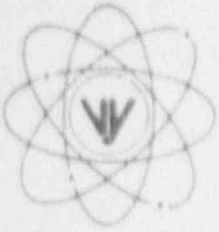


VERMONT YANKEE NUCLEAR POWER CORPORATION



Ferry Road, Brattleboro, VT 05301-7002

REPLY TO
ENGINEERING OFFICE
580 MAIN STREET
BOLTON, MA 01740
(508) 778-6711

April 30, 1991
BVY 91/48

United States Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

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

Subject: Vermont Yankee Annual Radiological Environmental Surveillance Report

Dear Sir:

Enclosed please find one copy of the Annual Radiological Environmental Surveillance Report for Vermont Yankee Nuclear Power Station, submitted in accordance with Technical Specification 6.7.C.3. This report contains a summary and analysis of the radiological environmental data collected for the calendar year 1990.

Should you have any questions regarding this submittal, please contact this office.

Very truly yours,

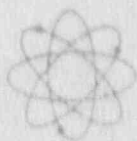
VERMONT YANKEE NUCLEAR POWER CORPORATION

Leonard A. Tremblay, Jr.
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cc: USNRC Region I Administrator
USNRC Resident Inspector - VYNPS
USNRC Project Manager - VYNPS

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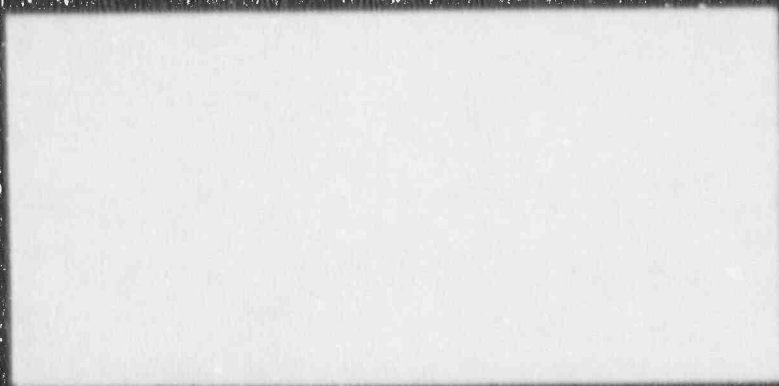
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VERMONT YANKEE NUCLEAR POWER STATION

VERNON, VERMONT



VERMONT YANKEE NUCLEAR POWER STATION
VERMONT YANKEE NUCLEAR POWER CORPORATION

ANNUAL RADIOLOGICAL ENVIRONMENTAL
SURVEILLANCE REPORT

January - December 1990

April 1991

Prepared By;
Yankee Atomic Electric Company
Environmental Engineering Department
580 Main Street
Bolton, Massachusetts 01740

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1.0 INTRODUCTION

The radiological environmental surveillance program at the Vermont Yankee Nuclear Power Station 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 standby monitoring capability for rapid assessment of risk to the general public in the event of unanticipated or accidental releases of radioactive material.

During 1990, as in the past, Aquatec, Inc. collected all of the aquatic environmental samples, while the plant Chemistry staff collected the bulk of the terrestrial environmental samples (including ground water) and the environmental thermoluminescent dosimeters (TLDs) for direct radiation measurements. After the initial processing, all samples were sent to the Yankee Atomic Environmental Laboratory in Westborough, Massachusetts for further processing and radionuclide analysis. TLDs were also sent to this laboratory for processing.

This report is a summary of the findings of the Radiological Environmental Surveillance Program for 1990. It is being provided in compliance with plant Technical Specification 6.7.C.3.

2.0 RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE PROGRAM

In this section, Table 2.1 summarizes the surveillance program as required by plant Technical Specification 3.9.C. Table 2.2 lists the sampling stations and their specific locations with distances measured from the plant stack. Given in Table 2.3 are distances and directions relative to the center of the Turbine Building for all TLD locations. The sampling locations are shown on maps in Figures 2.1 through 2.3 and the TLD locations are shown on the maps in Figures 2.4 through 2.6.

TABLE 2.1

Radiological Environmental Surveillance Program
Vermont Yankee Nuclear Power Station

<u>Media</u>	<u>Sampling Frequency</u>	<u>Required Analyses</u>
Air Particulate (AP)	- Semimonthly (2) - Quarterly Composite	Gross beta Gamma spectroscopy
Charcoal Filter (CF)	- Semimonthly (2)	Iodine-131
Milk (TM)	- Monthly (6)	Gamma spectroscopy, Iodine-131
Mixed Vegetation (TG)	- Quarterly (1)	Gamma spectroscopy
Silage (TC)	- Annually (3)	Gamma spectroscopy
Groundwater (WG)	- Quarterly	Gamma spectroscopy, H-3
River Water (WR)	- Monthly (5) - Quarterly Composite	Gamma spectroscopy H-3
Sediment (SE)	- Semiannually	Gamma spectroscopy
Fish (FH)	- Semiannually	Gamma spectroscopy
Direct Radiation (DR)	- Quarterly	Integrated gamma dose(4)

-
- (1) Collection frequency dependent upon availability of samples during winter.
 (2) Weekly, when main plant stack effluent release rate of Iodine-131 is equal to or greater than 0.1 uCi/sec.
 (3) Collected at harvest time in reasonable proximity to specified location; subject to availability.
 (4) Outer ring TLDs - De-dose quarterly unless gaseous release LCO was exceeded in period.
 (5) Composite sample collected over month at downstream location.
 (6) Semimonthly when milk animals are identified as being on pasture.

TABLE 2.2

Radiological Environmental Surveillance Locations
Vermont Yankee Nuclear Power Station

<u>Station Code</u> (Media - Sta. No.)	<u>Station Description</u>	<u>Zone*</u>	<u>Distance</u> <u>From Plant</u> <u>Stack</u> (km)	<u>Direction</u> <u>From Plant</u> <u>Stack</u>
AP/CF/TG-11	River Station No. 3.3	1	1.9	SSE
AP/CF/TG-12	N. Hinsdale, NH	1	3.6	NNW
AP/CF/TG-13	Hinsdale Substation	1	3.1	E
AP/CF/TG-14	Northfield, MA	1	11.3	SSE
AP/CF/TG-15**	Tyler Hill Road	1	3.2	WNW
AP/CF/TG-21	Spofford Lake, NH	2	16.1	NNE
TM-11**	Miller Farm	1	0.8	WNW
TM-12**	Dominick	1	5.2	E
TM-13	Newton Farm	1	5.1	SSE
TM-14	Brown Farm	1	2.6	S
TM-16	Tall Oaks Farm	1	4.7	WNW
TM-19**	Mitchell Farm	1	4.0	NNE
TM-20	Ranney Farm	2	17.0	N
WG-11	VY Plant Well	1	--	On-Site
WG-12	Vernon Nursing Well	1	2.0	SSE
WG-21	Brattleboro C. C.	2	12.1	NNW
WR-11	River Station No. 3.3	1	1.9	Downriver
WR-21	Rt. 9 Bridge	2	12.8	Upriver
FH-11	Vernon Pond	1	--	On-Site
FH-21	Rt. 9 Bridge	2	12.8	Upriver
SE-11	Shoreline Downriver	1	0.8	On-Site
SE-12	N. Storm Drain Outfall	1	0.15	On-Site
TC-11**	Miller Farm	1	0.8	WNW
TC-12**	Dominick	1	5.2	E
TC-13	Newton Farm	1	5.1	SSE
TC-14	Brown Farm	1	2.6	S
TC-16	Tall Oaks Farm	1	4.7	WNW
TC-19**	Mitchell Farm	1	4.0	NNE
TC-20	Ranney Farm	2	17.0	N

* 1 = Indicator Station; 2 = Control Station.

** This location is not considered a requirement of Technical Specification Table 3.9.3.

TABLE 2.3

Environmental Direction Radiation Monitoring Locations
Vermont Yankee Nuclear Power Station

<u>Station Code</u> (Media - Sta. No.)	<u>Station Description</u>	<u>Zone*</u>	<u>Distance</u> <u>From Center</u> <u>of Turbine</u> <u>Building</u> <u>(km)</u>	<u>Direction</u> <u>From</u> <u>Center</u> <u>of Turbine</u> <u>Building</u>
DR-1	River Station 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	I	11.0	SSE
DR-5	Spofford Lake, NH	O	16.3	NNE
DR-6	Vernon School	I	0.46	WSW
DR-7	Site Boundary	SB	0.27	W
DR-8	Site Boundary	SB	0.25	SW
DR-9	Inner Ring	I	2.1	N
DR-10	Outer Ring	O	4.6	N
DR-11	Inner Ring	I	2.0	NNE
DR-12	Outer Ring	O	3.6	NNE
DR-13	Inner Ring	I	1.4	NE
DR-14	Outer Ring	O	4.3	NE
DR-15	Inner Ring	I	1.4	ENE
DR-16	Outer Ring	O	2.9	ENE
DR-17	Inner Ring	I	1.2	E
DR-18	Outer Ring	O	3.0	E
DR-19	Inner Ring	I	3.5	ESE
DR-20	Outer Ring	O	5.3	ESE
DR-21	Inner Ring	I	1.8	SE
DR-22	Outer Ring	O	3.2	SE
DR-23	Inner Ring	I	1.8	SSE
DR-24	Outer Ring	O	3.9	SSE
DR-25	Inner Ring	I	2.0	S
DR-26	Outer Ring	O	3.7	S
DR-27	Inner Ring	I	1.0	SSW
DR-28	Outer Ring	O	2.2	SSW
DR-29	Inner Ring	I	0.7	WSW
DR-30	Outer Ring	O	2.3	SW
DR-31	Inner Ring	I	0.8	W
DR-32	Outer Ring	O	5.0	WSW
DR-33	Inner Ring	I	0.9	WNW
DR-34	Outer Ring	O	4.9	W
DR-35	Inner Ring	I	1.4	WNW
DR-36	Outer Ring	O	4.7	WNW

TABLE 2.3
(Continued)

Environmental Direction Radiation Monitoring Locations
Vermont Yankee Nuclear Power Station

<u>Station Code</u> <u>(Media - Sta. No.)</u>	<u>Station Description</u>	<u>Zone*</u>	<u>Distance</u> <u>From Center</u> <u>of Turbine</u> <u>Building</u> <u>(km)</u>	<u>Direction</u> <u>From</u> <u>Center</u> <u>of Turbine</u> <u>Building</u>
DR-37	Inner Ring	I	3.0	NW
DR-38	Outer Ring	O	7.7	NW
DR-39	Inner Ring	I	3.2	NNW
DR-40	Outer Ring	O	5.8	NNW
DR-41**	Site Boundary	SB	0.38	SSW
DR-42**	Site Boundary	SB	0.60	S
DR-43**	Site Boundary	SB	0.42	SSE
DR-44**	Site Boundary	SB	0.21	SE
DR-45**	Site Boundary	SB	0.12	NE
DR-46**	Site Boundary	SB	0.29	NNW
DR-47**	Site Boundary	SB	0.51	NNW
DR-48**	Site Boundary	SB	0.82	NW
DR-49**	Site Boundary	SB	0.27	WNW
DR-50**	Governor Hunt House	I	0.34	SSW
DR-51**	Site Boundary	SB	0.27	W

* I = Inner Ring; O = Outer Ring; SB = Site Boundary.

** This location is not considered a requirement of Technical Specification Table 3.9.3.

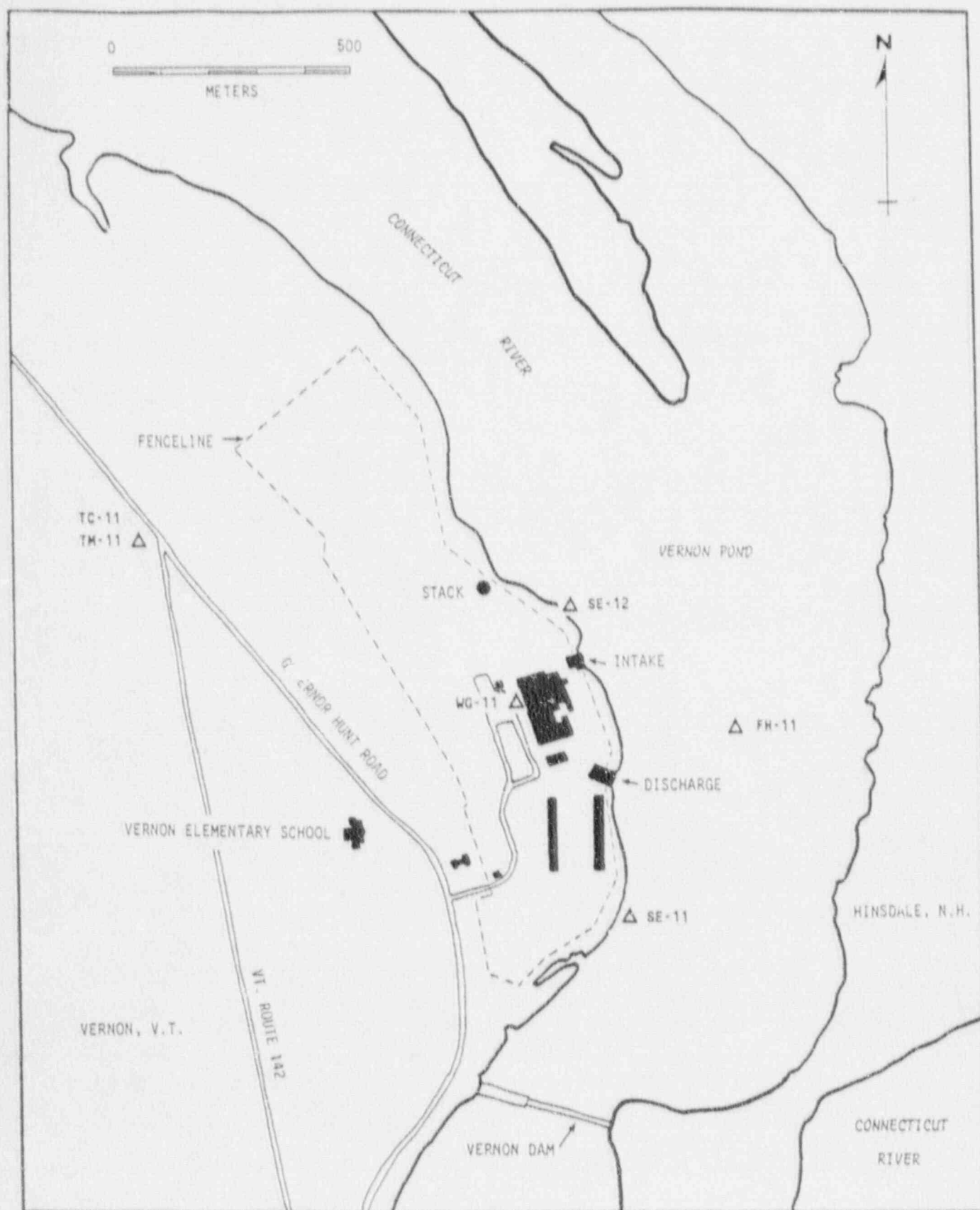


Figure 2.1 Environmental Radiological Monitoring Locations in Close Proximity to Plant

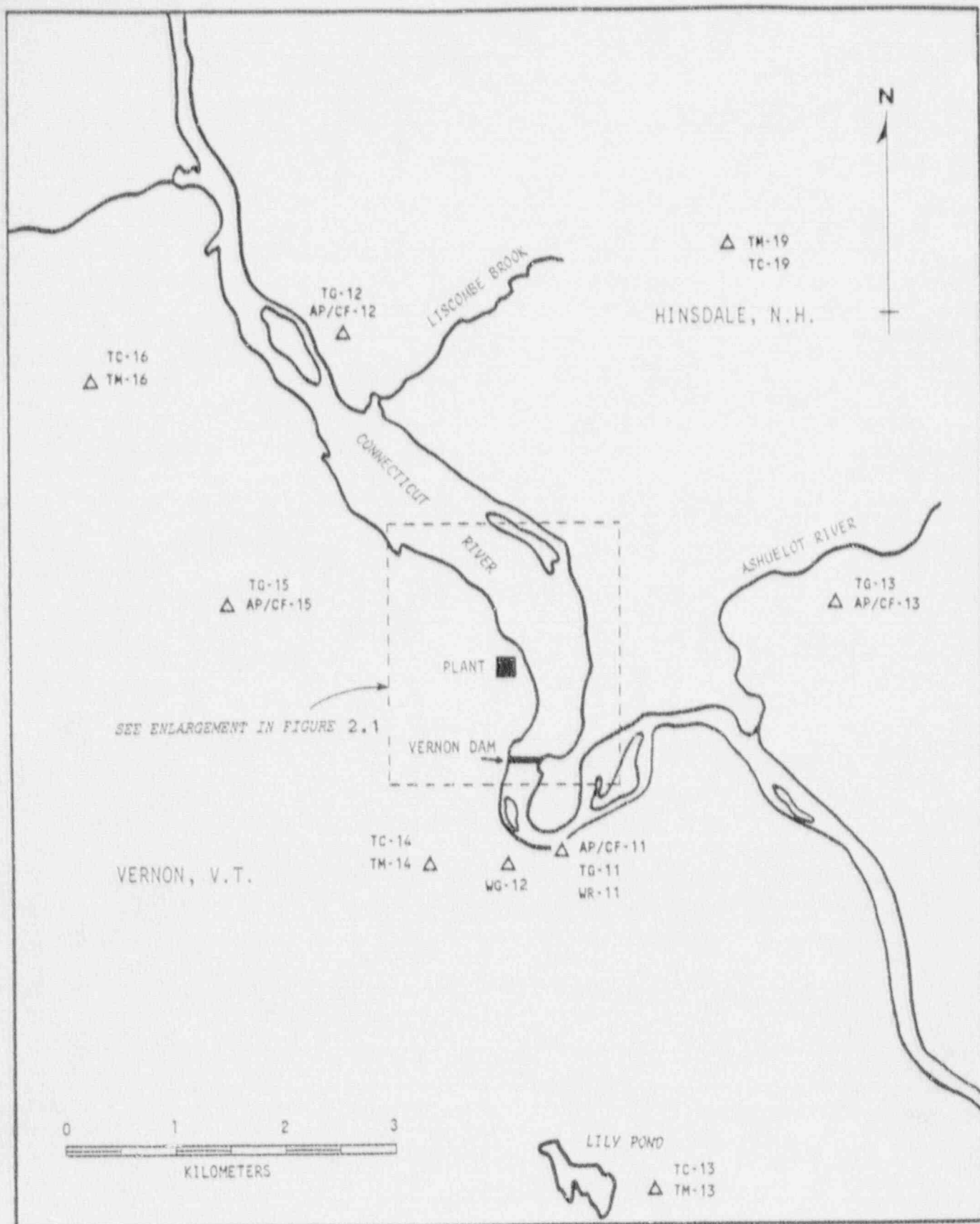


Figure 2.2 Environmental Radiological Monitoring Locations Within 5 Kilometers of Plant

