( 0/ 2)*	(-6.0 ± 27.5)E 0 (-3.3 - 2.2)E 1 *( 0/ 2)*
MN-54 ( 4) ( 0)		( 5.0 ± 5.1)E 0 (-1.4 - 101.0)E -1 *( 0/ 2)*	11 ( 5.0 ± 5.1)E 0 (-1.4 - 101.0)E -1 *( 0/ 2)*	(-4.6 ± 25.3)E -1 (-3.0 - 2.1)E 0 *( 0/ 2)*
CO-58 ( 4) ( 0)		( 9.4 ± 12.3)E 0 (-2.8 - 21.7)E 0 *( 0/ 2)*	11 ( 9.4 ± 12.3)E 0 (-2.8 - 21.7)E 0 *( 0/ 2)*	(-1.6 ± 7.9)E -1 (-9.5 - 6.2)E -1 *( 0/ 2)*
FE-59 ( 4) ( 0)		( 1.8 ± 1.1)E 1 ( 7.3 - 28.6)E 0 *( 0/ 2)*	11 ( 1.8 ± 1.1)E 1 ( 7.3 - 28.6)E 0 *( 0/ 2)*	( 1.6 ± .8)E 1 ( 8.0 - 24.6)E 0 *( 0/ 2)*
CO-60 ( 4) ( 0)		(-7.5 ± 7.4)E 0 (-1.5 - -.0)E 1 *( 0/ 2)*	21 ( 1.3 ± .5)E 1 ( 8.1 - 17.6)E 0 *( 0/ 2)*	( 1.3 ± .5)E 1 ( 8.1 - 17.6)E 0 *( 0/ 2)*
ZN-65 ( 4) ( 0)		(-2.2 ± 1.8)E 1 (-3.9 - -.4)E 1 *( 0/ 2)*	21 (-1.1 ± 12.5)E 0 (-1.4 - 1.1)E 1 *( 0/ 2)*	(-1.1 ± 12.5)E 0 (-1.4 - 1.1)E 1 *( 0/ 2)*
ZR-95 ( 4) ( 0)		( 3.2 ± 2.0)E 1 ( 1.2 - 5.2)E 1 *( 0/ 2)*	11 ( 3.2 ± 2.0)E 1 ( 1.2 - 5.2)E 1 *( 0/ 2)*	(-1.4 ± .8)E 1 (-2.3 - -.6)E 1 *( 0/ 2)*

\* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.

\*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERMONT, VT  
JANUARY - DECEMBER 1983