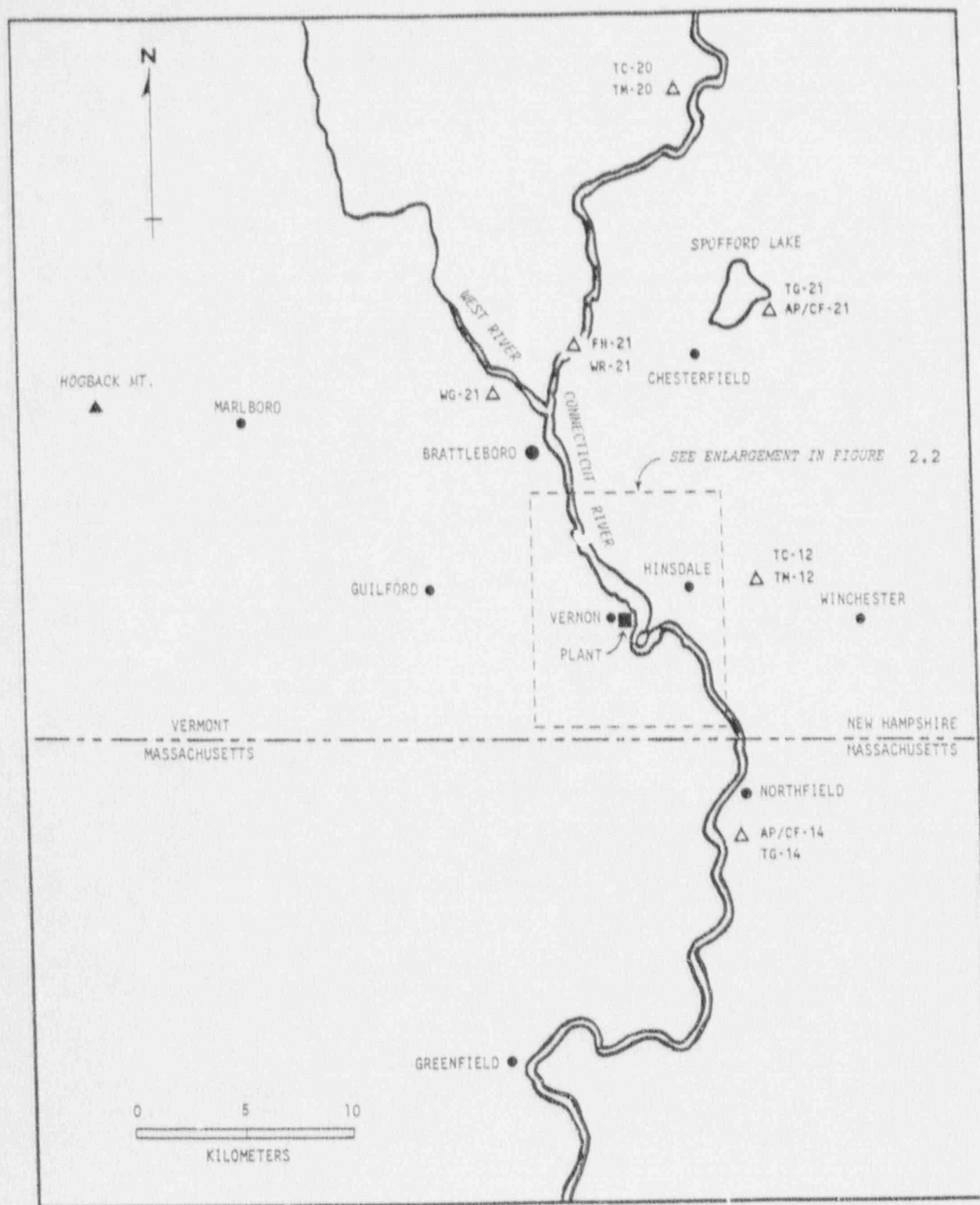


Figure 2.3 Environmental Radiological Monitoring Locations
Greater Than 5 Kilometers from Plant

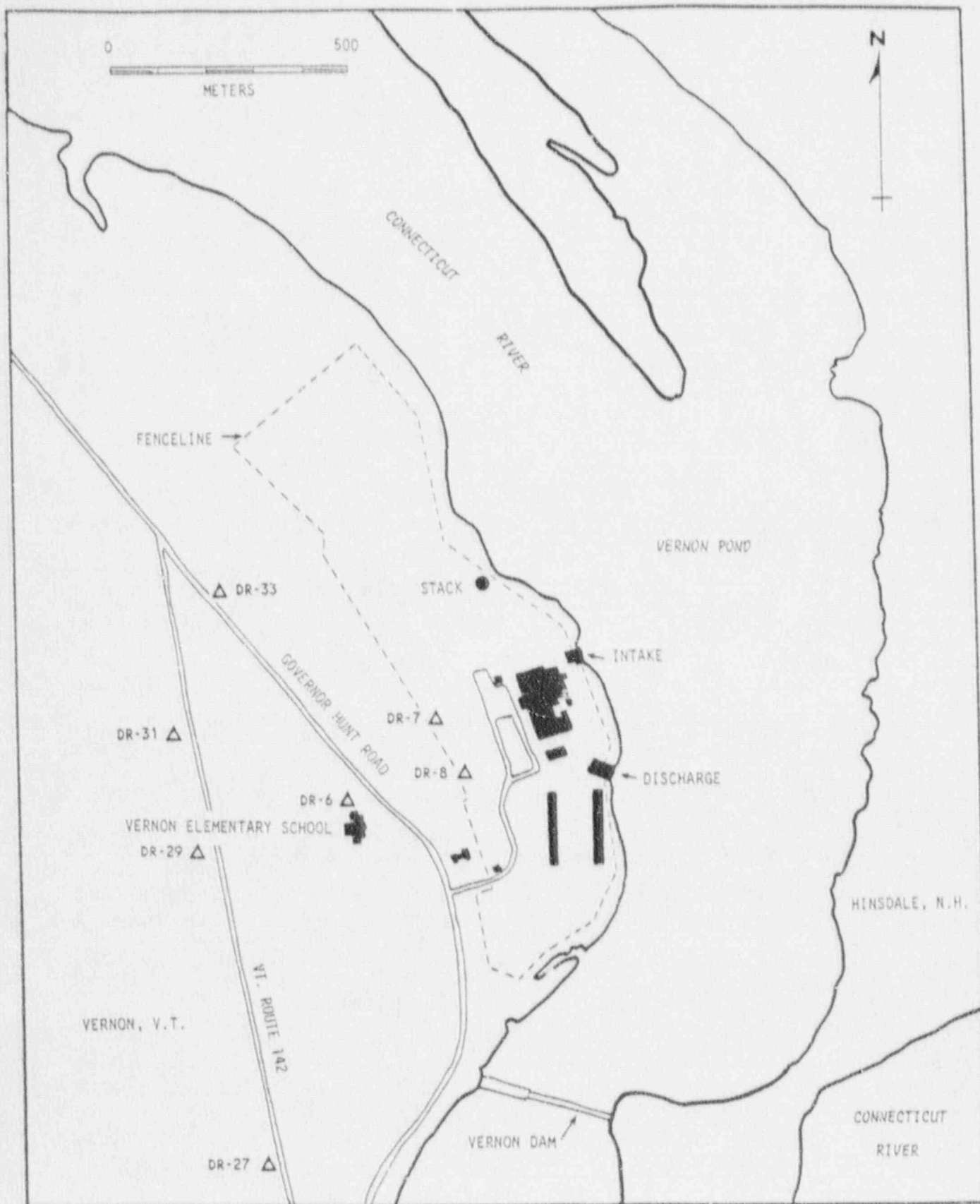


Figure 2.4 TLD Locations in Close Proximity to Plant

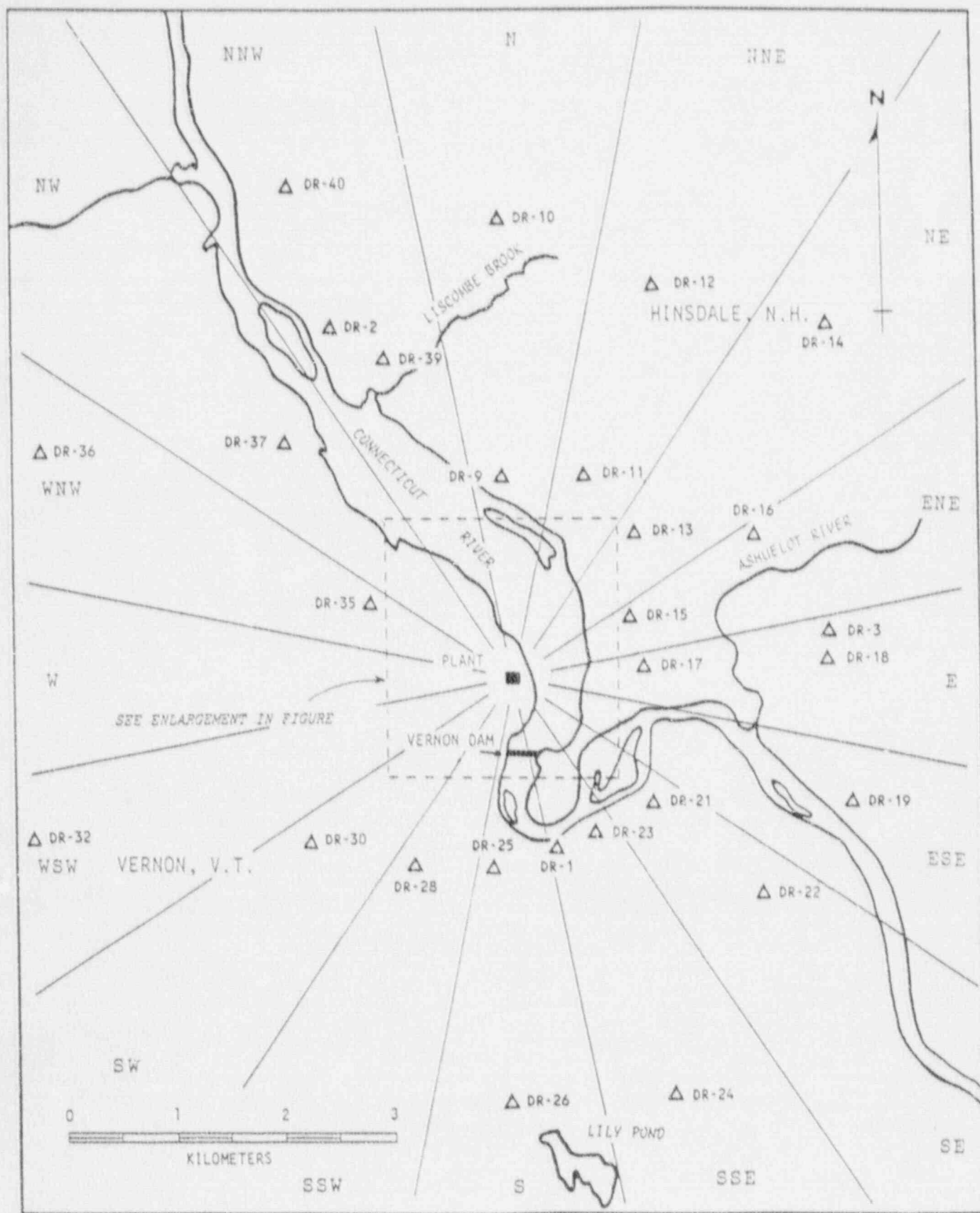


Figure 2.5 TLD Locations Within 5 Kilometers of Plant

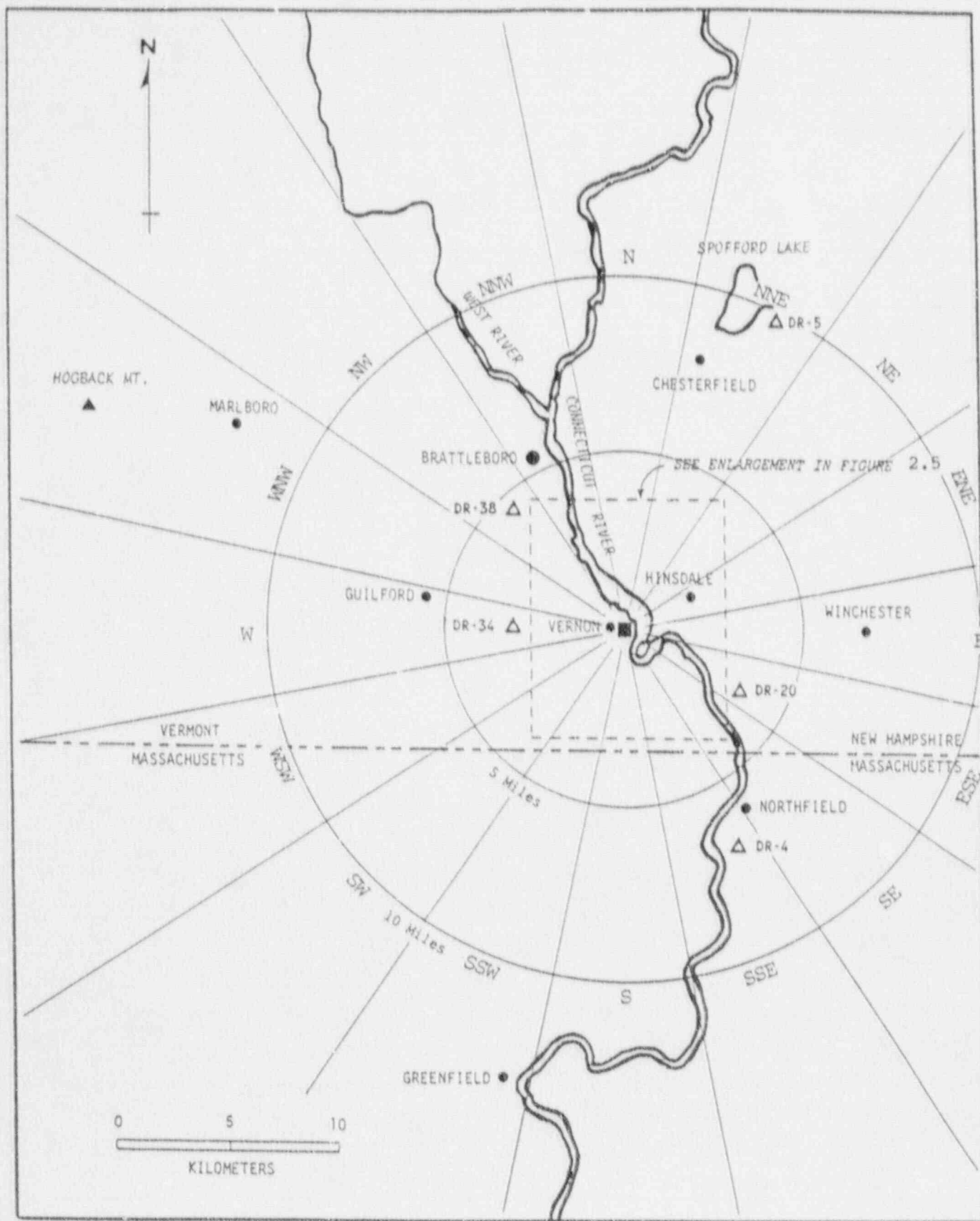


Figure 2.6 TLD Locations Greater Than 5 Kilometers from Plant

3.0 SUMMARY OF 1990 RADIOLOGICAL ENVIRONMENTAL DATA

The following pages summarize the analytical results of the environmental samples which were collected during 1990. 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. At the top of each table are listed 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 of control measurements. 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 specified in Technical Specification Table 4.9.3.

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. Direct radiation (TLD) monitoring locations are subdivided into site boundary, inner ring, and outer ring (emergency response) stations.

A set of statistical parameters is calculated 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 that radionuclide. For each of these three groups of data, these parameters are as follows:

- o The mean value of all concentrations.
- o The standard error of the mean.
- o The lowest and highest concentration.

- o The number of positive measurements (a concentration which is greater than the a posteriori LLD for that analysis) 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.

Pursuant to Technical Specification Table 4.9.3 (Footnote f), any concentration below the LLD for its analysis is reported as "not detected." These values are set to zero for averaging purposes. Where a range of values is reported in the tables of this section, values less than the a posteriori LLD for the analysis are reported as zero.

A) Air Particulate

Air monitoring stations were established at a total of six locations (five are required by Technical Specifications). Five of these locations are indicators, while the remaining one is a control station. Airborne particulates are collected by passing the air through a glass-fiber filter. These filters are collected bi-weekly and are 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 daughter products. Quarterly composite air filters from each location are analyzed for gamma emitting radionuclides.

Naturally occurring Be-7 was detected on all quarterly composite samples. Bi-weekly gross-beta counts (Figures 3.1 and 3.2) showed random fluctuation throughout 1990 at indicator stations and controls, thereby indicating that any plant contribution was negligible. Several unusually low concentrations in 1990, as shown in Figures 3.1 and 3.2, were due to unknown causes. Each of the low measurements was confirmed with a recount. A slightly but noticeably higher gross-beta measurement for the week of May 15 to May 29 at AP-13 (see Figure 3.1) was due to a gas meter malfunction. As such, it cannot be considered a valid measurement.

There were two interruptions in the air particulate sampling program during 1990. The sampler at AP-13 was out of service for approximately 27.5 hours (May 29-30) during the replacement of a malfunctioning gas meter. The sampler at AP-11 was out of service for approximately 16 days (between September 25 and October 12). On September 25, it was discovered that power was out at the location due to tree limbs having fallen on the electrical wires. The hour meter for the sampler indicated that the power had been interrupted earlier that day. Repairs to restore power to the site were completed and the sampler resumed operation on October 12.

GROSS BETA MEASUREMENTS ON AIR PARTICULATE FILTERS
- VERMONT YANKEE NUCLEAR POWER STATION -

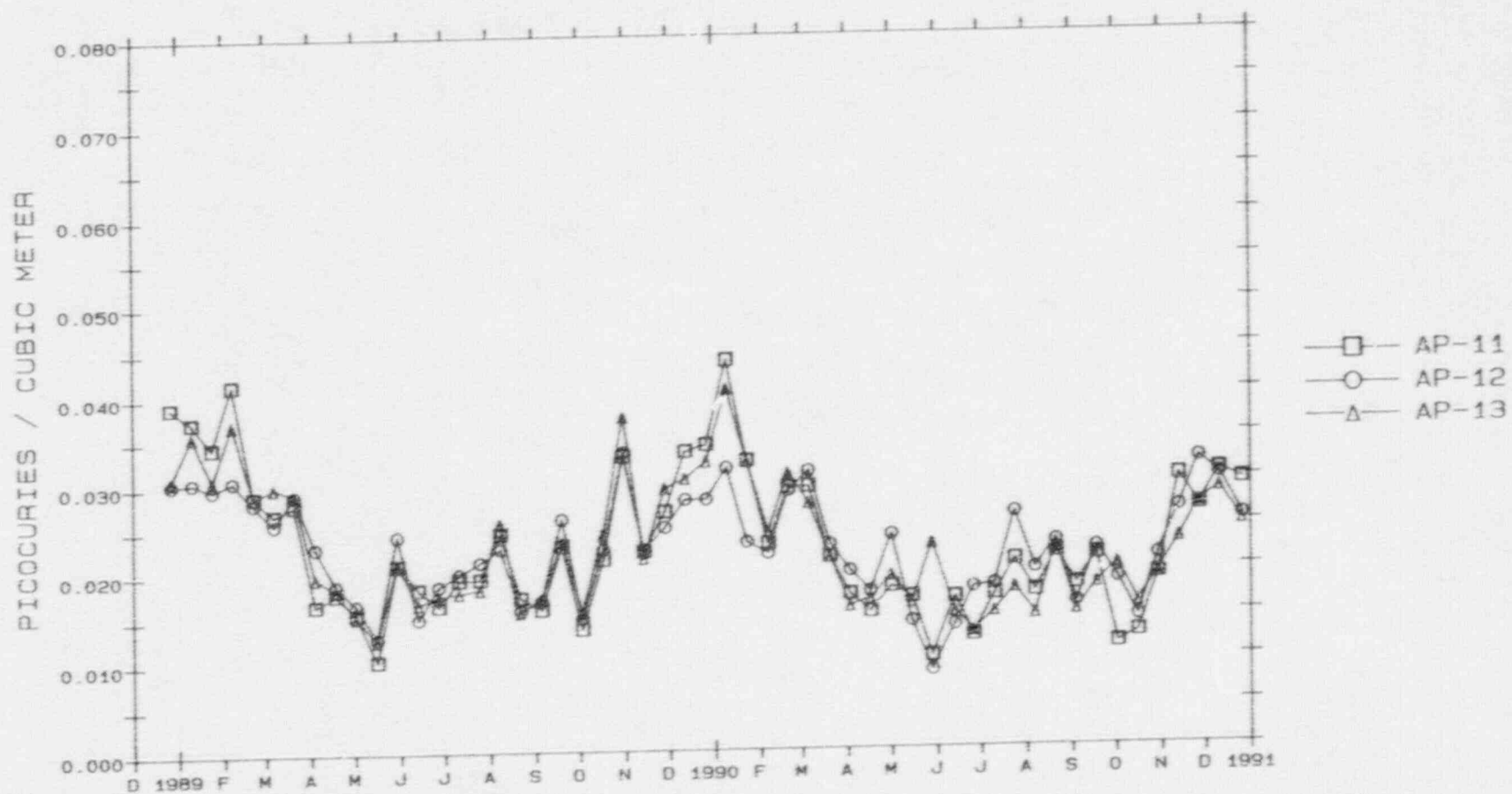
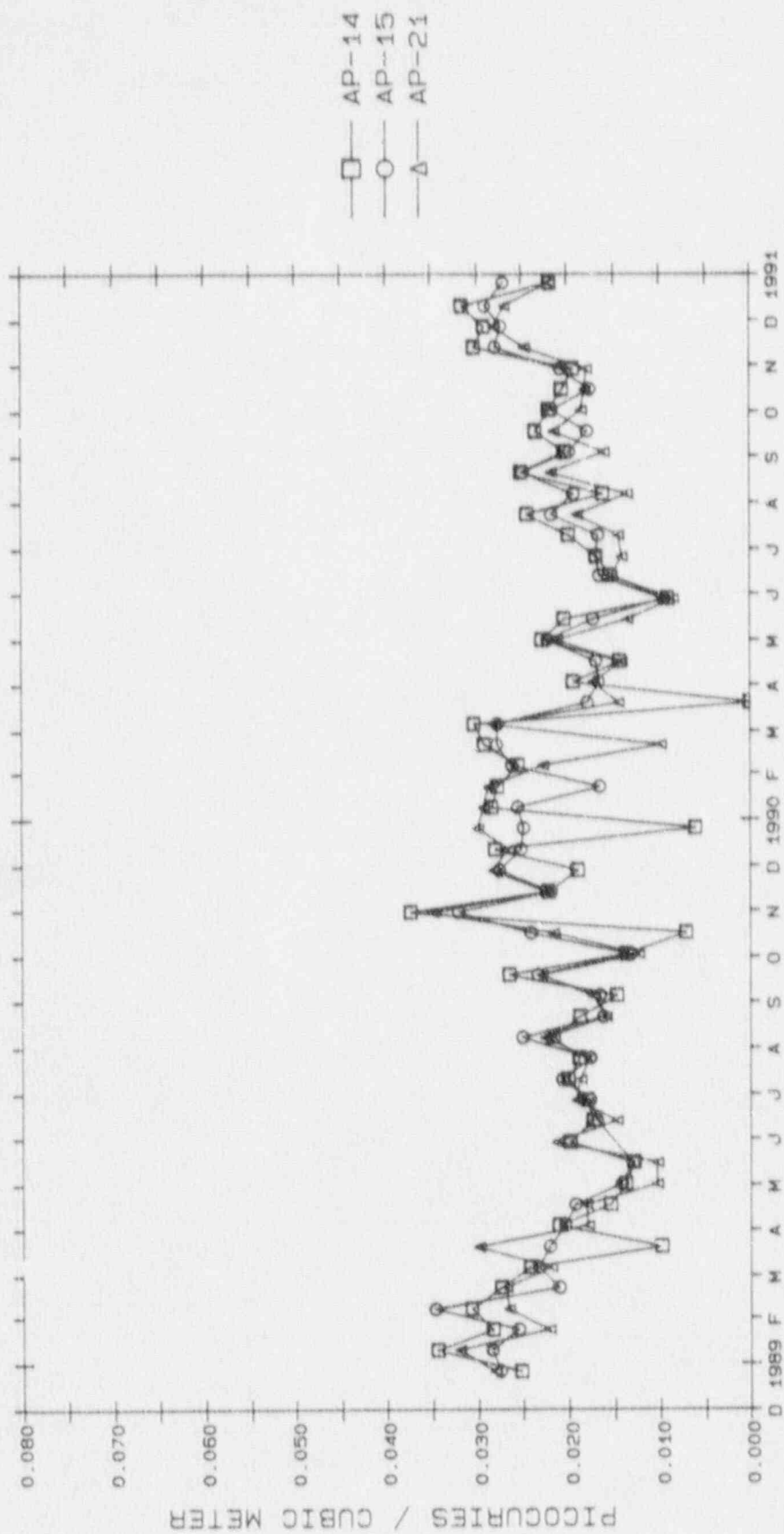


Figure 3.2

GROSS BETA MEASUREMENTS ON AIR PARTICULATE FILTERS
- VERMONT YANKEE NUCLEAR POWER STATION -



ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT
(JANUARY - DECEMBER 1990)

MEDIUM: AIR PARTICULATE

UNITS: PC1/CU. M

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 (156) (0)	.01	(2.2 ± 0.1)E -2 (0.0 - 4.4)E -2 *(129/130)*	12 (2.2 ± 0.1)E -2 (8.6 - 32.0)E -3 *(26/ 26)*	(1.9 ± 0.1)E -2 (8.5 - 29.3)E -3 *(26/ 26)*
BE-7 (24) (0)		(4.9 ± 0.4)E -2 (2.2 - 9.0)E -2 *(20/ 20)*	15 (5.4 ± 1.2)E -2 (3.7 - 9.0)E -2 *(4/ 4)*	(5.1 ± 0.8)E -2 (3.3 - 7.2)E -2 *(4/ 4)*
K-40 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 20)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
MN-54 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 20)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
CO-58 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 20)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
FE-59 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 20)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
CO-60 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 20)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
ZN-65 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 20)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
ZR-95 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 20)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(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 1990)

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 STA. RANGE NO. DETECTED**	MEAN RANGE NO. DETECTED**
AG-110m (24) (0)		(0.0 ± 0.0) E 0 *(0 / 20)*	ALL EQUAL	(0.0 ± 0.0) E 0 *(0 / 4)*
RU-103 (24) (0)		(0.0 ± 0.0) E 0 *(0 / 20)*	ALL EQUAL	(0.0 ± 0.0) E 0 *(0 / 4)*
RU-106 (24) (0)		(0.0 ± 0.0) E 0 *(0 / 20)*	ALL EQUAL	(0.0 ± 0.0) E 0 *(0 / 4)*
SB-124 (24) (0)		(0.0 ± 0.0) E 0 *(0 / 20)*	ALL EQUAL	(0.0 ± 0.0) E 0 *(0 / 4)*
CS-134 (24) (0)	.05	(0.0 ± 0.0) E 0 *(0 / 20)*	ALL EQUAL	(0.0 ± 0.0) E 0 *(0 / 4)*
CS-137 (24) (0)	.06	(0.0 ± 0.0) E 0 *(0 / 20)*	ALL EQUAL	(0.0 ± 0.0) E 0 *(0 / 4)*
BA-140 (24) (0)		(0.0 ± 0.0) E 0 *(0 / 20)*	ALL EQUAL	(0.0 ± 0.0) E 0 *(0 / 4)*
CE-141 (24) (0)		(0.0 ± 0.0) E 0 *(0 / 20)*	ALL EQUAL	(0.0 ± 0.0) E 0 *(0 / 4)*
CE-144 (24) (0)		(0.0 ± 0.0) E 0 *(0 / 20)*	ALL EQUAL	(0.0 ± 0.0) E 0 *(0 / 4)*
TH-232 (24) (0)		(0.0 ± 0.0) E 0 *(0 / 20)*	ALL EQUAL	(0.0 ± 0.0) E 0 *(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 *()*.

B) Charcoal Filters

Charcoal filter cartridges are situated in series with the air particulate glass-fiber filters. Monitoring stations were established at a total of six locations (five are required by Technical Specifications). Five of these are indicators and one is a control. Charcoal filters from the air sampling stations were collected and analyzed bi-weekly for I-131 activity.

During 1990, no I-131 was detected on charcoal filters.

There were two interruptions in the charcoal filter sampling program during 1990. The sampler at CF-13 was out of service for approximately 27.5 hours (May 29-30) during the replacement of a malfunctioning gas meter. The samples at CF-11 was out of service for approximately 16 days (between September 25 and October 12). On September 25, it was discovered that power was out at the location due to tree limbs having fallen on the electrical wires. The hour meter for the sampler indicated that the power had been interrupted earlier that day. Repairs to restore power to the site were completed and the sampler was returned to operation on October 12.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT
(JANUARY - DECEMBER 1990)

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 STA. RANGE NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
1-131 (156) (0)	.07	(0.0 ± 0.0)E 0 *(0/130)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 26)*

* 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 (not a Technical Specification requirement). Semi-monthly sampling was done at Stations TM-12, TM-14, and TM-20 when the cows were on pasture.

Following the Land Use Census in 1990, the Mitchell Farm (TM-19) was added to the milk sampling program (for goat milk). Due to limited availability, samples will only be collected there as available.

Detectable concentrations of Cs-137 and Sr-90 were measured in milk samples submitted from most indicator locations during 1990. As shown in Figures 3.3 and 3.4, concentrations were similar to those detected in previous years. The two new locations (TM-12 added to the program in 1989 and TM-19 in 1990) show significant levels of Cs-137 and Sr-90 also. The detected levels are consistent with those measured in cow milk and goat milk at other New England locations and are not believed to be caused by plant emissions. Such levels have been well documented and are attributed to fallout from nuclear weapons tests, although Cs-137 levels after May 1986 were elevated somewhat due to Chernobyl-related fallout. Differences between dairy farms can be attributed to differences in feeding practices between farms. A much higher transfer coefficient for Strontium and Cesium (from vegetation to milk) for goats also causes greater Sr-90 and Cs-137 concentrations in goat milk.

In addition to these radionuclides, naturally occurring K-40 was detected in all samples. No I-131 was detected in any of the samples.