MEDIUM: AQUATIC VEGETATION

UNITS: PCI/KG WET

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS	STATION WITH HIGHEST MEAN	CONTROL STATIONS
		MEAN RANGE NO. DETECTED**	MEAN RANGE STA. NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
RU-103 ( 4) ( 0)		( 4.3 ± 9.3)E 0 (-5.0 - 13.6)E 0 *( 0/ 2)*	21 ( 7.7 ± 3.1)E 0 ( 4.6 - 10.8)E 0 *( 0/ 2)*	( 7.7 ± 3.1)E 0 ( 4.6 - 10.8)E 0 *( 0/ 2)*
RU-106 ( 4) ( 0)		(-3.2 ± 3.1)E 1 (-6.2 - -.1)E 1 *( 0/ 2)*	21 ( 1.4 ± 2.1)E 1 (-8.0 - 35.0)E 0 *( 0/ 2)*	( 1.4 ± 2.1)E 1 (-8.0 - 35.0)E 0 *( 0/ 2)*
I-131 ( 4) ( 0)		(-1.8 ± 5.5)E 1 (-7.3 - 3.7)E 1 *( 0/ 2)*	11 (-1.8 ± 5.5)E 1 (-7.3 - 3.7)E 1 *( 0/ 2)*	(-3.9 ± .7)E 1 (-4.5 - -3.2)E 1 *( 0/ 2)*
CS-134 ( 4) ( 0)		( 5.1 ± 4.3)E 0 ( 8.9 - 94.0)E -1 *( 0/ 2)*	11 ( 5.1 ± 4.3)E 0 ( 8.9 - 94.0)E -1 *( 0/ 2)*	(-4.0 ± 36.3)E -1 (-4.0 - 3.2)E 0 *( 0/ 2)*
CS-137 ( 4) ( 0)		(-8.2 ± 2.6)E 0 (-1.1 - -.6)E 1 *( 0/ 2)*	21 (-3.1 ± 7.3)E 0 (-1.0 - .4)E 1 *( 0/ 2)*	(-3.1 ± 7.3)E 0 (-1.0 - .4)E 1 *( 0/ 2)*
BA-140 ( 4) ( 0)		(-2.3 ± 1.7)E 1 (-4.0 - -.6)E 1 *( 0/ 2)*	21 ( 9.5 ± 332.5)E -1 (-3.2 - 3.4)E 1 *( 0/ 2)*	( 9.5 ± 332.5)E -1 (-3.2 - 3.4)E 1 *( 0/ 2)*
CE-141 ( 4) ( 0)		( 7.6 ± 10.8)E 0 (-3.1 - 18.4)E 0 *( 0/ 2)*	21 ( 2.6 ± 1.9)E 1 ( 7.6 - 45.3)E 0 *( 0/ 2)*	( 2.6 ± 1.9)E 1 ( 7.6 - 45.3)E 0 *( 0/ 2)*
CE-144 ( 4) ( 0)		( 1.7 ± 1.4)E 1 ( 3.3 - 31.3)E 0 *( 0/ 2)*	11 ( 1.7 ± 1.4)E 1 ( 3.3 - 31.3)E 0 *( 0/ 2)*	( 1.4 ± 21.0)E 0 (-2.0 - 2.2)E 1 *( 0/ 2)*
AC-228 ( 4) ( 0)		( 8.7 ± 18.3)E 0 (-9.6 - 27.0)E 0 *( 0/ 2)*	21 ( 2.4 ± .8)E 1 ( 1.6 - 3.2)E 1 *( 0/ 2)*	( 2.4 ± .8)E 1 ( 1.6 - 3.2)E 1 *( 0/ 2)*

- \* NON-ROUTINE REFERS TO THE NUMBER OF SAMPLE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.
- \*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

K) Sediment

During 1983, sediment samples were collected from three locations. In June, a grab sample was collected from each station, and in September, a core was taken at each. Each sample was analyzed for gamma-emitting radionuclides.

Cesium-137 was detected in all but one sample. As has been discussed in previous Vermont Yankee Radiological Environmental Surveillance Reports, this radioactivity has been due to nuclear weapons testing fallout. Since there were no liquid releases during 1982 or 1983, it can be concluded that the similar levels of Cs-137 in 1983 sediment samples were due also to nuclear weapons testing fallout.

Low levels of plant-related Co-60 were detected in a special series of non-routine sediment samples collected during 1983, and are the subject of a separate report (see LER 83-23/3L).

Except for naturally-occurring Be-7, K-40, and Ac-228, and the Cs-137 and Co-60 discussed above, no radionuclides were detected in sediment samples during 1983.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: SEDIMENT