Figure 3.3

CESIUM-137 IN MILK
- VERMONT YANKEE NUCLEAR POWER STATION -

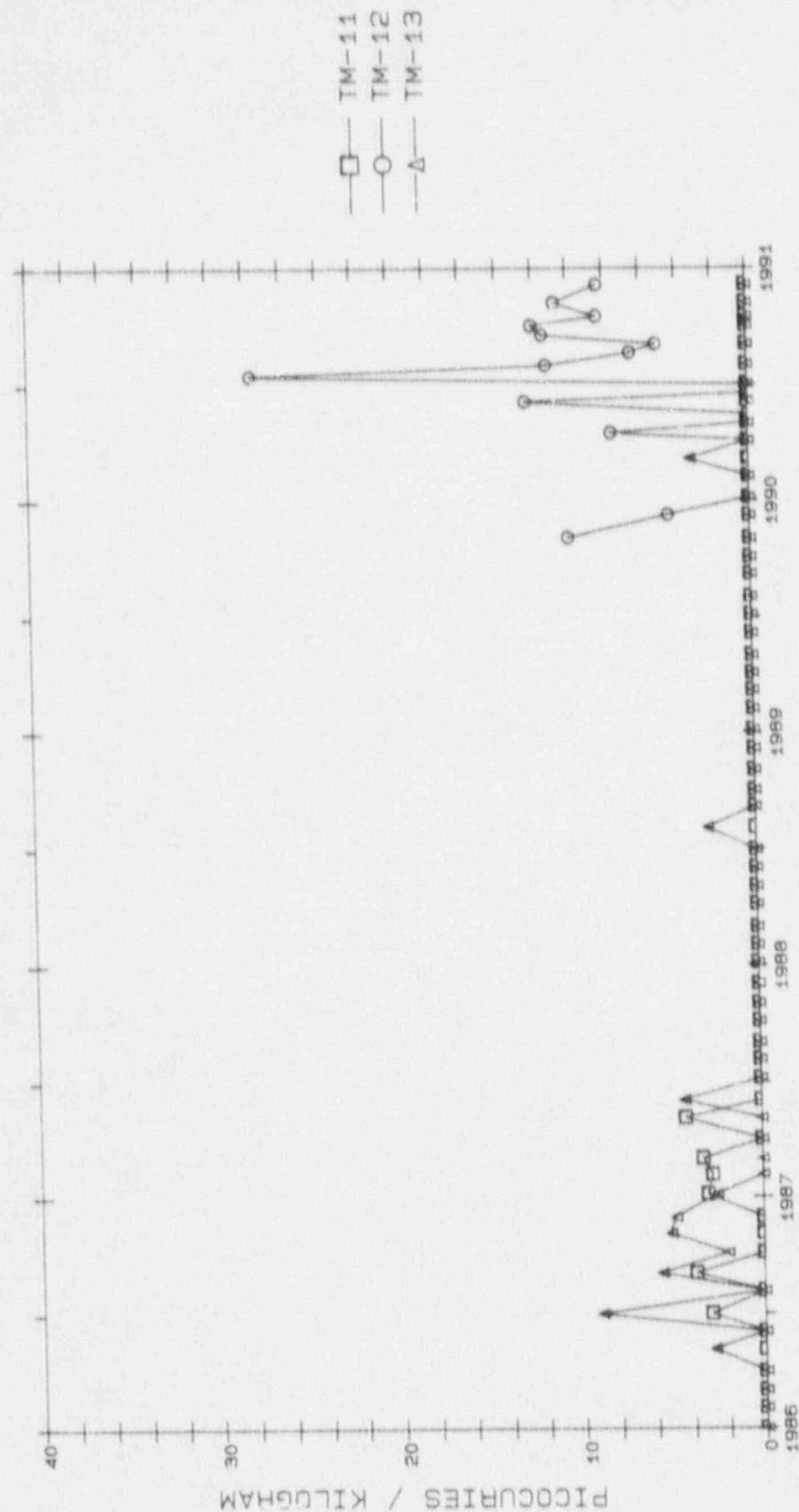


Figure 3.4

CESIUM-137 IN MILK
- VERMONT YANKEE NUCLEAR POWER STATION -

-24-

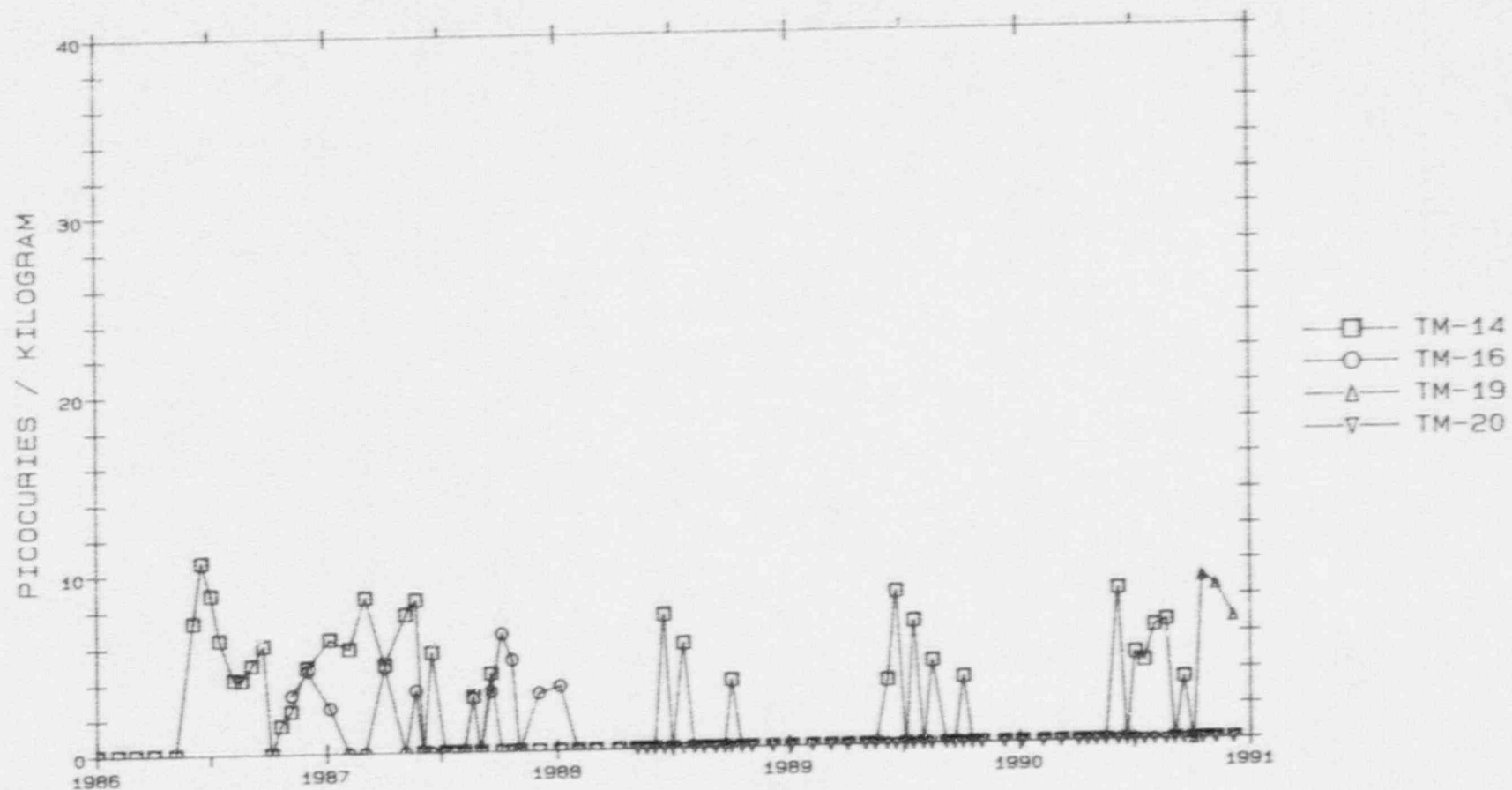


Figure 3.5

STRONTIUM-90 IN MILK
- VERMONT YANKEE NUCLEAR POWER STATION -

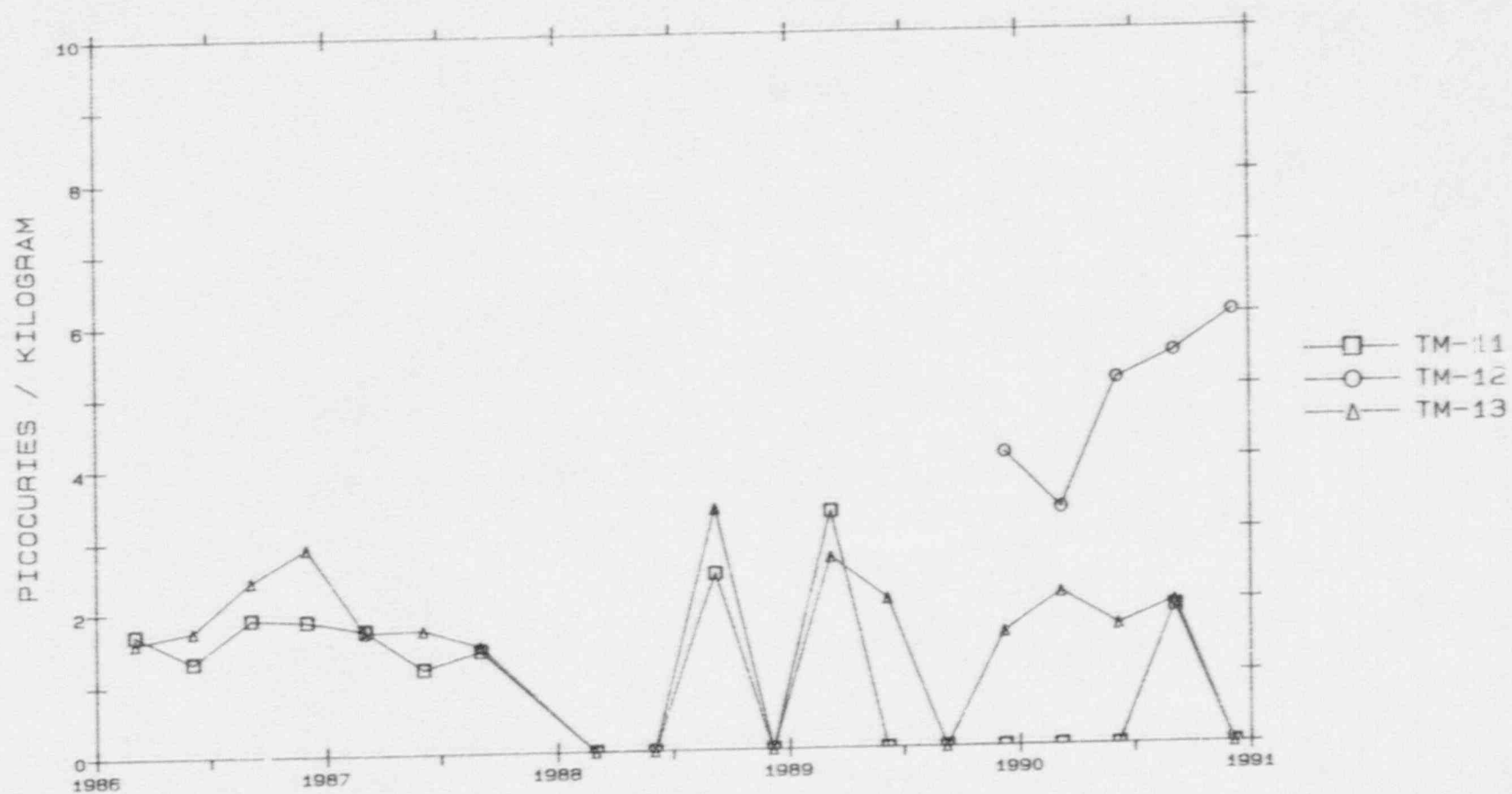
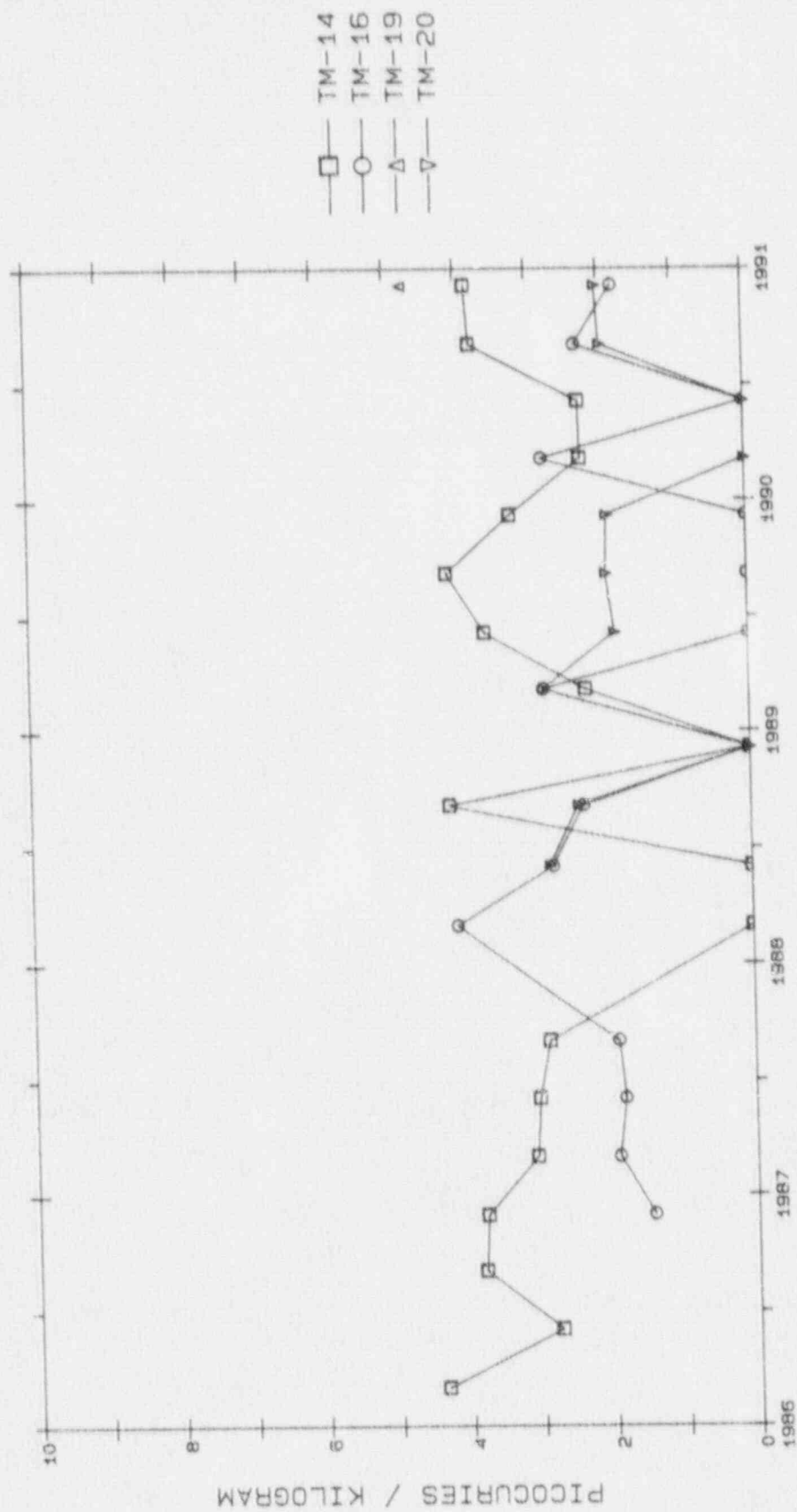


Figure 3.6

STRONTIUM-90 IN MILK
- VERMONT YANKEE NUCLEAR POWER STATION -



ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERMONT, VT
(JANUARY - DECEMBER 1990)

MEDIUM: MILK

UNITS: PCI/KG

RADIOISOTOPES (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**
SR-89 (25) (0)		(0.0 ± 0.0)E 0 *(0/ 21)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
SR-90 (25) (0)		(2.4 ± 0.4)E 0 (0.0 - 6.0)E 0 *(16/ 21)*	12 (5.0 ± 0.6)E 0 (3.3 - 6.0)E 0 *(4/ 4)*	(1.0 ± 0.6)E 0 (0.0 - 2.0)E 0 *(2/ 4)*
BE-7 (100) (0)		(0.0 ± 0.0)E 0 *(0/ 81)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 19)*
K-40 (100) (0)		(1.5 ± 0.0)E 3 (10.0 - 21.5)E 2 *(81/ 81)*	12 (1.9 ± 0.0)E 3 (1.5 - 2.2)E 3 *(19/ 19)*	(1.3 ± 0.0)E 3 (1.2 - 1.4)E 3 *(19/ 19)*
MN-54 (100) (0)		(0.0 ± 0.0)E 0 *(0/ 81)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 19)*
CO-58 (100) (0)		(0.0 ± 0.0)E 0 *(0/ 81)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 19)*
FE-59 (100) (0)		(0.0 ± 0.0)E 0 *(0/ 81)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 19)*
CO-60 (100) (0)		(0.0 ± 0.0)E 0 *(0/ 81)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 19)*
ZN-65 (100) (0)		(0.0 ± 0.0)E 0 *(0/ 81)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 19)*

* 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 1990)

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 S.A. RANGE NO. NO. DETECTED**		MEAN RANGE NO. DETECTED**	
ZR-95 (100) (0)		(0.0 ± 0.0)E 0 *(0/ 81)*		ALL EQUAL		(0.0 ± 0.0)E 0 *(0/ 19)*	
AG-110M(100) (0)		(0.0 ± 0.0)E 0 *(0/ 81)*		ALL EQUAL		(0.0 ± 0.0)E 0 *(0/ 19)*	
RU-103 (100) (0)		(0.0 ± 0.0)E 0 *(0/ 81)*		ALL EQUAL		(0.0 ± 0.0)E 0 *(0/ 19)*	
RU-106 (100) (0)		(0.0 ± 0.0)E 0 *(0/ 81)*		ALL EQUAL		(0.0 ± 0.0)E 0 *(0/ 19)*	
SB-124 (100) (0)		(0.0 ± 0.0)E 0 *(0/ 81)*		ALL EQUAL		(0.0 ± 0.0)E 0 *(0/ 19)*	
I-131 (100) (0)	1.	(0.0 ± 0.0)E 0 *(0/ 81)*		ALL EQUAL		(0.0 ± 0.0)E 0 *(0/ 19)*	
CS-134 (100) (0)	15.	(0.0 ± 0.0)E 0 *(0/ 81)*		ALL EQUAL		(0.0 ± 0.0)E 0 *(0/ 19)*	
CS-137 (100) (0)	18.	(2.3 ± 0.5)E 0 (0.0 ± 2.8)E 1 *(21/ 81)*		12 (6.4 ± 1.6)E 0 (0.0 ± 2.8)E 1 *(11/ 19)*		(0.0 ± 0.0)E 0 *(0/ 19)*	
BA-140 (100) (0)	15.	(0.0 ± 0.0)E 0 *(0/ 81)*		ALL EQUAL		(0.0 ± 0.0)E 0 *(0/ 19)*	
CE-141 (100) (0)		(0.0 ± 0.0)E 0 *(0/ 81)*		ALL EQUAL		(0.0 ± 0.0)E 0 *(0/ 19)*	

* 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 1990)

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. NO. DETECTED**	MEAN RANGE NO. DETECTED**
CE-144 (100) (0)		(0.0 ± 0.0)E 0 *(0/ 81)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 19)*
TH-232 (100) (0)		(0.0 ± 0.0)E 0 *(0/ 81)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 19)*

- * 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 September from the six air sampling locations. Samples were not available during the winter months. 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 on most samples and K-40 on all samples, Cs-137 was detected on two samples. The levels detected in 1990 are consistent with those measured in previous years, as shown in Figures 3.7 and 3.8, and are believed to be caused by nuclear weapons testing fallout that has persisted in the environment. The highest measured value for 1990 at Station TG-11 is approximately two percent of the reporting level for Cs-137 in vegetation given in Technical Specification Table 3.9.4. The highest level for any station over the five-year period shown in Figures 3.7 and 3.8 was a single quarterly measurement in 1988 at Station TG-15. This measurement was approximately 9 percent of the reporting level. (These comparisons are only made to put the values in perspective. Reporting levels apply only to radionuclides emitted from the plant.)

Figure 3.7

CESIUM-137 IN MIXED GRASSES
- VERMONT YANKEE NUCLEAR POWER STATION -

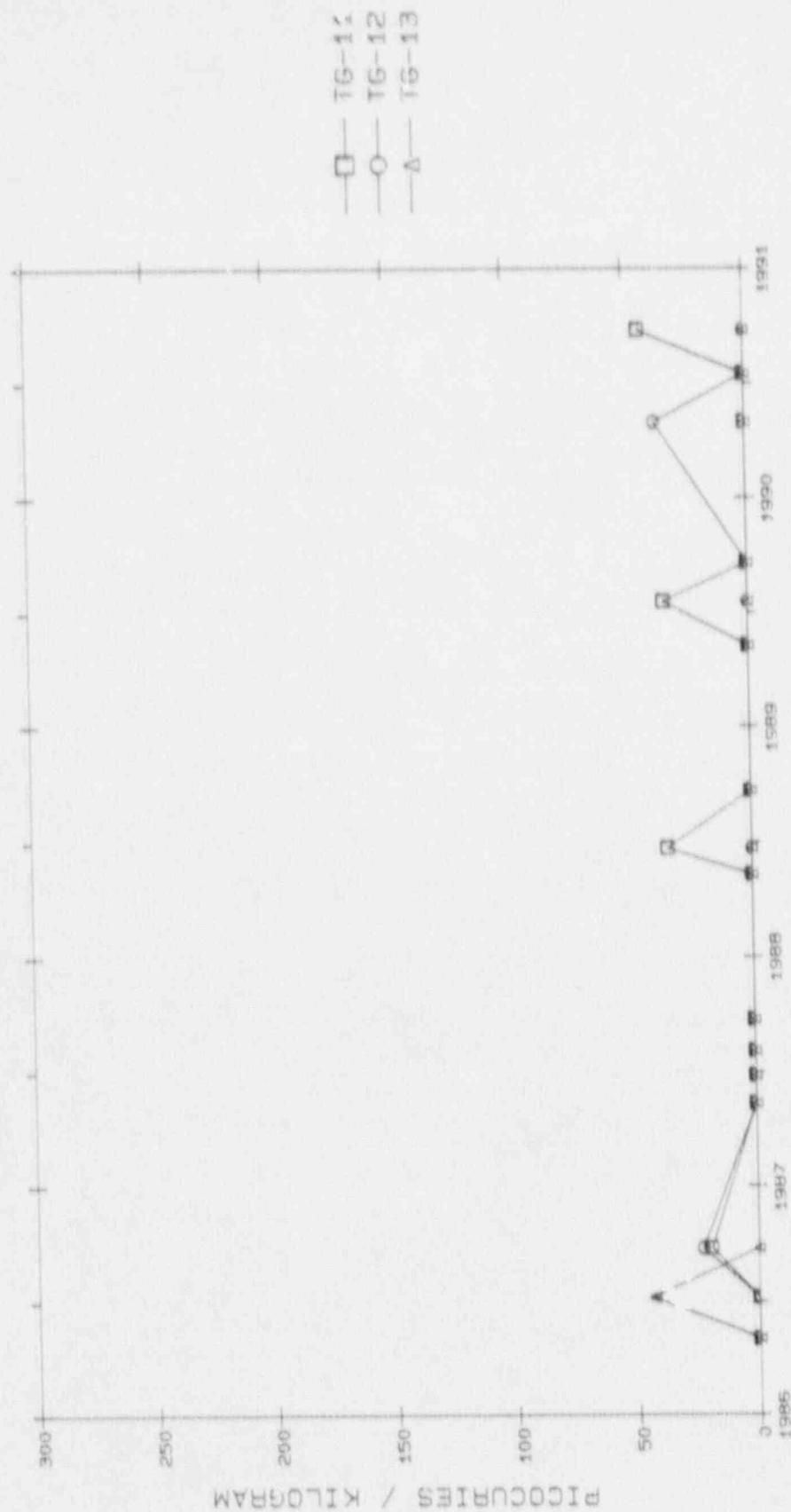
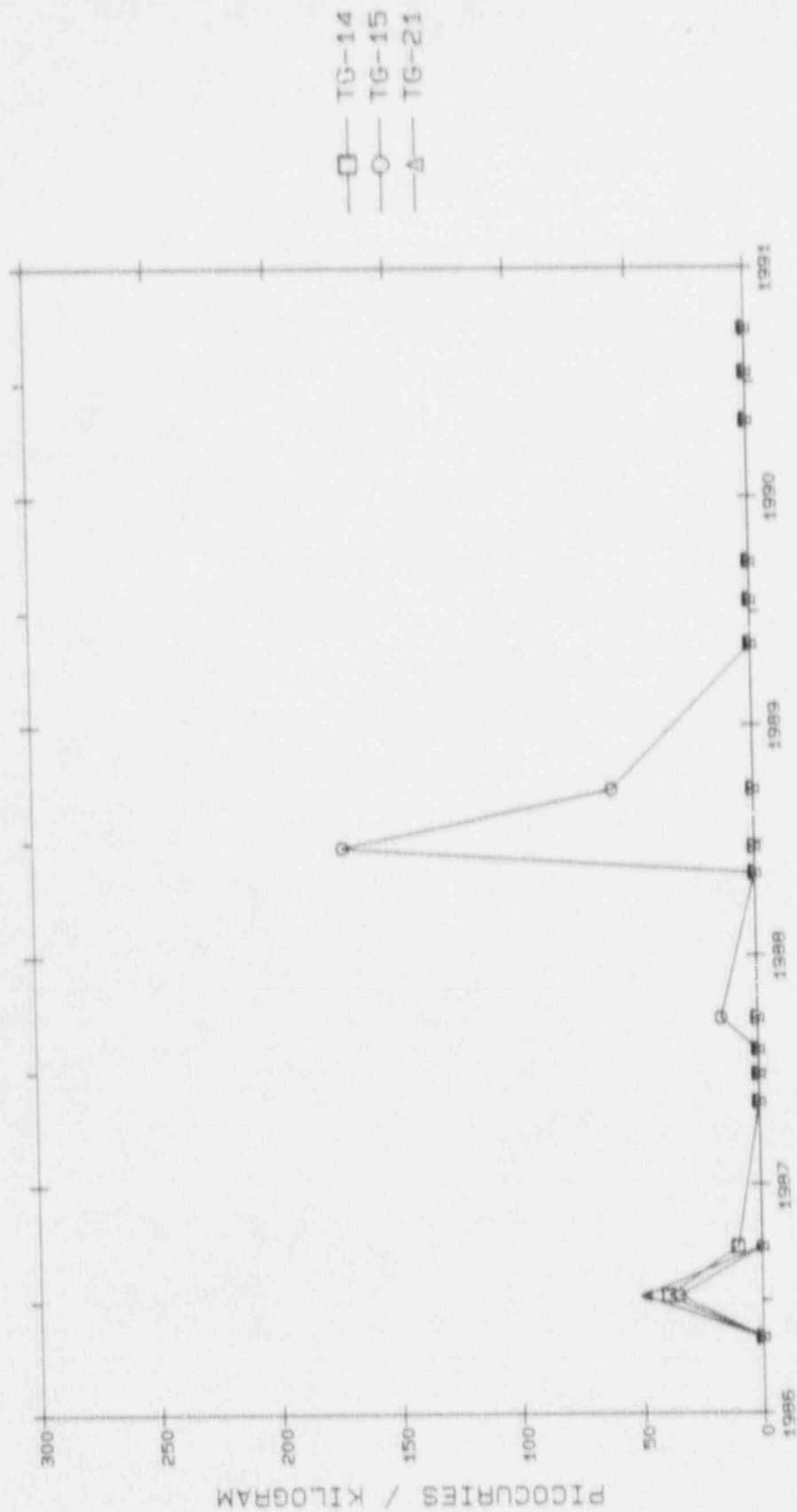


Figure 3.8

CESIUM-137 IN MIXED GRASSES
- VERMONT YANKEE NUCLEAR POWER STATION -



ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT
(JANUARY - DECEMBER 1990)

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 NO. DETECTED**
BE-7 (18) (0)		(2.5 ± 0.8)E 2 (0.0 - 8.1)E 2 *(7/ 15)*	21 (6.5 ± 2.4)E 2 (3.3 - 11.2)E 2 *(3/ 3)*	(6.5 ± 2.4)E 2 (3.3 - 11.2)E 2 *(3/ 3)*
K-40 (18) (0)		(5.3 ± 0.3)E 3 (2.8 - 6.8)E 3 *(15/ 15)*	21 (6.1 ± 0.8)E 3 (5.3 - 7.6)E 3 *(3/ 3)*	(6.1 ± 0.8)E 3 (5.3 - 7.6)E 3 *(3/ 3)*
MN-54 (18) (0)		(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 3)*
CO-58 (18) (0)		(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 3)*
FE-59 (18) (0)		(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 3)*
CO-60 (18) (0)		(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 3)*
ZN-65 (18) (0)		(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 3)*
ZR-95 (18) (0)		(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 3)*
AG-110M (18) (0)		(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(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. >3 STD DEVIATIONS) IS INDICATED WITH *()*.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT
(JANUARY - DECEMBER 1990)

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 STA. RANGE NO. DETECTED**	MEAN RANGE NO. DETECTED**
RU-103 (18) (0)		(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 3)*
RU-106 (18) (0)		(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 3)*
SB-124 (18) (0)		(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 3)*
I-131 (18) (0)	60.	(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 3)*
CS-134 (18) (0)	60.	(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 3)*
CS-137 (18) (2)	80.	(5.4 ± 3.7)E 0 (0.0 ± 4.3)E 1 *(2/ 15)*	11 (1.4 ± 1.4)E 1 (0.0 ± 4.3)E 1 *(1/ 3)*	(0.0 ± 0.0)E 0 *(0/ 3)*
BA-140 (18) (0)		(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 3)*
CE-141 (18) (0)		(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 3)*
CE-144 (18) (0)		(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 3)*
TH-232 (18) (0)		(0.0 ± 0.0)E 0 *(0/ 15)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(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. >3 STD DEVIATIONS) IS INDICATED WITH *()*.

E) Silage

Silage samples were collected at the milk sampling stations during October of 1990. Each sample was analyzed for gamma-emitting radionuclides and I-131.

Naturally-occurring K-40 was detected in all silage samples, and naturally-occurring Be-7 was detected in most. No man-made radionuclides were detected in any of them.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT
(JANUARY - DECEMBER 1990)

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 STA. RANGE NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
BE-7 (7) (0)		(4.4 ± 2.6)E 2 (0.0 ± 1.7)E 3 *(4/ 6)*	14 (1.7 ± 0.2)E 3 *(1/ 1)*	(4.9 ± 0.9)E 02 *(1/ 1)*
K-40 (7) (0)		(6.1 ± 1.9)E 3 (2.0 ± 14.1)E 3 *(6/ 6)*	12 (1.4 ± 0.1)E 4 *(1/ 1)*	(2.9 ± 0.2)E 3 *(1/ 1)*
MN-54 (7) (0)		(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
CO-58 (7) (0)		(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
FE-59 (7) (0)		(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
CO-60 (7) (0)		(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
ZN-65 (7) (0)		(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
ZR-95 (7) (0)		(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
AC-110M (7) (0)		(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)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 1990)

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 STA. RANGE NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
RU-103 (7) (0)		(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
RU-106 (7) (0)		(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
SE-124 (7) (0)		(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
I-131 (7) (0)	60.	(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
CS-134 (7) (0)	60.	(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
CS-137 (7) (0)	80.	(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
BA-140 (7) (0)		(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
CE-144 (7) (0)		(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
CE-144 (7) (0)		(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 1)*
TH-232 (7) (0)		(0.0 ± 0.0)E 0 *(0/ 6)*	ALL EQUAL	(0.0 ± 0.0)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) Groundwater

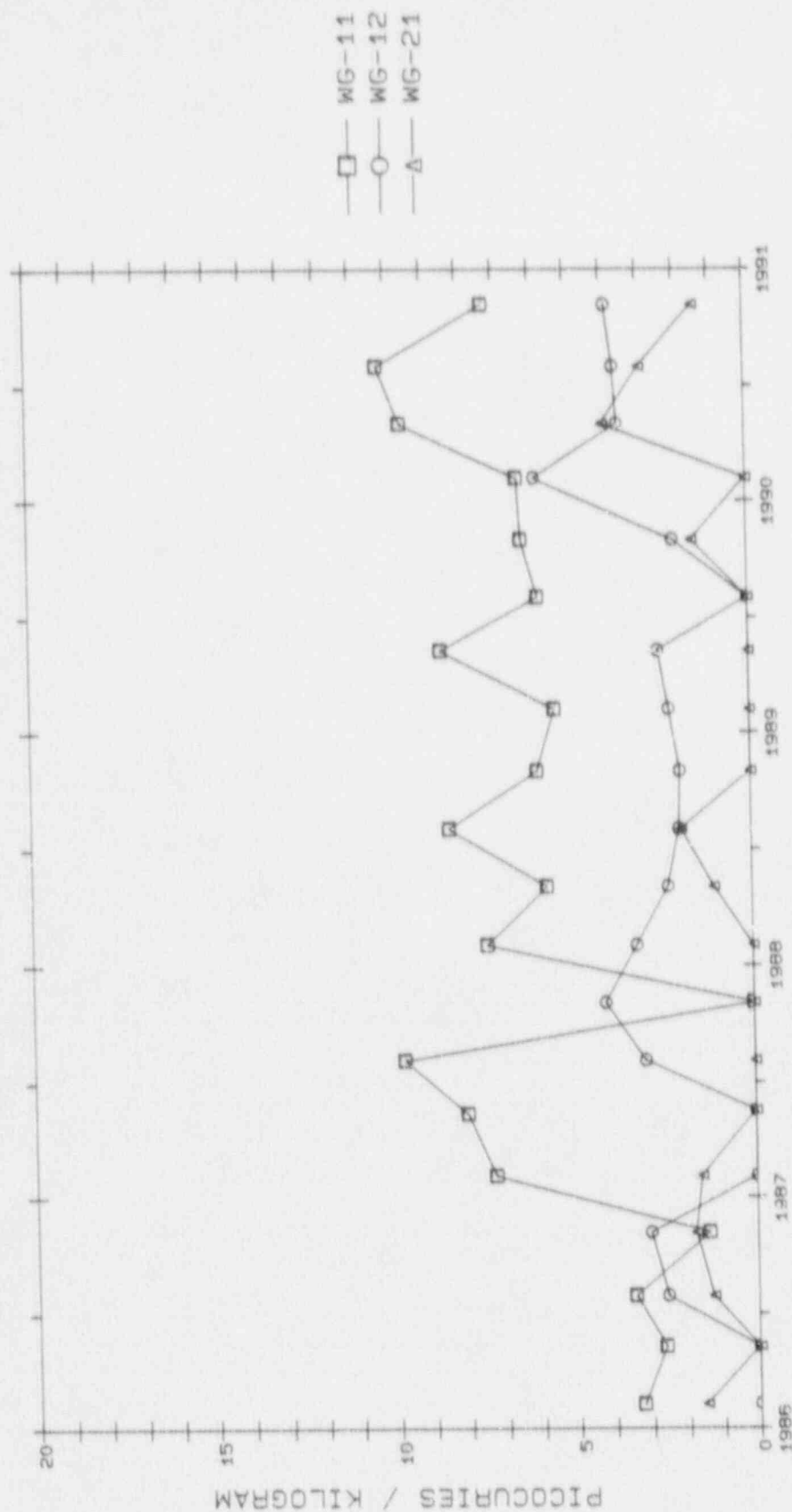
Groundwater grab samples were collected from two indicator (only one is required by Technical Specifications) and one control station on a quarterly basis. These samples were analyzed for H-3 and gamma-emitting radionuclides. Additionally, gross-beta analyses were performed, although they are not required.

The gross-beta concentrations at WG-11 have been elevated since 1987, as can be seen in Figure 3.9. No explanation for these levels has been found, although a problem with low well-water levels and moving to a new well may have caused a change in naturally-occurring radioactivity. Elevated radium levels at WG-11 are suspected, as confirmed by a sample collected there in August of 1988. The gross-beta levels in 1990 are consistent with those in the previous several years. No gamma-emitting radionuclides or H-3 were detected in groundwater during this time.

During February of 1990, the control water sample at WG-21 was not available. An alternate control sample for that period was collected at the Southern Vermont Engineering Company.

Figure 3.9

GROSS-BETA MEASUREMENTS ON GROUND WATER
- VERMONT YANKEE NUCLEAR POWER STATION -



ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT
(JANUARY - DECEMBER 1990)

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 STA. RANGE NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
GR-B (12) (0)	4.	(6.3 ± 0.9)E 0 (3.5 - 10.2)E 0 *(8/ 8)*	11 (8.4 ± 0.9)E 0 (6.4 - 10.2)E 0 *(4/ 4)*	(2.1 ± 0.9)E 0 (0.0 - 4.0)E 0 *(3/ 4)*
BE-7 (12) (0)		(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
K-40 (12) (0)		(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
MN-54 (12) (0)	15.	(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
CO-58 (12) (0)	15.	(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
FE-59 (12) (0)	30.	(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
CO-60 (12) (0)	15.	(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
ZN-65 (12) (0)	30.	(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
ZR-95 (12) (0)	15.	(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(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 1990)

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 STA. RANGE NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
AG-110M (12) (0)		(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
RU-103 (12) (0)		(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
RU-106 (12) (0)		(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
SB-124 (12) (0)		(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
I-131 (12) (0)		(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
CS-134 (12) (0)	15.	(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
CS-137 (12) (0)	18.	(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
BA-140 (12) (0)	15.	(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
CE-141 (12) (0)		(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
CE-144 (12) (0)		(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(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 1990)

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 STA. RANGE NO. NO. DETECTED**	MEAN RANGE NO. DETECTED**
TH-232 (12) (0)		(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*
H-3 (12) (0)	3000.	(0.0 ± 0.0)E 0 *(0/ 8)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(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.

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G) River Water

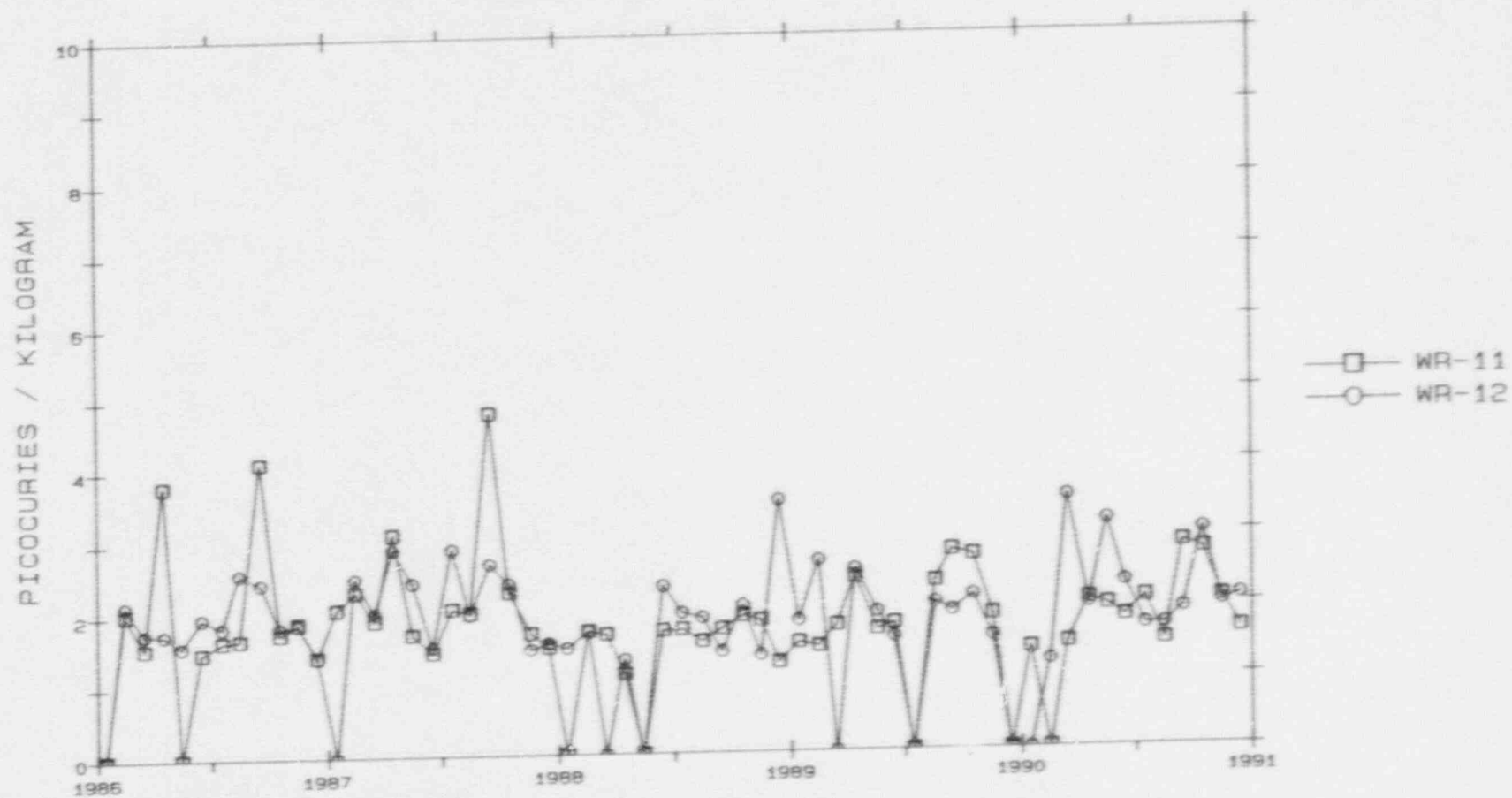
River water is analyzed monthly for gamma-emitting radionuclides and gross-beta (not required by Technical Specifications). The monthly samples are composited and analyzed for H-3 on a quarterly basis. A composite sampler is used at Station WR-11 and grab samples are taken at Station WR-21.

Gross-beta radioactivity was detected in all samples during 1990. Considerable fluctuation in gross-beta levels at both the indicator and control locations over the past nine years is evident in Figure 3.10. The mean value, however, for the indicator stations was similar to that of the control station and to that of previous years, indicating that those radionuclides detected are not due to plant operations, but are due to naturally occurring radioactivity. No gamma-emitting radionuclides or H-3 were detected in any of the samples.

On one occasion during 1990, the automatic composite sampling system at WR-11 was temporarily out of service. On September 25, it was discovered that power was out at the sampling location due to tree limbs having fallen on the electrical wires. The hour meter on the adjacent air sampler indicated what the power had been interrupted earlier that day. Repairs to restore power to the site were completed and the sampler resumed operation on October 12. Consequently, the composited sample for the month represents the periods of September 13-25 and October 12-16.

Figure 3.10

GROSS-BETA MEASUREMENTS ON RIVER WATER
- VERMONT YANKEE NUCLEAR POWER STATION -



ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT
(JANUARY - DECEMBER 1990)

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 (24) (0)	4.	(1.9 ± 0.2)E 0 (9.5 - 28.3)E -1 *(12/ 12)*	21 (2.1 ± 0.2)E 0 (1.0 - 3.5)E 0 *(12/ 12)*	(2.1 ± 0.2)E 0 (1.0 - 3.5)E 0 *(12/ 12)*
BE-7 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
K-40 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
MN-54 (24) (0)	15.	(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
CO-58 (24) (0)	15.	(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
FE-59 (24) (0)	30.	(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
CO-60 (24) (0)	15.	(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
ZN-65 (24) (0)	30.	(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
ZR-95 (24) (0)	15.	(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)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.
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ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT
(JANUARY - DECEMBER 1990)

MEDIUM: RIVER WATER

UNITS: PCI/KG

RADIOISOTOPES (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**
AD-110M (24) (0)		(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
RU-103 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
RU-106 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
SB-124 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
I-131 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
CS-134 (24) (0)	15.	(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
CS-137 (24) (0)	18.	(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
BA-140 (24) (0)	15.	(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
CE-141 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
CE-144 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)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.

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ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT
(JANUARY - DECEMBER 1990)

MEDIUM: RIVER WATER

UNITS: PCI/KG

RADIOISOTOPES (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**
TH-232 (24) (0)		(0.0 ± 0.0)E 0 *(0/ 12)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 12)*
H-3 (8) (0)	3000.	(0.0 ± 0.0)E 0 *(0/ 4)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 4)*

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H) Sediment

During 1990, sediment samples were collected from two locations in May and October. Each sample was analyzed for gamma-emitting radionuclides. One grab sample was collected at Station SE-11 and 20 grab samples at Station SE-12 during May. During October, one was again collected at SE-11 and 40 at SE-12.

Cesium-137 was detected in all samples. Since there were no liquid releases during 1982 through 1990, it can be concluded that the levels of Cs-137 in 1990 sediment samples were due to nuclear weapons testing fallout, as has been discussed in previous Vermont Yankee Radiological Environmental Surveillance Reports. This is further supported by the fact that similar levels have in the past been detected at Station SE-21, a control station, and at control locations at other power plants. Low levels of Co-60 have been detected in many samples collected at Station SE-12 (N. Storm Drain Outfall) during 1990 and in previous years. The activity is localized to a small area and is due to plant operations. The Co-60 levels in 1990 were similar to those reported in previous years, and are well under the reporting level specified in plant Technical Specifications.

It should be noted here that the statistics given in the following table are heavily weighted toward Station SE-12, since 60 of the 62 samples were collected there. No Co-60 was detected at Station SE-11.

Naturally occurring Be-7, K-40, and Th-232 were also detected in most samples.

ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT
(JANUARY - DECEMBER 1990)

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**	
BE-7 (62) (7)		(9.6 ± 3.9)E 1 (0.0 - 1.8)E 3 *(7/ 62)*		12 (9.9 ± 4.0)E 1 (0.0 - 1.8)E 3 *(7/ 60)*		NO DATA	
K-40 (62) (0)		(1.3 ± 0.0)E 4 (9.2 - 17.1)E 3 *(62/ 62)*		12 (1.3 ± 0.0)E 4 (9.2 - 17.1)E 3 *(60/ 60)*		NO DATA	
MN-54 (62) (0)		(0.0 ± 0.0)E 0 *(0/ 62)*		ALL EQUAL		NO DATA	
CO-58 (62) (0)		(0.0 ± 0.0)E 0 *(0/ 62)*		ALL EQUAL		NO DATA	
FE-59 (62) (0)		(0.0 ± 0.0)E 0 *(0/ 62)*		ALL EQUAL		NO DATA	
CO-60 (62) (13)		(3.4 ± 1.1)E 1 (0.0 - 4.9)E 2 *(13/ 62)*		12 (3.5 ± 1.1)E 1 (0.0 - 4.9)E 2 *(13/ 60)*		NO DATA	
ZN-65 (62) (0)		(0.0 ± 0.0)E 0 *(0/ 62)*		ALL EQUAL		NO DATA	
ZR-95 (62) (0)		(0.0 ± 0.0)E 0 *(0/ 62)*		ALL EQUAL		NO DATA	
AG-110M (62) (0)		(0.0 ± 0.0)E 0 *(0/ 62)*		ALL EQUAL		NO DATA	

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ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT
(JANUARY - DECEMBER 1990)

MEDIUM: SEDIMENT

UNITS: PCI/KG DRY

RADIOISOTOPES (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 (62) (0)		(0.0 ± 0.0)E 0 *(0/ 62)*			ALL EQUAL		NO DATA
RU-106 (62) (0)		(0.0 ± 0.0)E 0 *(0/ 62)*			ALL EQUAL		NO DATA
SB-124 (62) (0)		(0.0 ± 0.0)E 0 *(0/ 62)*			ALL EQUAL		NO DATA
I-131 (62) (0)		(0.0 ± 0.0)E 0 *(0/ 62)*			ALL EQUAL		NO DATA
CS-134 (62) (0)	150.	(0.0 ± 0.0)E 0 *(0/ 62)*			ALL EQUAL		NO DATA
CS-137 (62) (0)	180.	(2.1 ± 0.1)E 2 (6.2 - 39.1)E 1 *(62/ 62)*		12	(2.2 ± 0.1)E 2 (7.4 - 39.1)E 1 *(60/ 60)*		NO DATA
BA-140 (62) (0)		(0.0 ± 0.0)E 0 *(0/ 62)*			ALL EQUAL		NO DATA
CE-141 (62) (0)		(0.0 ± 0.0)E 0 *(0/ 62)*			ALL EQUAL		NO DATA
CE-144 (62) (0)		(0.0 ± 0.0)E 0 *(0/ 62)*			ALL EQUAL		NO DATA
TH-232 (62) (0)		(9.4 ± 0.2)E 2 (5.5 - 14.4)E 2 *(62/ 62)*		12	(9.4 ± 0.2)E 2 (5.5 - 14.4)E 2 *(60/ 60)*		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.

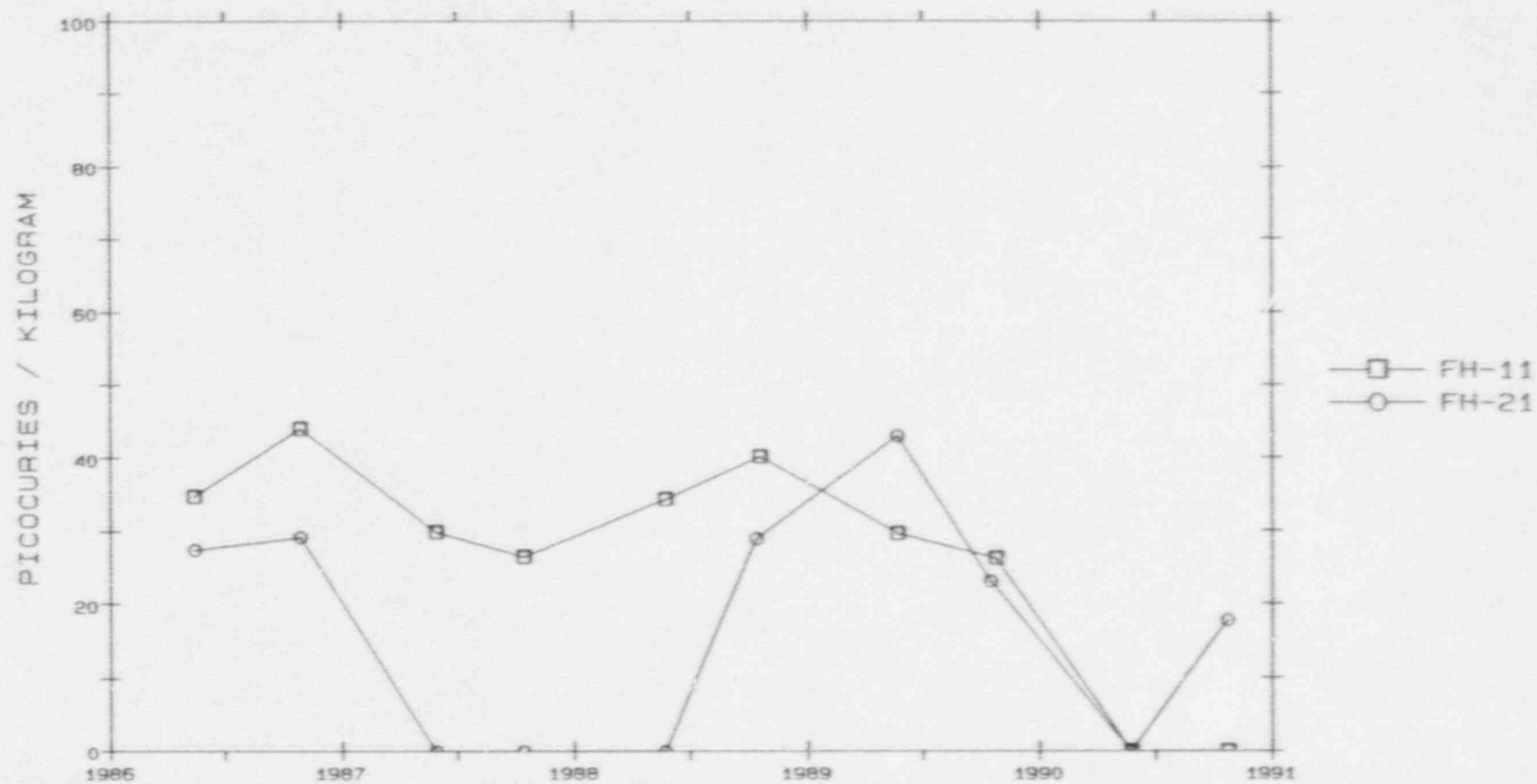
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3 STD DEVIATIONS) IS INDICATED WITH *()*.