UNITS: PCI/KG DRY

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****	STATION WITH HIGHEST MEAN *****	CONTROL STATIONS *****
		MEAN RANGE NO. DETECTED**	MEAN RANGE STA. NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
BE-7 ( 9) ( 0)		( 2.5 ± 1.3)E 2 (-2.4 - 6.4)E 2 *( 0/ 6)*	12 ( 3.6 ± 1.5)E 2 ( 1.7 - 6.4)E 2 *( 0/ 3)*	( 2.0 ± 3.0)E 2 (-2.6 - 7.5)E 2 *( 1/ 3)*
K-40 ( 9) ( 0)		( 9.6 ± .8)E 3 ( 7.8 - 12.5)E 3 *( 6/ 6)*	12 ( 1.1 ± .1)E 4 ( 9.6 - 12.5)E 3 *( 3/ 3)*	( 7.5 ± .7)E 3 ( 6.8 - 8.8)E 3 *( 3/ 3)*
CR-51 ( 9) ( 0)		(-6.3 ± 8.6)E 1 (-3.6 - 1.9)E 2 *( 0/ 6)*	21 ( 3.8 ± 1.4)E 2 ( 1.6 - 6.4)E 2 *( 0/ 3)*	( 3.8 ± 1.4)E 2 ( 1.6 - 6.4)E 2 *( 0/ 3)*
MN-54 ( 9) ( 0)		(-1.1 ± 1.4)E 1 (-5.9 - 2.7)E 1 *( 0/ 6)*	11 ( 1.6 ± .5)E 1 ( 9.6 - 26.6)E 0 *( 0/ 3)*	( 1.3 ± .6)E 1 ( 4.3 - 23.6)E 0 *( 0/ 3)*
CO-58 ( 9) ( 0)		( 9.1 ± 7.1)E 0 (-2.0 - 3.2)E 1 *( 0/ 6)*	12 ( 1.4 ± .2)E 1 ( 9.1 - 16.3)E 0 *( 0/ 3)*	(-1.6 ± 1.0)E 1 (-3.5 - .1)E 1 *( 0/ 3)*
FE-59 ( 9) ( 0)		(-3.4 ± 2.5)E 1 (-1.4 - .2)E 2 *( 0/ 6)*	11 (-3.2 ± 1.5)E 1 (-5.1 - -.3)E 1 *( 0/ 3)*	(-3.4 ± 2.8)E 1 (-7.0 - 2.2)E 1 *( 0/ 3)*
CO-60 ( 9) ( 0)		( 3.5 ± 133.6)E -1 (-5.1 - 3.8)E 1 *( 0/ 6)*	21 ( 8.4 ± 13.5)E 0 (-1.9 - 2.3)E 1 *( 0/ 3)*	( 8.4 ± 13.5)E 0 (-1.9 - 2.3)E 1 *( 0/ 3)*
ZN-65 ( 9) ( 0)		(-1.8 ± 1.7)E 1 (-6.8 - 3.9)E 1 *( 0/ 6)*	11 (-1.0 ± 2.6)E 1 (-5.2 - 3.9)E 1 *( 0/ 3)*	(-1.7 ± 3.8)E 1 (-8.9 - 4.0)E 1 *( 0/ 3)*
ZR-95 ( 9) ( 0)		( 2.9 ± 25.6)E 0 (-6.4 - 11.5)E 1 *( 0/ 6)*	21 ( 3.6 ± 2.3)E 1 ( 1.0 - 8.1)E 1 *( 0/ 3)*	( 3.6 ± 2.3)E 1 ( 1.0 - 8.1)E 1 *( 0/ 3)*

- \* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.  
\*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. 2 STD DEVIATIONS) IS INDICATED WITH \*( )\*.



ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: SEDIMENT

UNITS: PCI/KG DRY

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****	STATION WITH HIGHEST MEAN *****	CONTROL STATIONS *****
		MEAN RANGE NO. DETECTED**	STA. NO. MEAN RANGE NO. DETECTED**	MEAN RANGE NO. DETECTED**
RU-103 ( 9) ( 0)		( 1.1 ± 2.1)E 1 (-6.4 - 7.1)E 1 *( 0/ 6)*	12 ( 2.5 ± 3.0)E 1 (-3.2 - 7.1)E 1 *( 0/ 3)*	(-1.0 ± 2.4)E 1 (-5.8 - 1.8)E 1 *( 0/ 3)*
RU-106 ( 9) ( 0)		( 2.7 ± 6.7)E 1 (-1.9 - 2.7)E 2 *( 0/ 6)*	21 ( 6.2 ± 9.9)E 1 (-1.2 - 2.2)E 2 *( 0/ 3)*	( 6.2 ± 9.9)E 1 (-1.2 - 2.2)E 2 *( 0/ 3)*
I-131 ( 9) ( 0)		(-2.5 ± 1.7)E 2 (-1.0 - .1)E 3 *( 0/ 6)*	12 (-1.1 ± 1.8)E 2 (-4.6 - .9)E 2 *( 0/ 3)*	(-2.1 ± 1.1)E 2 (-3.9 - -.1)E 2 *( 0/ 3)*
CS-134 ( 9) ( 0)	150.	( 2.2 ± 12.3)E 0 (-3.8 - 5.0)E 1 *( 0/ 6)*	12 ( 3.0 ± 25.5)E 0 (-3.8 - 5.0)E 1 *( 0/ 3)*	(-1.0 ± .9)E 1 (-2.6 - .6)E 1 *( 0/ 3)*
CS-137 ( 9) ( 0)	180.	( 1.5 ± .2)E 2 ( 7.2 - 24.5)E 1 *( 6/ 6)*	12 ( 1.7 ± .4)E 2 ( 9.9 - 24.5)E 1 *( 3/ 3)*	( 8.4 ± 1.9)E 1 ( 6.1 - 12.1)E 1 *( 2/ 3)*
BA-140 ( 9) ( 0)		(-1.2 ± .9)E 2 (-3.9 - 2.4)E 2 *( 0/ 6)*	12 (-6.8 ± 18.4)E 1 (-3.9 - 2.4)E 2 *( 0/ 3)*	(-1.3 ± .2)E 2 (-1.8 - -1.0)E 2 *( 0/ 3)*
CE-141 ( 9) ( 0)		( 3.3 ± 1.0)E 1 (-6.2 - 65.6)E 0 *( 0/ 6)*	21 ( 7.5 ± 1.3)E 1 ( 5.0 - 9.6)E 1 *( 0/ 3)*	( 7.5 ± 1.3)E 1 ( 5.0 - 9.6)E 1 *( 0/ 3)*
CE-144 ( 9) ( 0)		(-1.0 ± 4.5)E 1 (-2.1 - .7)E 2 *( 0/ 6)*	12 ( 5.9 ± .6)E 1 ( 4.7 - 6.8)E 1 *( 0/ 3)*	( 3.2 ± 6.1)E 1 (-8.4 - 11.9)E 1 *( 0/ 3)*
AC-228 ( 9) ( 0)		( 6.2 ± 1.0)E 2 ( 2.9 - 9.4)E 2 *( 6/ 6)*	12 ( 8.0 ± .7)E 2 ( 6.8 - 9.4)E 2 *( 3/ 3)*	( 6.2 ± .9)E 2 ( 4.7 - 7.9)E 2 *( 3/ 3)*

- \* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.  
\*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*(    )\*.

L) Finfish

Twice during 1983, finfish samples were collected from each of three locations. Each sample consisted of mixed freshwater species. All were analyzed for gamma-emitting radionuclides. Cesium-137 was detected in six of the seven samples collected. As can be seen in the following data table, the mean and range for indicator stations are lower than those for the control stations, indicating that the radioactivity is not due to plant operations but to nuclear weapons testing fallout. No other radionuclides were detected except for naturally-occurring K-40.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: FINFISH