1) Fish

Fish samples were collected from two locations during May and again in October of 1990. Each sample consisted of mixed samples of yellow perch and smallmouth bass. All were analyzed for gamma-emitting radionuclides. Cesium-137 was detected only at the control location. The detected level is similar to those in past years (see Figure 3.11) and is consistent with well-documented environmental levels caused by nuclear weapons testing fallout. No other radionuclides were detected except for naturally-occurring K-40.

Figure 3.11

CESIUM-137 IN FISH
- VERMONT YANKEE NUCLEAR POWER STATION -



ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT
(JANUARY - DECEMBER 1990)

MEDIUM: FISH

UNITS: PCI/KG WET

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	REQUIRED LLD	INDICATOR STATIONS *****	STA. NO.	STATION WITH HIGHEST MEAN *****	CONTROL STATIONS *****
		MEAN RANGE NO. DETECTED**		MEAN RANGE NO. DETECTED**	MEAN RANGE NO. DETECTED**
BE-7 (4) (0)		(0.0 ± 0.0)E 0 *(0/ 2)*		ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
K-40 (4) (0)		(2.9 ± 0.2)E 3 (2.7 ± 3.2)E 3 *(2/ 2)*	11	(2.9 ± 0.2)E 3 (2.7 ± 3.2)E 3 *(2/ 2)*	(2.8 ± 0.2)E 3 (2.6 ± 3.0)E 3 *(2/ 2)*
MN-54 (4) (0)	130.	(0.0 ± 0.0)E 0 *(0/ 2)*		ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
CO-58 (4) (0)	130.	(0.0 ± 0.0)E 0 *(0/ 2)*		ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
FE-59 (4) (0)	260.	(0.0 ± 0.0)E 0 *(0/ 2)*		ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
CO-60 (4) (0)	130.	(0.0 ± 0.0)E 0 *(0/ 2)*		ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
ZN-65 (4) (0)	260.	(0.0 ± 0.0)E 0 *(0/ 2)*		ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
ZR-95 (4) (0)		(0.0 ± 0.0)E 0 *(0/ 2)*		ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
AG-110M (4) (0)		(0.0 ± 0.0)E 0 *(0/ 2)*		ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*

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ENVIRONMENTAL RADIOLOGICAL PROGRAM SUMMARY
VERMONT YANKEE NUCLEAR POWER STATION, VERNON, VT
(JANUARY - DECEMBER 1990)

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 (4) (0)		(0.0 ± 0.0)E 0 *(0/ 2)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
RU-106 (4) (0)		(0.0 ± 0.0)E 0 *(0/ 2)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
SB-124 (4) (0)		(0.0 ± 0.0)E 0 *(0/ 2)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
I-131 (4) (0)		(0.0 ± 0.0)E 0 *(0/ 2)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
CS-134 (4) (0)	100.	(0.0 ± 0.0)E 0 *(0/ 2)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
CS-137 (4) (0)	150.	(0.0 ± 0.0)E 0 *(0/ 2)*	21 (8.9 ± 8.9)E 0 (0.0 ± 1.8)E 1 *(1/ 2)*	(8.9 ± 8.9)E 0 (0.0 ± 1.8)E 1 *(1/ 2)*
BA-140 (4) (0)		(0.0 ± 0.0)E 0 *(0/ 2)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
CE-141 (4) (0)		(0.0 ± 0.0)E 0 *(0/ 2)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
CE-144 (4) (0)		(0.0 ± 0.0)E 0 *(0/ 2)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*
TH-232 (4) (0)		(0.0 ± 0.0)E 0 *(0/ 2)*	ALL EQUAL	(0.0 ± 0.0)E 0 *(0/ 2)*

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J) In Situ

During the period October 19 through 21, 1990, an in situ survey was performed at selected sites surrounding the Vermont Yankee plant. A Canberra portable, down-looking, high-purity Germanium detector coupled to a PC-interfaced 8000-channel multichannel analyzer was used for gamma spectroscopy. A Reuter Stokes RS-112 High Pressure Ionization Chamber (HPIC) was used for direct exposure rate measurements.

The sites chosen for the survey represent the six air sampling locations, two off-site locations and three on-site or fenceline locations. Since these sites were monitored at only one time during 1990, they are not listed as routine monitoring locations in Table 2.2. They are shown, however, in Table 3.1.

Table 3.1 shows the results for both the Germanium in situ and HPIC measurements. The first four columns of data give exposure rates for the four radionuclides detected, based on the Germanium spectra. The fifth column of data gives the total exposure rate from those four terrestrial radionuclides. The sixth (last) column lists the total measured HPIC exposure rate, which includes terrestrial and cosmic radiation. The difference in exposure rates between the Germanium and HPIC methods is explained by the cosmic ray contribution to the total exposure measured by the HPIC (estimated at 3.7 to 3.8 $\mu\text{R/hr}$).

It can be seen from Table 3.1 that most of the exposure is due to radiation from naturally occurring Th-232, U-238, and K-40, as well as from cosmic radiation. A small residual amount of Cs-137 from atmospheric nuclear weapons testing fallout adds a small amount to the total exposure at all locations, including the controls.

TABLE 3.1

Summary of In Situ Measurements - October 19 Through 21, 1990
 Vermont Yankee Nuclear Power Station
 (uR/hour \pm 1 standard deviation)

Location	HPGe In Situ				Terrestrial Total	Total HPIC
	Th-232	U-238	K-40	Cs-137		
Spofford Lake (Control)	1.94 \pm 0.20	1.09 \pm 0.17	2.10 \pm 0.22	0.04 \pm 0.01	5.2 \pm 0.3	9.5 \pm 0.5
Brattleboro CC (Control)	1.28 \pm 0.14	0.78 \pm 0.12	1.30 \pm 0.14	0.24 \pm 0.04	3.7 \pm 0.2	7.7 \pm 0.4
Vernon Nursing Home	1.31 \pm 0.14	0.87 \pm 0.14	1.53 \pm 0.16	0.18 \pm 0.03	3.9 \pm 0.3	8.1 \pm 0.4
Tyler Hill Road	2.14 \pm 0.22	1.09 \pm 0.17	1.59 \pm 0.17	0.14 \pm 0.02	5.0 \pm 0.3	9.5 \pm 0.5
Governor Hunt House	1.58 \pm 0.17	0.83 \pm 0.13	1.56 \pm 0.16	0.10 \pm 0.02	4.1 \pm 0.3	8.8 \pm 0.5
North Hinsdale	1.60 \pm 0.17	0.84 \pm 0.13	1.56 \pm 0.16	0.11 \pm 0.02	4.1 \pm 0.3	8.1 \pm 0.4
Hinsdale Substation	1.68 \pm 0.18	1.05 \pm 0.17	1.49 \pm 0.16	0.14 \pm 0.02	4.4 \pm 0.3	8.7 \pm 0.4
Northfield	1.49 \pm 0.16	0.92 \pm 0.14	1.41 \pm 0.15	0.05 \pm 0.01	3.9 \pm 0.3	8.0 \pm 0.4
River Station 3.3	1.48 \pm 0.16	0.84 \pm 0.13	1.39 \pm 0.15	0.02 \pm 0.01	3.7 \pm 0.3	8.1 \pm 0.4
North-40 Well No. 111 (On-Site)	1.57 \pm 0.16	0.94 \pm 0.15	1.55 \pm 0.16	0.07 \pm 0.01	4.1 \pm 0.3	8.7 \pm 0.4
North-40 Well No. 113-S (On-Site)	1.37 \pm 0.17	0.77 \pm 0.13	1.55 \pm 0.17	0.04 \pm 0.02	3.7 \pm 0.3	8.4 \pm 0.4

K) Direct Radiation

Direct gamma radiation exposure was determined from the use of thermoluminescent dosimeters (TLDs). Beginning in 1988, Panasonic UD-801AS1 and UD-814AS1 calcium sulfate dosimeters were used, replacing the previous Victoreen $\text{CaF}_2\text{:Mn}$ dosimeters. A total of five elements were in place at each monitoring location. Fifty-one sets of TLDs were read out on a quarterly schedule. Sixteen of these were located at inner ring stations and sixteen at outer ring stations. Twelve were located at the site boundary, six were at special interest locations, and one was a control.

Summaries of the results for 1990 can be seen in the table below and in Figures 3.12 to 3.25. A complete station-by-station summary is given in Table 3.2. In this table, the quarterly averages for inner ring stations (i.e., those locations that could possibly be influenced by plant operations) can be compared with those for the outer ring stations (i.e., those locations outside of the range of influence of the plant). Upon examining the quarterly exposure rates in the table, it is evident that the inner ring exposure rates are not statistically different from those of the outer ring.

Upon examining Figure 3.15, it is evident that Stations DR-45 and DR-46 had higher average exposure rate than any other station. Both locations are on-site, and the higher exposure rates are due to plant operations in the immediate vicinity of the TLDs. As can be seen on the map in Figure 2.4, there is no significant dose potential to the surrounding population or any real individual from these sources.

As can be seen in Figure 3.13, Station DR-6 had a high reading during the third quarter of 1987. Over-response of the TLDs is suspected. Panasonic TLDs from the Yankee Environmental Laboratory were co-located with the standard Victoreen during 1987. The Panasonic TLD at DR-6 during the third quarter gave a reading of

7.2 micro-R per hour. Additionally, two TLD stations (DR-7 and DR-8) located between the plant and DR-6 had readings of 11.36 and 10.81 micro-R per hour, which is substantially lower than the 24.04 micro-R per hour at DR-6.

As noted in Table 3.2, TLDs were found to be missing in the field for the following locations during 1990: DR-47 for the second quarter, DR-16 for the third quarter, and DR-15 and DR-28 for the fourth quarter.

Environmental Radiological Program Summary
Vermont Yankee Nuclear Power Station
January - December 1990

Medium: Direct Radiation
Measurements (TLD)

Units: Micro-R per
Hour

<u>Inner Ring</u>	<u>Site</u>		<u>Station With</u>	<u>Outer Ring</u>
<u>Mean</u>	<u>Boundary</u>		<u>Highest Mean</u>	<u>Mean</u>
<u>Range</u>	<u>Mean</u>		<u>Mean</u>	<u>Mean</u>
<u>(No. Meas.)*</u>	<u>Range</u>	<u>Station</u>	<u>Range</u>	<u>Range</u>
	<u>(No. Meas.)*</u>	<u>No.</u>	<u>(No. Meas.)*</u>	<u>(No. Meas.)*</u>
6.5 \pm 0.6	10.2 \pm 7.1		31.3 \pm 4.7	6.6 \pm 0.8
5.1 - 8.2	5.8 - 35.0	46	24.4 - 35.0	4.9 - 8.2
(87)	(47)		(4)	(66)

* Most measurements based on five readings per station.

TABLE 3.2

Summary of Direct Radiation Measurements - 1990
Vermont Yankee Nuclear Power Station
 (Micro-R Per Hour)

<u>Location</u>	<u>Type*</u>	<u>QTR 1</u>	<u>QTR 2</u>	<u>QTR 3</u>	<u>QTR 4</u>	<u>Yearly Mean</u>
DR-1	I	5.5	6.4	5.8	5.9	5.9
DR-2	I	5.5	6.9	6.4	6.4	6.3
DR-3	I	6.6	8.2	7.7	7.8	7.6
DR-4	I	5.3	6.6	6.3	6.3	6.1
DR-5	O	5.1	6.9	6.2	6.8	6.3
DR-6	I	5.5	7.1	6.5	6.8	6.5
DR-7	SB	7.0	9.4	8.1	8.7	8.3
DR-8	SB	7.2	9.1	7.8	8.5	8.2
DR-9	I	5.7	6.7	6.1	6.6	6.3
DR-10	O	4.9	5.5	5.1	5.3	5.2
DR-11	I	5.1	6.3	5.7	6.0	5.8
DR-12	O	5.2	6.2	5.6	6.2	5.8
DR-13	I	5.8	6.7	6.1	6.3	6.2
DR-14	O	6.7	8.0	7.4	8.0	7.5
DR-15	I	6.7	7.1	6.6	**	6.8
DR-16	O	7.0	7.3	**	7.3	7.2
DR-17	I	5.7	6.9	6.3	6.6	6.4
DR-18	O	6.3	7.3	6.9	7.0	6.9
DR-19	I	6.1	7.1	6.8	7.0	6.8
DR-20	O	6.4	8.0	7.5	7.7	7.4
DR-21	I	5.7	7.2	6.8	6.8	6.6
DR-22	C	6.3	7.2	6.8	6.7	6.8
DR-23	I	6.1	7.0	6.5	7.0	6.7
DR-24	O	5.3	6.1	5.6	6.0	5.8
DR-25	I	6.1	6.9	6.2	6.6	6.5
DR-26	O	5.8	7.2	6.8	7.4	6.8
DR-27	I	5.8	7.2	6.6	6.8	6.6
DR-28	O	5.7	7.1	6.8	**	6.5
DR-29	I	5.9	7.2	6.6	7.0	6.7
DR-30	O	5.7	6.9	6.4	6.6	6.4
DR-31	I	5.9	7.5	6.5	7.2	6.8
DR-32	O	5.7	6.9	6.5	6.8	6.5
DR-33	I	6.0	7.2	6.8	7.3	6.8
DR-34	O	6.2	7.4	6.9	7.4	7.0
DR-35	I	6.5	7.1	6.4	7.0	6.8
DR-36	O	6.5	8.2	7.9	8.0	7.7
DR-37	I	5.7	7.3	6.9	7.5	6.9
DR-38	O	6.1	7.4	6.8	7.3	6.9
DR-39	I	5.7	6.8	6.5	7.0	6.5
DR-40	O	6.0	6.8	6.2	6.9	6.5
DR-41	SB	6.6	7.9	7.2	8.0	7.4
DR-42	SB	5.8	7.3	6.5	7.2	6.7
DR-43	SB	6.3	7.8	6.9	7.6	7.2
DR-44	SB	7.6	8.3	6.7	7.6	7.6

TABLE 3.2
(Continued)

Summary of Direct Radiation Measurements - 1990
Vermont Yankee Nuclear Power Station

Location	Type*	QTR 1	QTR 2	QTR 3	QTR 4	Yearly Mean
DR-45	SB	15.7	14.2	12.6	20.0	15.6
DR-46	SB	24.4	33.2	35.0	32.5	31.3
DR-47	SB	7.0	**	8.0	8.6	7.9
DR-48	SB	6.2	7.8	6.8	7.4	7.1
DR-49	SB	6.3	7.2	6.4	6.9	6.7
DR-50	I	6.0	7.5	6.7	7.1	6.8
DR-51	SB	7.2	9.2	8.0	8.5	8.2
QTR Mean		5.9	7.0	6.5	6.8	6.5
Inner Ring		±0.4	±0.4	±0.4	±0.5	±0.6
QTR Mean		5.9	7.1	6.6	7.0	6.6
Outer Ring		±0.6	±0.7	±0.7	±0.7	±0.8
QTR Mean		8.9	11.0	10.0	11.0	10.2
Site Boundary		±5.5	±7.6	±8.0	±7.6	±7.1

*I = Inner Ring; O = Outer Ring; SB = Site Boundary.
**TLDs missing in the field.

Figure 3.12

EXPOSURE RATE AT INDICATOR TLDS. DR 01-03
- VERMONT YANKEE NUCLEAR POWER STATION -

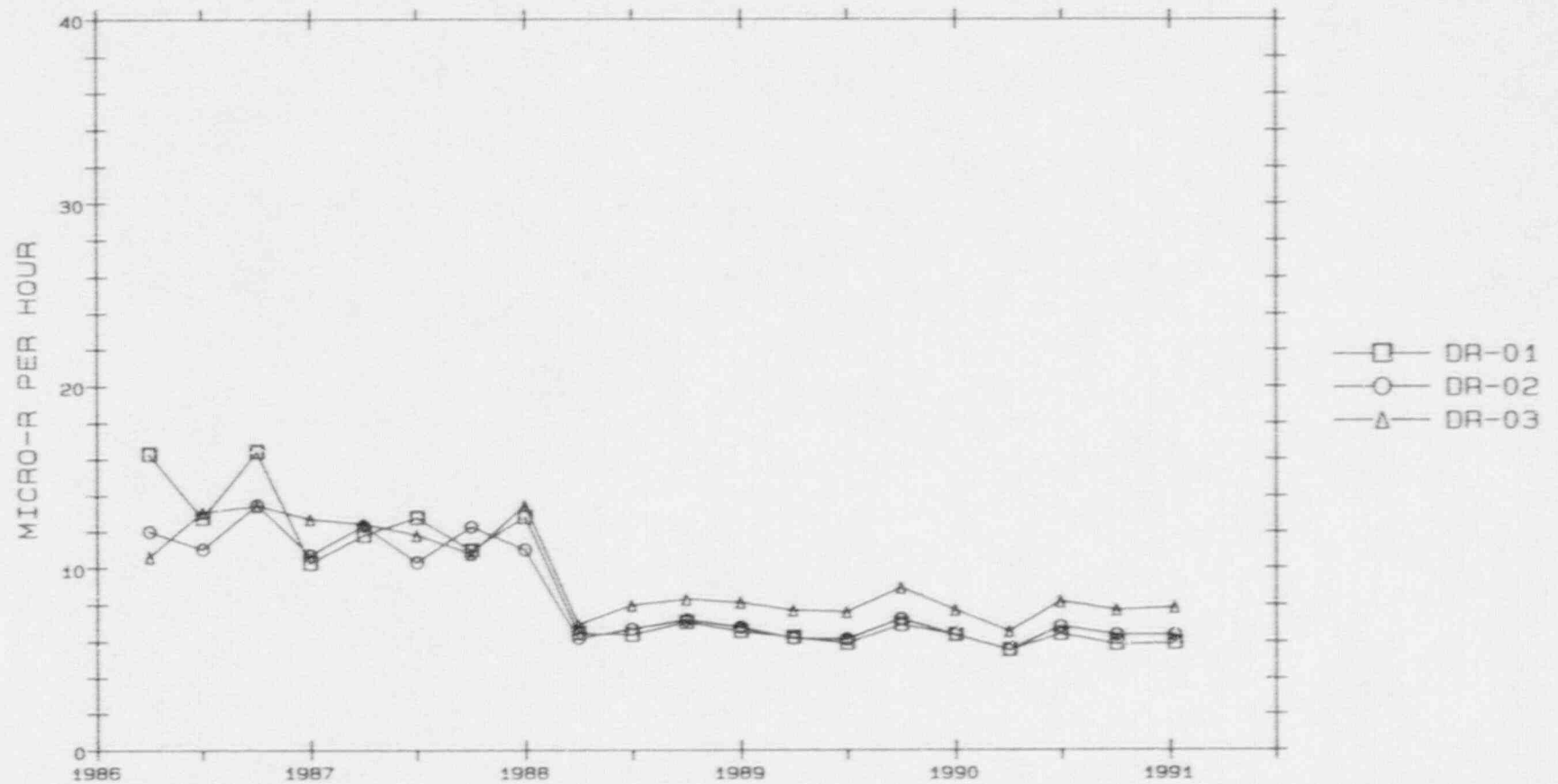


Figure 3.13

EXPOSURE RATE AT INDICATOR TLDS. DR 04, 06, 50
- VERMONT YANKEE NUCLEAR POWER STATION -

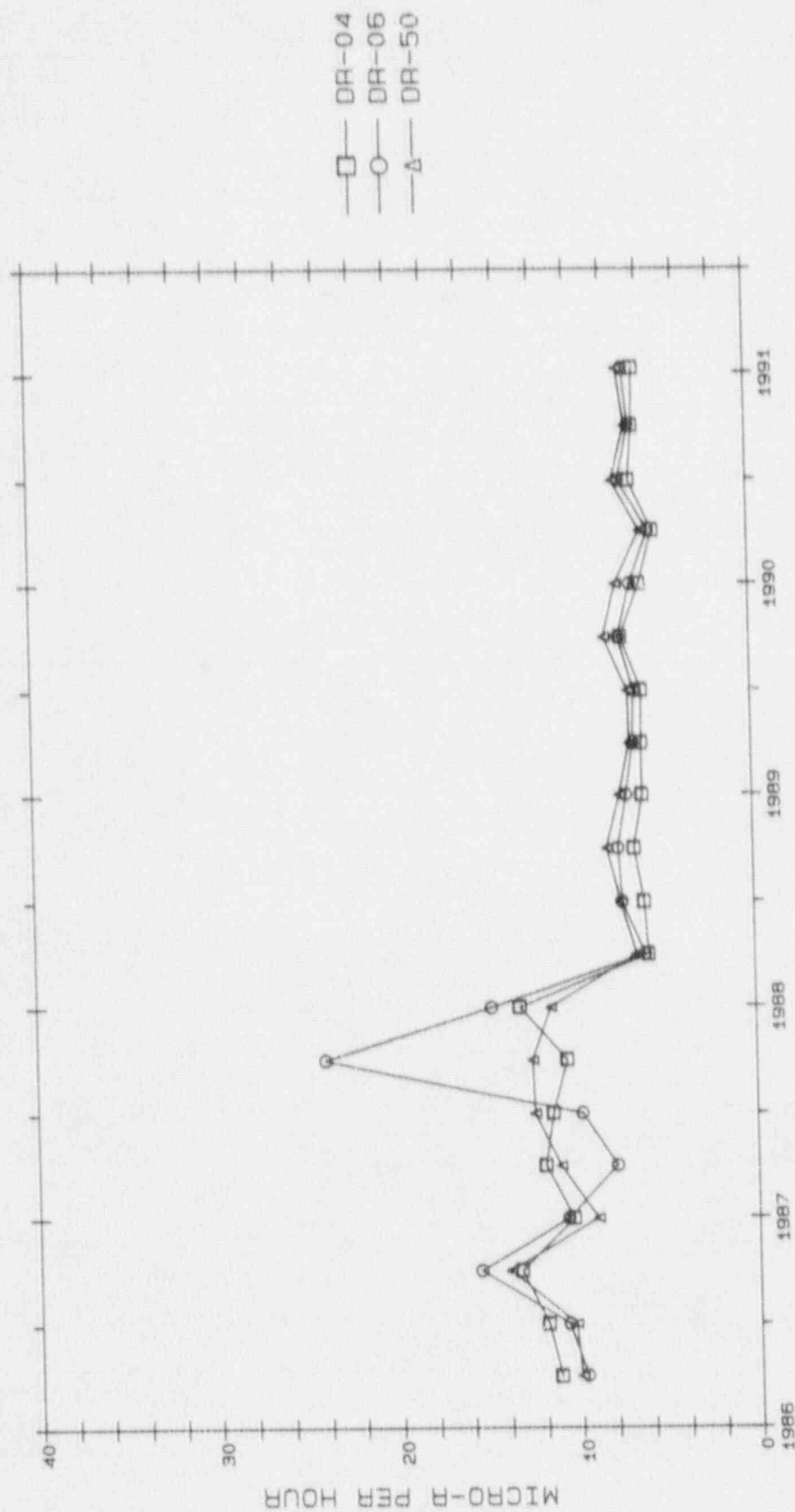


Figure 3.14

EXPOSURE RATE AT SITE BOUNDARY TLDS, DR 07-08, 41-42
- VERMONT YANKEE NUCLEAR POWER STATION -

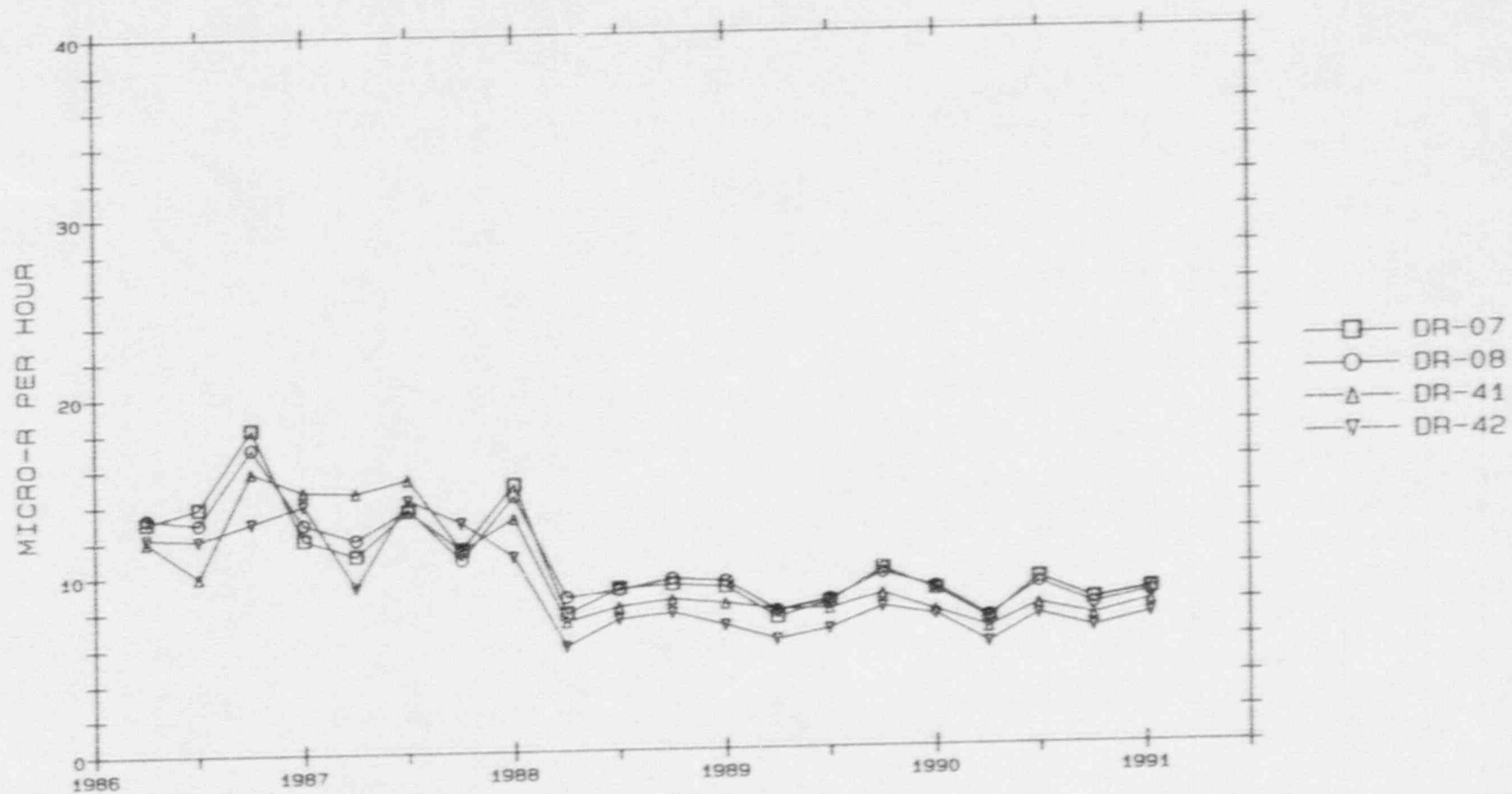


Figure 3.15

EXPOSURE RATE AT SITE BOUNDARY TLDS, DR 43-46
- VERMONT YANKEE NUCLEAR POWER STATION -

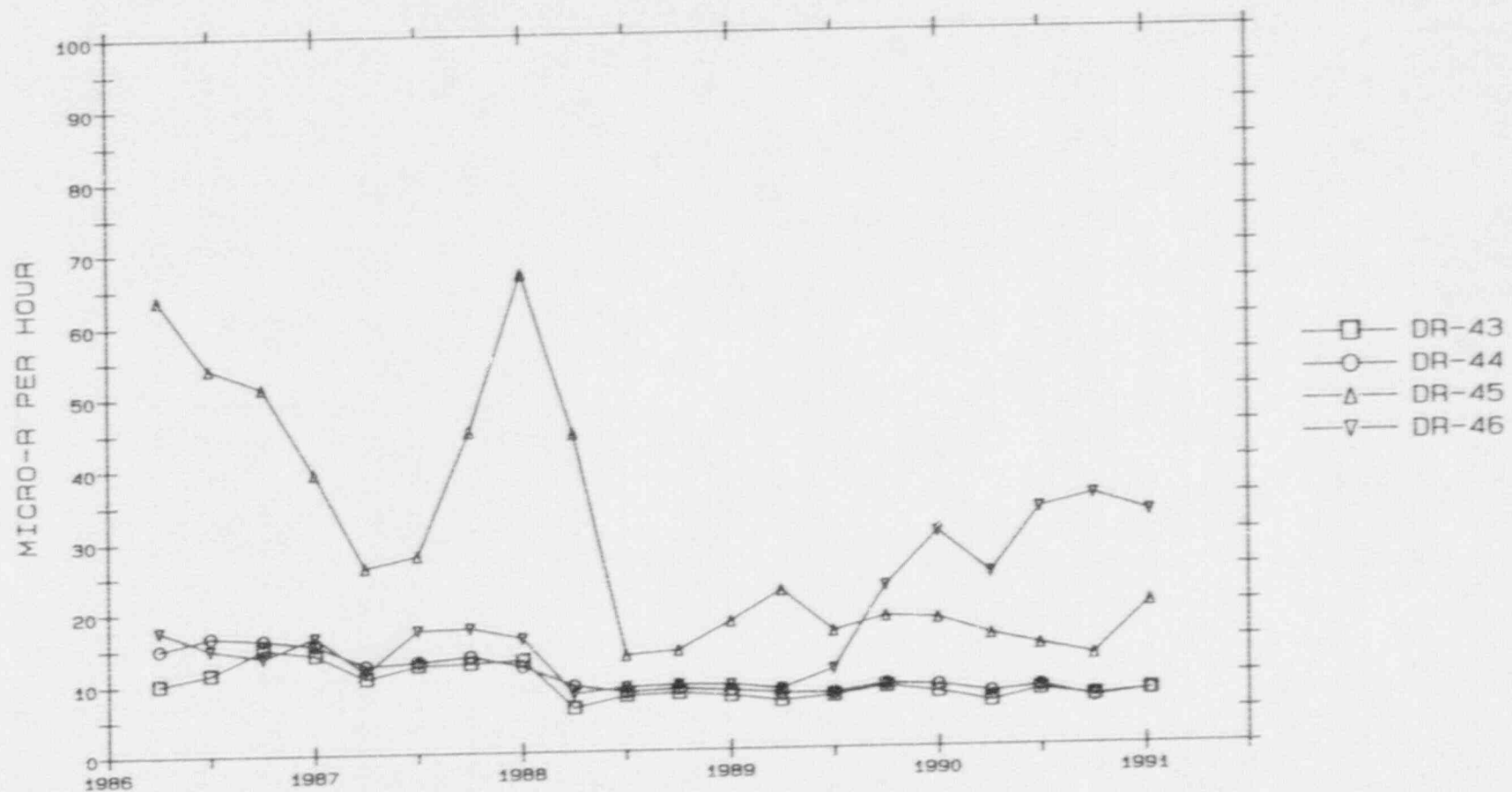


Figure 3.16

EXPOSURE RATE AT SITE BOUNDARY TLDS, DR 47-49, 51
- VERMONT YANKEE NUCLEAR POWER STATION -

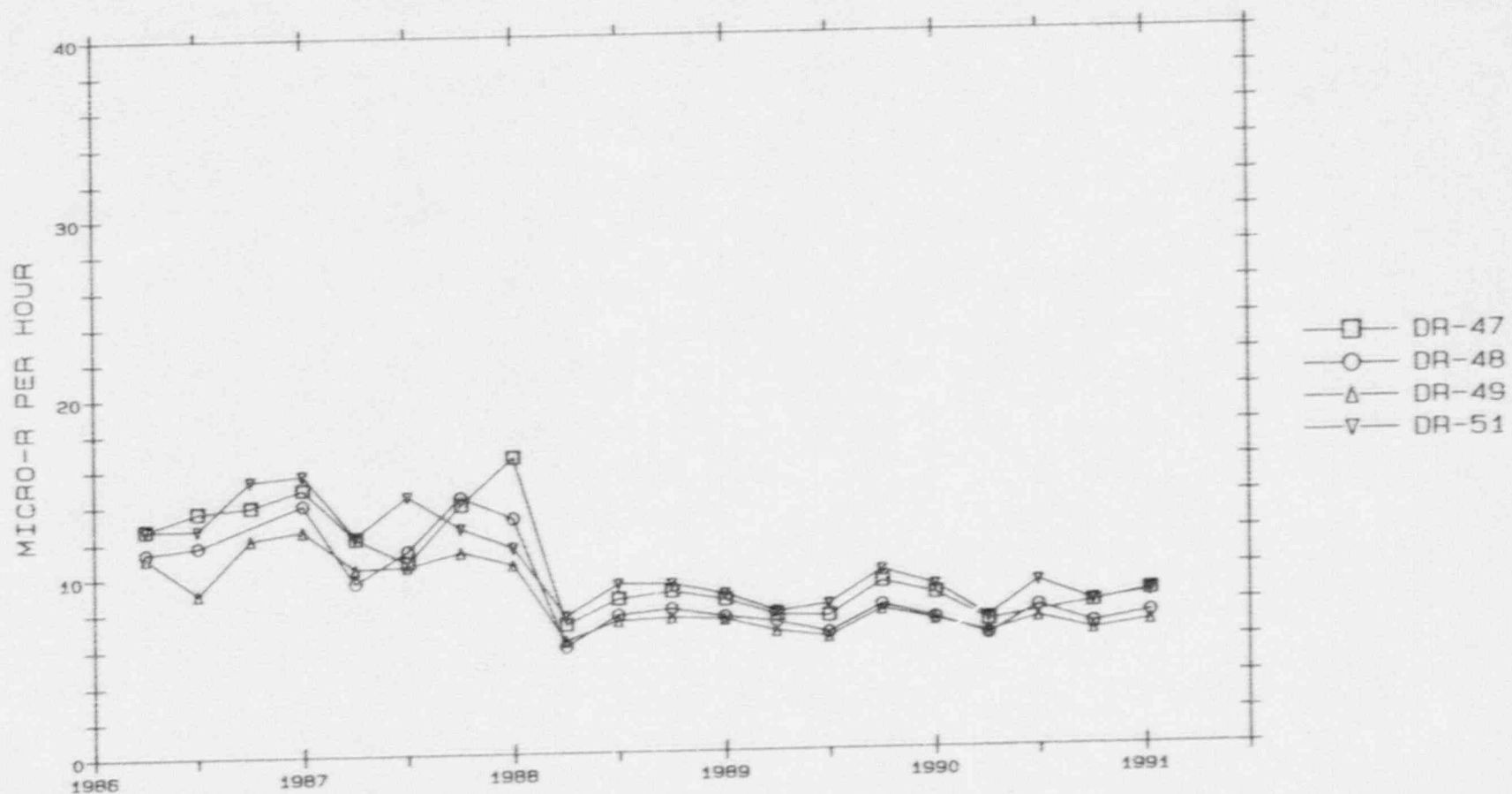


Figure 3.17

EXPOSURE RATE AT INNER RING TLDS, DR 09-15 (Odd)
- VERMONT YANKEE NUCLEAR POWER STATION -

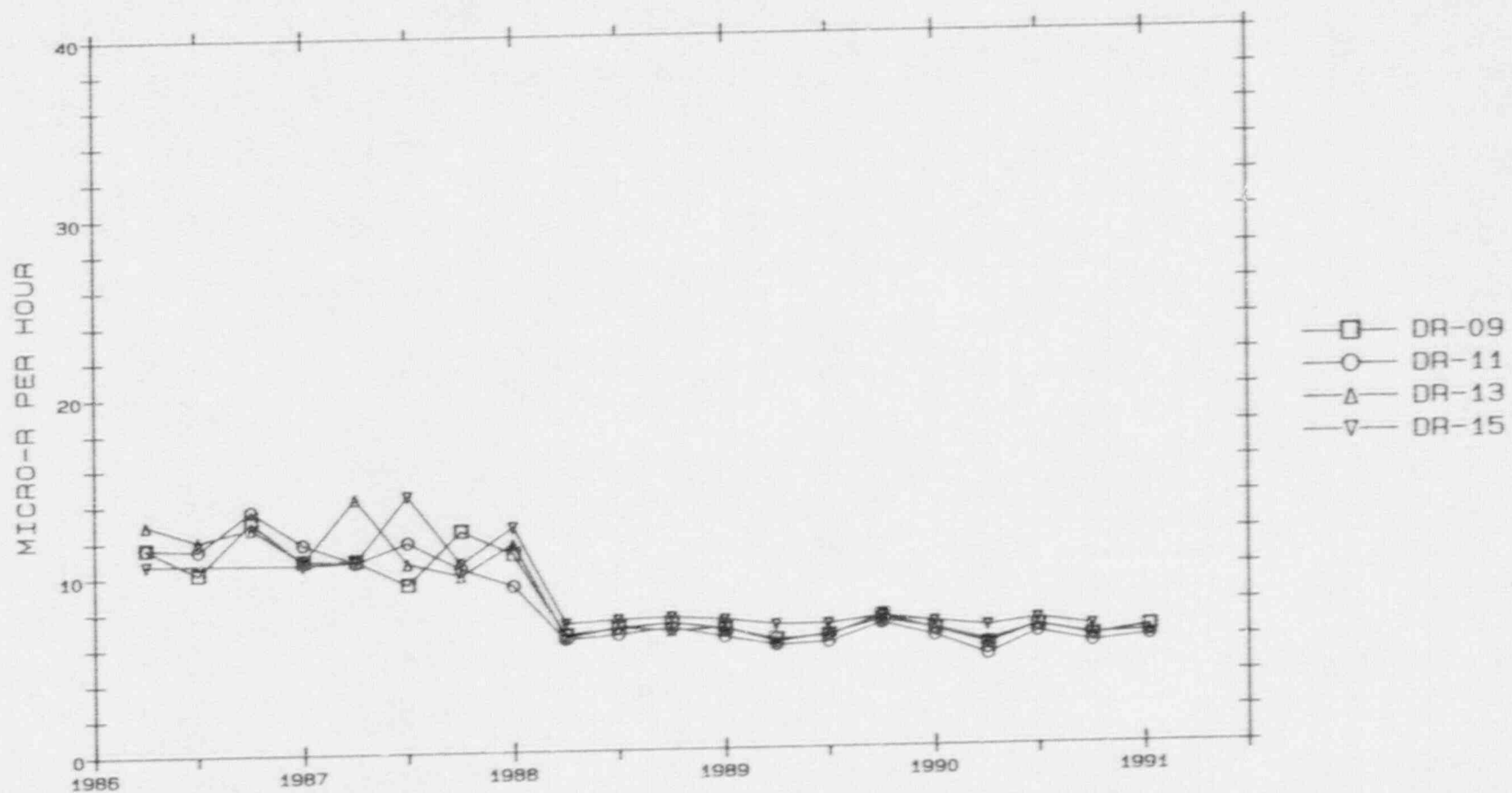