UNITS: PCI/KG WET

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****	STATION WITH HIGHEST MEAN *****	CONTROL STATIONS *****
		MEAN RANGE NO. DETECTED**	MEAN RANGE STA. NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
BE-7 ( 7) ( 0)		( 1.0 ± 3.6)E 1 (-1.3 - .7)E 2 *( 0/ 5)*	21 ( 1.2 ± .5)E 2 ( 7.3 - 16.5)E 1 *( 0/ 2)*	( 1.2 ± .5)E 2 ( 7.3 - 16.5)E 1 *( 0/ 2)*
K-40 ( 7) ( 0)		( 3.3 ± .2)E 3 ( 2.7 - 3.7)E 3 *( 5/ 5)*	12 ( 3.5 ± .2)E 3 ( 3.4 - 3.7)E 3 *( 2/ 2)*	( 3.4 ± .2)E 3 ( 3.3 - 3.6)E 3 *( 2/ 2)*
CR-51 ( 7) ( 0)		(-7.3 ± 7.2)E 1 (-3.5 - .5)E 2 *( 0/ 5)*	12 ( 2.9 ± 2.3)E 1 ( 6.1 - 52.2)E 0 *( 0/ 2)*	( 1.2 ± 2.5)E 1 (-1.3 - 3.7)E 1 *( 0/ 2)*
MN-54 ( 7) ( 0)	130.	(-7.1 ± 49.5)E -1 (-1.4 - 1.3)E 1 *( 0/ 5)*	21 ( 7.9 ± 2.9)E 0 ( 5.1 - 10.8)E 0 *( 0/ 2)*	( 7.9 ± 2.9)E 0 ( 5.1 - 10.8)E 0 *( 0/ 2)*
CO-58 ( 7) ( 0)	130.	( 2.3 ± 11.3)E 0 (-3.9 - 2.3)E 1 *( 0/ 5)*	12 ( 1.5 ± .8)E 1 ( 6.6 - 23.4)E 0 *( 0/ 2)*	(-2.4 ± .3)E 0 (-2.7 - -2.1)E 0 *( 0/ 2)*
FE-59 ( 7) ( 0)	260.	(-2.5 ± 1.2)E 1 (-6.5 - -.3)E 1 *( 0/ 5)*	12 (-7.0 ± 4.1)E 0 (-1.1 - -.3)E 1 *( 0/ 2)*	(-1.6 ± 4.4)E 1 (-6.0 - 2.9)E 1 *( 0/ 2)*
CO-60 ( 7) ( 0)	130.	( 2.0 ± 6.4)E 0 (-1.1 - 2.5)E 1 *( 0/ 5)*	11 ( 8.7 ± 8.7)E 0 (-4.7 - 25.1)E 0 *( 0/ 3)*	(-2.0 ± .8)E 1 (-2.8 - -1.3)E 1 *( 0/ 2)*
ZN-65 ( 7) ( 0)	260.	(-9.5 ± 154.3)E -1 (-5.9 - 2.9)E 1 *( 0/ 5)*	21 ( 1.1 ± .8)E 1 ( 2.2 - 18.8)E 0 *( 0/ 2)*	( 1.1 ± .8)E 1 ( 2.2 - 18.8)E 0 *( 0/ 2)*
ZR-95 ( 7) ( 0)		(-1.5 ± 2.5)E 1 (-1.1 - .4)E 2 *( 0/ 5)*	12 ( 1.7 ± 2.1)E 1 (-4.5 - 38.5)E 0 *( 0/ 2)*	( 1.1 ± .2)E 1 ( 8.6 - 12.5)E 0 *( 0/ 2)*

- \* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.
- \*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY  
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT  
JANUARY - DECEMBER 1983

MEDIUM: FISH

UNITS: PCI/KG WET

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****	STATION WITH HIGHEST MEAN *****	CONTROL STATIONS *****
		MEAN RANGE NO. DETECTED**	MEAN STA. RANGE NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
RU-103 ( 7) ( 0)		(10.0 ± 8.9)E 0 (-1.7 - 3.2)E 1 *( 0/ 5)*	12 ( 2.0 ± 1.3)E 1 ( 7.3 - 32.4)E 0 *( 0/ 2)*	( 1.3 ± .0)E 1 ( 1.3 - 1.4)E 1 *( 0/ 2)*
RU-106 ( 7) ( 0)		( 1.9 ± 5.9)E 1 (-1.6 - 1.7)E 2 *( 0/ 5)*	21 ( 1.3 ± 1.2)E 2 ( 1.1 - 24.9)E 1 *( 0/ 2)*	( 1.3 ± 1.2)E 2 ( 1.1 - 24.9)E 1 *( 0/ 2)*
I-131 ( 7) ( 0)		(-3.7 ± 1.4)E 2 (-7.4 - -.2)E 2 *( 0/ 5)*	21 ( 8.3 ± 11.4)E 1 (-3.1 - 19.7)E 1 *( 0/ 2)*	( 8.3 ± 11.4)E 1 (-3.1 - 19.7)E 1 *( 0/ 2)*
CS-134 ( 7) ( 0)	130.	(-7.8 ± 3.6)E 0 (-1.9 - .1)E 1 *( 0/ 5)*	11 (-3.6 ± 3.7)E 0 (-1.1 - .1)E 1 *( 0/ 3)*	(-8.8 ± 7.2)E 0 (-1.6 - -.2)E 1 *( 0/ 2)*
CS-137 ( 7) ( 0)	150.	( 4.9 ± 1.2)E 1 ( 1.9 - 8.0)E 1 *( 4/ 5)*	21 ( 6.7 ± 1.7)E 1 ( 5.1 - 8.4)E 1 *( 2/ 2)*	( 6.7 ± 1.7)E 1 ( 5.1 - 8.4)E 1 *( 2/ 2)*
BA-140 ( 7) ( 0)		(-8.6 ± 2.2)E 1 (-1.5 - -.3)E 2 *( 0/ 5)*	21 (-4.6 ± 5.2)E 1 (-9.8 - .6)E 1 *( 0/ 2)*	(-4.6 ± 5.2)E 1 (-9.8 - .6)E 1 *( 0/ 2)*
CE-141 ( 7) ( 0)		( 2.5 ± 1.2)E 1 (-1.6 - 4.8)E 1 *( 0/ 5)*	12 ( 3.9 ± .2)E 1 ( 3.6 - 4.1)E 1 *( 0/ 2)*	( 1.8 ± .2)E 1 ( 1.7 - 2.0)E 1 *( 0/ 2)*
CE-144 ( 7) ( 0)		(-2.0 ± 2.4)E 1 (-7.7 - 4.2)E 1 *( 0/ 5)*	21 ( 6.6 ± 6.8)E 1 (-1.8 - 134.0)E 0 *( 0/ 2)*	( 6.6 ± 6.8)E 1 (-1.8 - 134.0)E 0 *( 0/ 2)*
AC-228 ( 7) ( 0)		( 2.3 ± 14.5)E 0 (-3.7 - 3.0)E 1 *( 0/ 5)*	21 ( 2.4 ± 5.3)E 1 (-2.9 - 7.7)E 1 *( 0/ 2)*	( 2.4 ± 5.3)E 1 (-2.9 - 7.7)E 1 *( 0/ 2)*

\* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT.

\*\* THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH \*( )\*.

M) Direct Radiation

Direct gamma radiation exposure was determined from the use of thermoluminescent dosimeters (TLDs). Two  $\text{CaF}_2:\text{Mn}$  TLDs were placed at each of the monitoring stations. The dosimeters at eighteen indicator stations and three control stations were collected and read out on a monthly schedule.

During June, the results for ten badge sets were not used due to instrument malfunction. The malfunction was apparently caused by extremely high humidity. The exposure that each of these sets would have measured was assumed to be equal to the annual average for that length period and that station. Summaries of the results for 1982 and 1983 can be seen in the table below. Annual average exposure rates are given for each station in Table 3.1.

Environmental Radiological Program Summary  
Vermont Yankee Nuclear Power Station, Vernon, Vermont  
January - December 1983

Medium: Direct Radiation  
Measurements (TLD)

Units: Micro-Rem per  
Hour

<u>Indicator Stations</u> Mean Range (No. Meas.)*	<u>Station With Highest Mean</u> Mean Range (No. Meas.)*	<u>Control Stations</u> Mean Range (No. Meas.)*
9.9	12.7	10.9
4.6 - 11.8	37      8.9 - 16.7	10.0 - 12.7
(98)	(12)	(36)

\*Most measurements based on readings from two TLD chips.

In Table 3.2, the annual average exposure rate for each Zone 1 station, and for all of them combined, was compared to the mean of the three Zone 2 stations for that year(s). By comparing the 1983 ratios with those from other years, it is evident that the Zone 1 ambient radiation levels have not changed significantly over the last six years with respect to the Zone 2 levels. This approach was used to eliminate any influence from global or regional changes in ambient radiation levels or from changes in the performance of the TLD system. Zone 1 site boundary stations were not included in the comparison since they are on-site locations and are subject to plant-related variations that could obscure seasonal or annual trends.

Table 3.1

Vermont Yankee  
Summary of Direct Radiation Measurements, 1983

<u>Station</u>	<u>Description</u>	<u>Zone</u>	<u>Micro-R Per Hour*</u>
GM-1.0	Hinsdale, NH	1	8.7
GM-1.1	N. Hinsdale, NH	1	8.5
GM-1.2	Hinsdale Sub.	1	9.1
GM-1.3	River Sta. No. 3.3	1	8.3
GM-1.4	Fairman Road	1	8.6
GM-1.5	Tyler Hill	1	9.0
GM-1.6	Site Boundary	1	9.1
GM-1.7	Site Boundary	1	8.7
GM-1.8	Site Boundary	1	9.9
GM-1.9	Site Boundary	1	10.0
GM-1.10	Site Boundary	1	9.2
GM-1.11	Site Boundary	1	8.6
GM-1.12	Site Boundary	1	9.0
GM-1.13	Site Boundary	1	10.2
GM-1.14	Site Boundary	1	22.7
GM-1.15	Site Boundary	1	11.3
GM-1.16	Site Boundary	1	9.1
GM-1.17	Vernon School	1	8.8
GM-2.1	Hogback Mt.	2	8.1
GM-2.2	Spofford Lake	2	8.6
GM-2.3	Northfield, MA	2	8.3

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\*Annual average exposure rate.

Table 3.2

Vermont Yankee  
Ratio\* of Zone 1\*\* to Zone 2 Exposures

<u>Station</u>	<u>Description</u>	<u>1983</u> <u>Ratio</u>	<u>1982</u> <u>Ratio</u>	<u>1978-82</u> <u>Ratio</u>
GM-1.0	Hinsdale, NH	1.04	1.05	1.04
GM-1.1	N. Hinsdale, NH	1.02	1.02	1.00
GM-1.2	Hinsdale Sub.	1.09	1.09	1.10
GM-1.3	River Sta. No. 3.3	1.00	1.03	1.05
GM-1.4	Fairman Road	1.03	1.09	1.08
GM-1.5	Tyler Hill	1.08	1.08	1.08
GM-1.17	Vernon School	1.06	1.08	1.10
All Zone 1** stations		1.05	1.06	1.06

---

\*Ratio of the annual average direct radiation exposure for a station to the mean of the Zone 2 (control) stations for that year.

\*\*Site boundary stations were not included.



#### 4.0 QUALITY ASSURANCE PROGRAM

Three separate Quality Assurance programs were performed during 1983 to demonstrate the validity of laboratory analyses by the Yankee Atomic Environmental Laboratory (YAEL).

YAEL participates in the EPA Interlaboratory Comparison (cross-check) program for those species and matrices routinely analyzed by the laboratory. This provides an independent check of accuracy and precision of the laboratory analysis. When the results of the cross-check analysis fall outside of the control limit, an investigation is made to determine the cause of the problem and corrective measures are taken.

YAEL maintains an intralaboratory quality control program to assure the validity and reliability of the data. This program includes quality control of laboratory equipment, use of reference standards for calibration, determination of counting efficiencies and analysis of blank and spiked samples. The records of the quality control program are reviewed by the responsible cognizant individual, and corrective measures are taken whenever applicable.

A blind duplicate/replicate program is maintained in which samples are prepared from split or homogenous media and sent to the laboratory for analysis. The results from this blind duplicate program are used to check for precision in laboratory analyses.

#### EPA Interlaboratory and Intralaboratory Results

The Quality Assurance program implemented at the analytical laboratory indicated good precision and accuracy in reported values. Table 4.1 shows the results of accuracy and precision for laboratory analyses in 1983 for EPA samples, intralaboratory analyses, and interlaboratory cross-check analyses. For accuracy, 57.2 and 82.7 percent of the results were within 5 and 10 percent of the known values, respectively, with 95.7 percent of all results falling within the laboratory criteria of 15 percent. For precision, 79.7 and 93.8 percent of the results were within 5 and 10 percent of the mean, respectively, with 99.5 percent of all results meeting the laboratory criteria of 15 percent.

Table 4.1

EPA Interlaboratory and Intralaboratory Results

<u>Total Number of Samples</u>	<u>Accuracy</u>		
	<u>0 to 5%</u>	<u>0 to 10%</u>	<u>0 to 15%*</u>
830	475 (57.2%)	686 (82.7%)	794 (95.7%)
<u>Total Number of Samples</u>	<u>Precision</u>		
	<u>0 to 5%</u>	<u>0 to 10%</u>	<u>0 to 15%*</u>
802	639 (79.7%)	752 (93.8%)	798 (99.5%)

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\*This category also contains those samples having a verified zero concentration which were analyzed and found not to contain the isotope of interest.

### Blind Duplicate-Replicate Program

A total of 62 paired samples were submitted for analysis during 1983. The data base used for the duplicate-replicate analysis consisted of paired measurements of 26 gamma emitting nuclides, H-3, Sr-89, Sr-90, low level I-131 and gross beta. A dual level criteria for agreement was established. If the paired measurements fall within  $\pm 15$  percent of their average value, then agreement between the measurements has been met. If the value falls outside of the  $\pm 15$  percent, then a two standard deviation range (95 percent confidence level) for duplicates and a three standard deviation range (99 percent confidence level) for replicates is established for each of the analyses. If the ranges overlap, agreement is obtained. One thousand five hundred and eighty-nine paired duplicate and replicate measurements were analyzed for 1983. A total of 99.9 percent of all measurements fell within the established criteria discussed above. The two measurements that did not meet the criteria were a Se-75 and a Ru-106 measurement from a gamma spectroscopy analysis on a single milk sample. The measurements were, however, within the three standard deviation criteria (99 percent confidence level). Positive Cs-137 and K-40 concentrations on that sample, along with all of the other less-than-detectable concentrations, did meet the acceptance criteria.

## 5.0 SUMMARY

During 1983, several samples collected as a part of the radiological environmental monitoring program at Vermont Yankee had detectable levels of man-made radionuclides. Most of this radioactivity has been shown to be due to fallout from atmospheric nuclear weapons tests. That which was likely due to plant operations was detected as follows: one ground water sample contained Mn-54, probably due to cross-contamination of the sample when it was handled inside the plant; one air particulate filter showed Co-60; and special sediment samples at one on-site location also showed Co-60. In all of these cases, it has been shown that the detected levels of plant-related radionuclides were very low and that the possible dose consequences to a conservative, hypothetical member of the public are insignificant.

REFERENCES

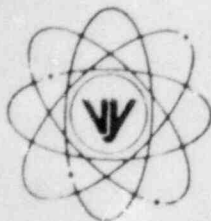
1. USNRC Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR50, Appendix I", 1977.
2. Radiological Environmental Monitoring Report, 1982. Maine Yankee Atomic Power Company.
3. USNRC Radiological Assessment Branch Technical Position, Revision 1, November 1979.

# VERMONT YANKEE NUCLEAR POWER CORPORATION

Certified By

*M. Taggart*

7-2-84



RD 5, Box 169, Ferry Road, Brattleboro, VT 05301

June 28, 1984  
FVY 84-68

REPLY TO  
ENGINEERING OFFICE  
1671 WORCESTER ROAD  
FRAMINGHAM, MASSACHUSETTS 01701  
TELEPHONE 517-872-8100

United States Nuclear Regulatory Commission  
Office of Inspection and Enforcement  
Region I  
631 Park Avenue  
King of Prussia, PA 19406

Attention: Dr. Thomas E. Murley  
Regional Administrator

Reference: (a) License No. DPR-28 (Docket No. 50-271)

Subject: Vermont Yankee 1983 Annual Radiological Environmental  
Surveillance Report

Dear Sir:

Enclosed herewith, please find three (3) copies of the Annual Radiological Environmental Surveillance Report for the Vermont Yankee Nuclear Power Station. This report contains a summary and analysis of the radiological environmental data collected for the calendar year 1983.

We trust that this information is deemed acceptable; however, should you have any questions regarding this submittal, please contact us.

Very truly yours,

VERMONT YANKEE NUCLEAR POWER CORPORATION

J. B. Sinclair  
Licensing Engineer

JBS/eg

Enclosure

IE25  
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