Figure 3.18

EXPOSURE RATE AT INNER RING TLDS, DR 17-23 (Odd)
- VERMONT YANKEE NUCLEAR POWER STATION -

-89-

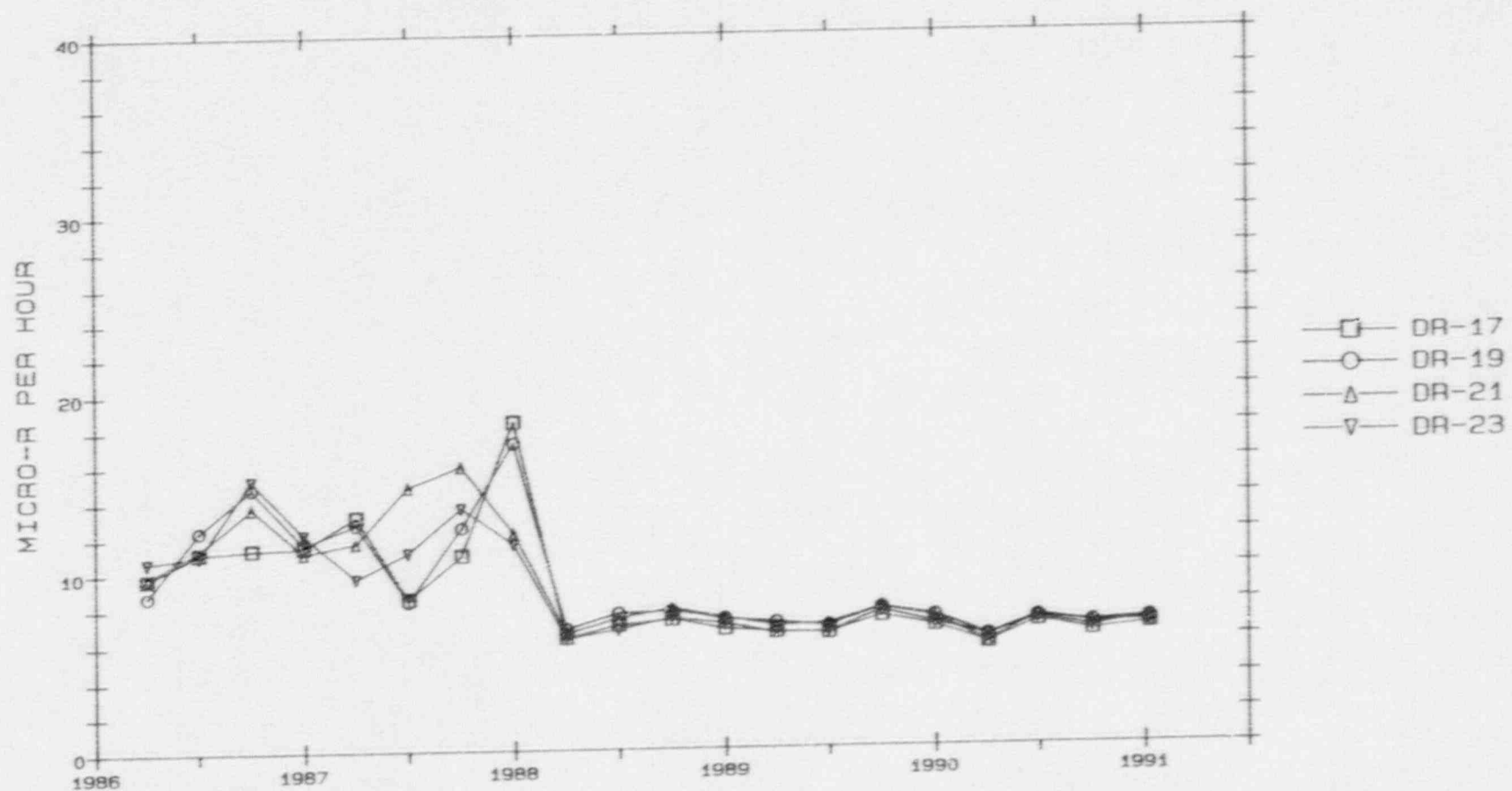


Figure 3.19

EXPOSURE RATE AT INNER RING TLDS, DR 25-31 (Odd)
- VERMONT YANKEE NUCLEAR POWER STATION -

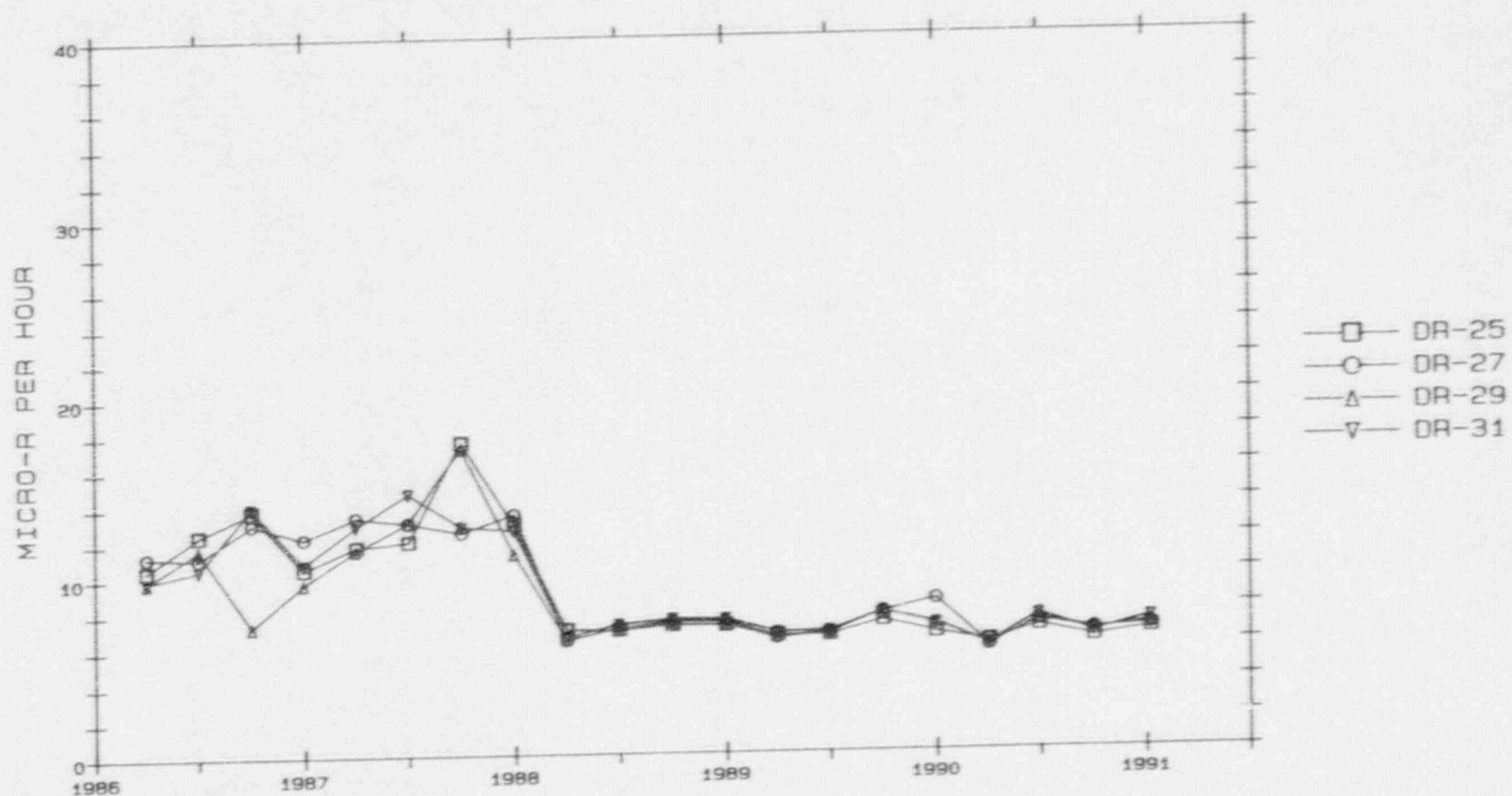


Figure 3.20

EXPOSURE RATE AT INNER RING TLDS. DR 33-39 (Odd)
- VERMONT YANKEE NUCLEAR POWER STATION -

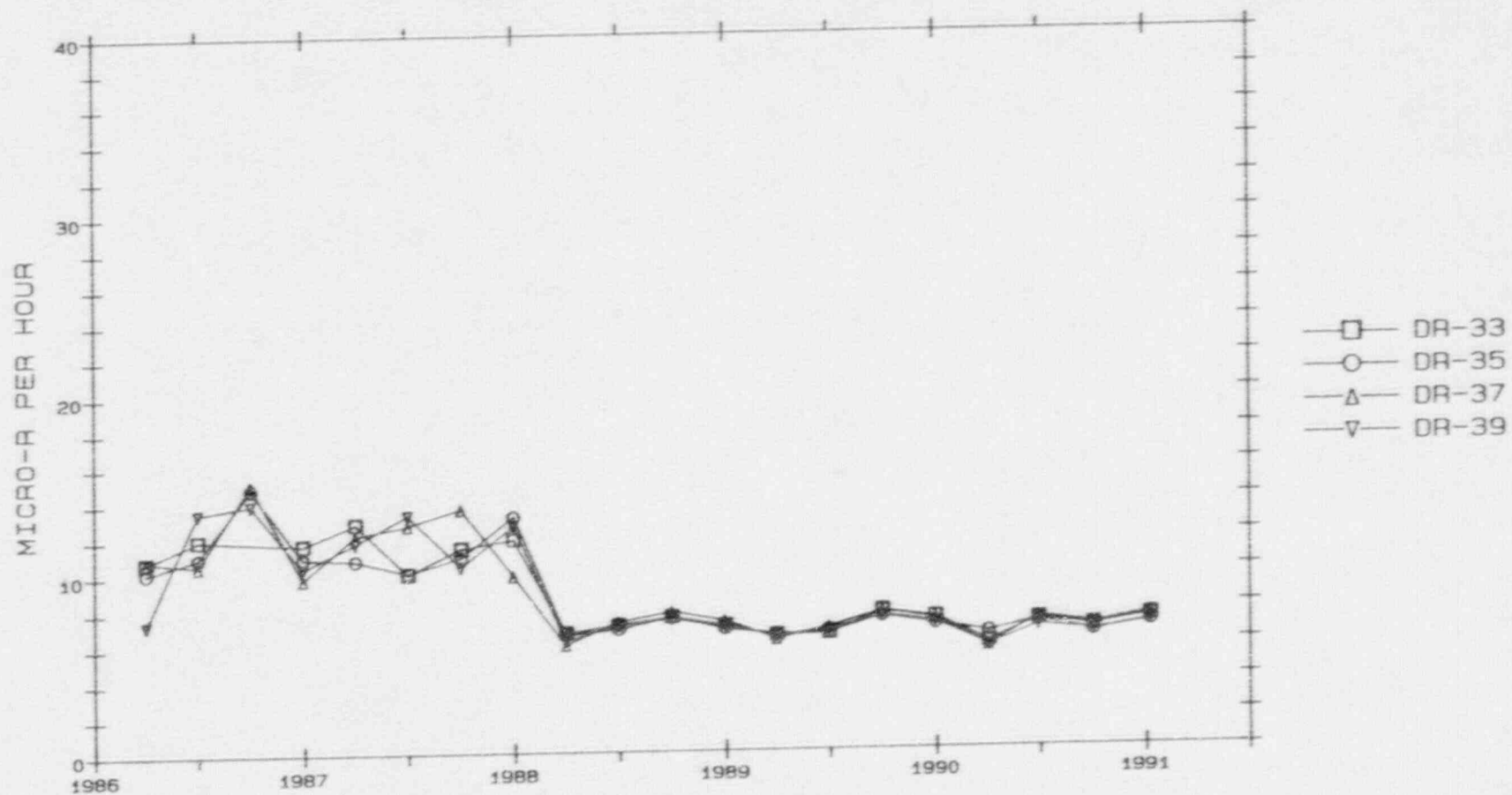


Figure 3.21

EXPOSURE RATE AT OUTER RING TLDS, DR 10-16 (Even)
- VERMONT YANKEE NUCLEAR POWER STATION -

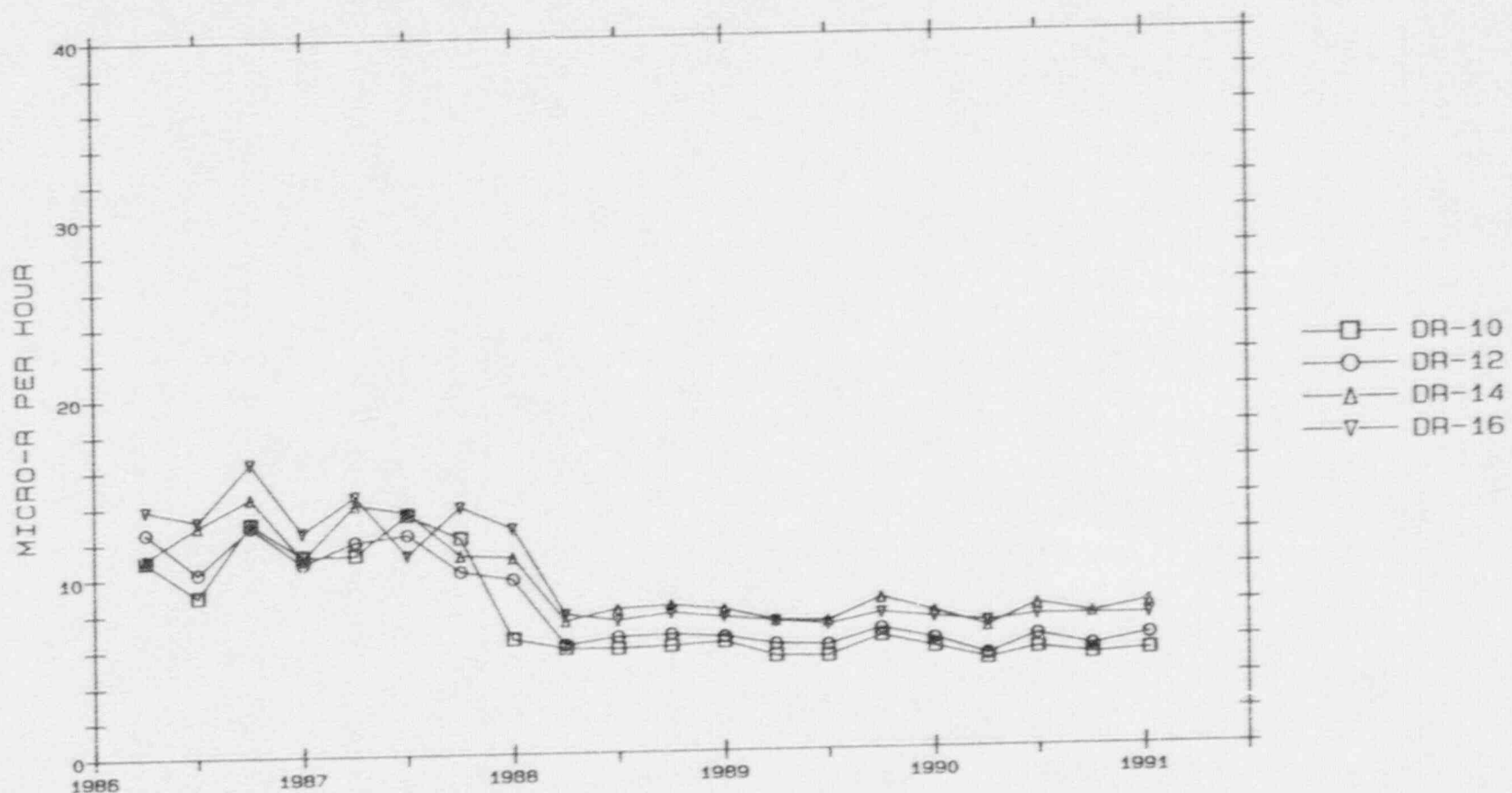


Figure 3.22

EXPOSURE RATE AT OUTER RING TLDS, DR 18-24 (Even)
- VERMONT YANKEE NUCLEAR POWER STATION -

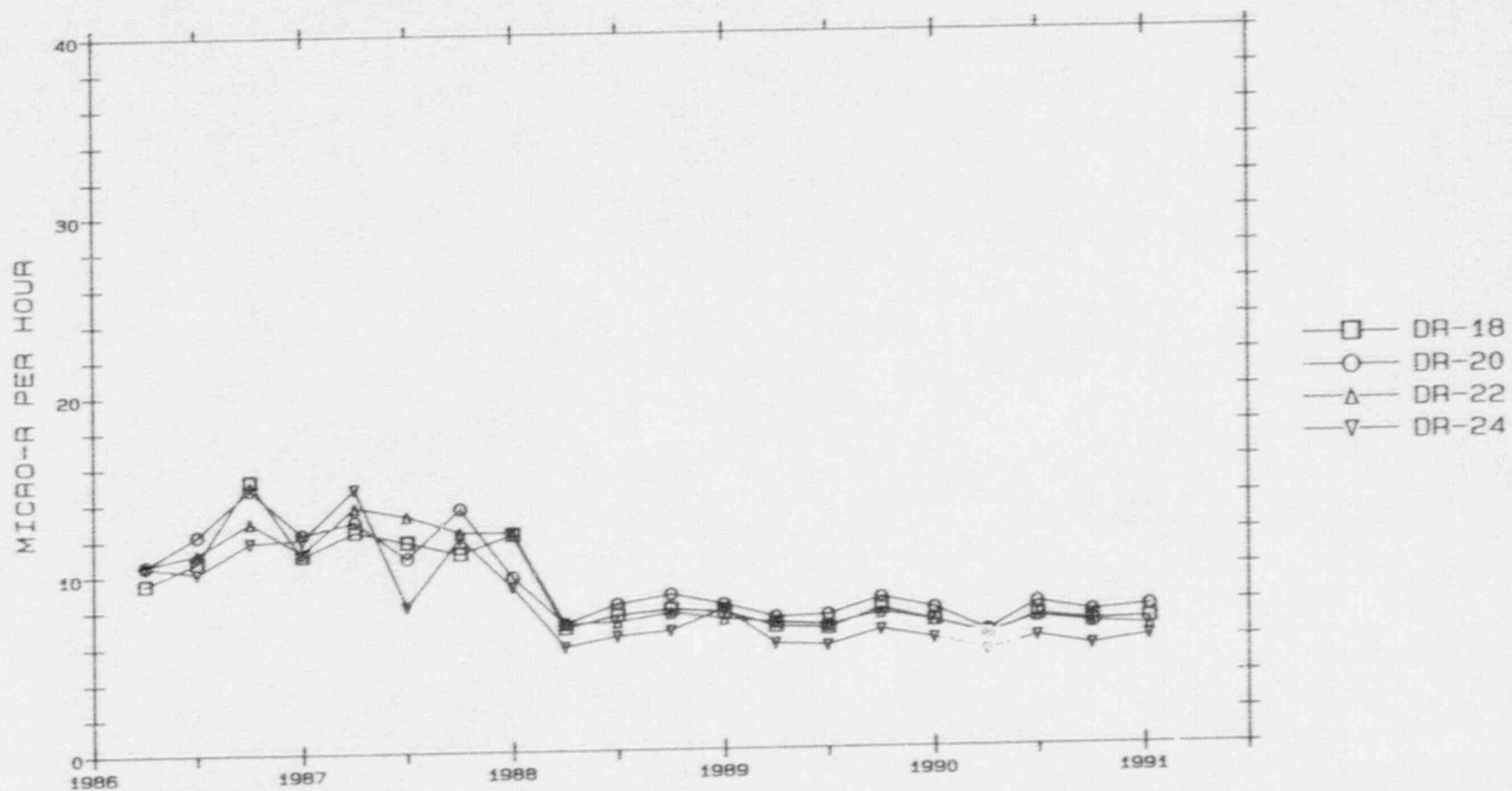


Figure 3.23

EXPOSURE RATE AT OUTER RING TLDS, DR 26-32 (Even)
- VERMONT YANKEE NUCLEAR POWER STATION -

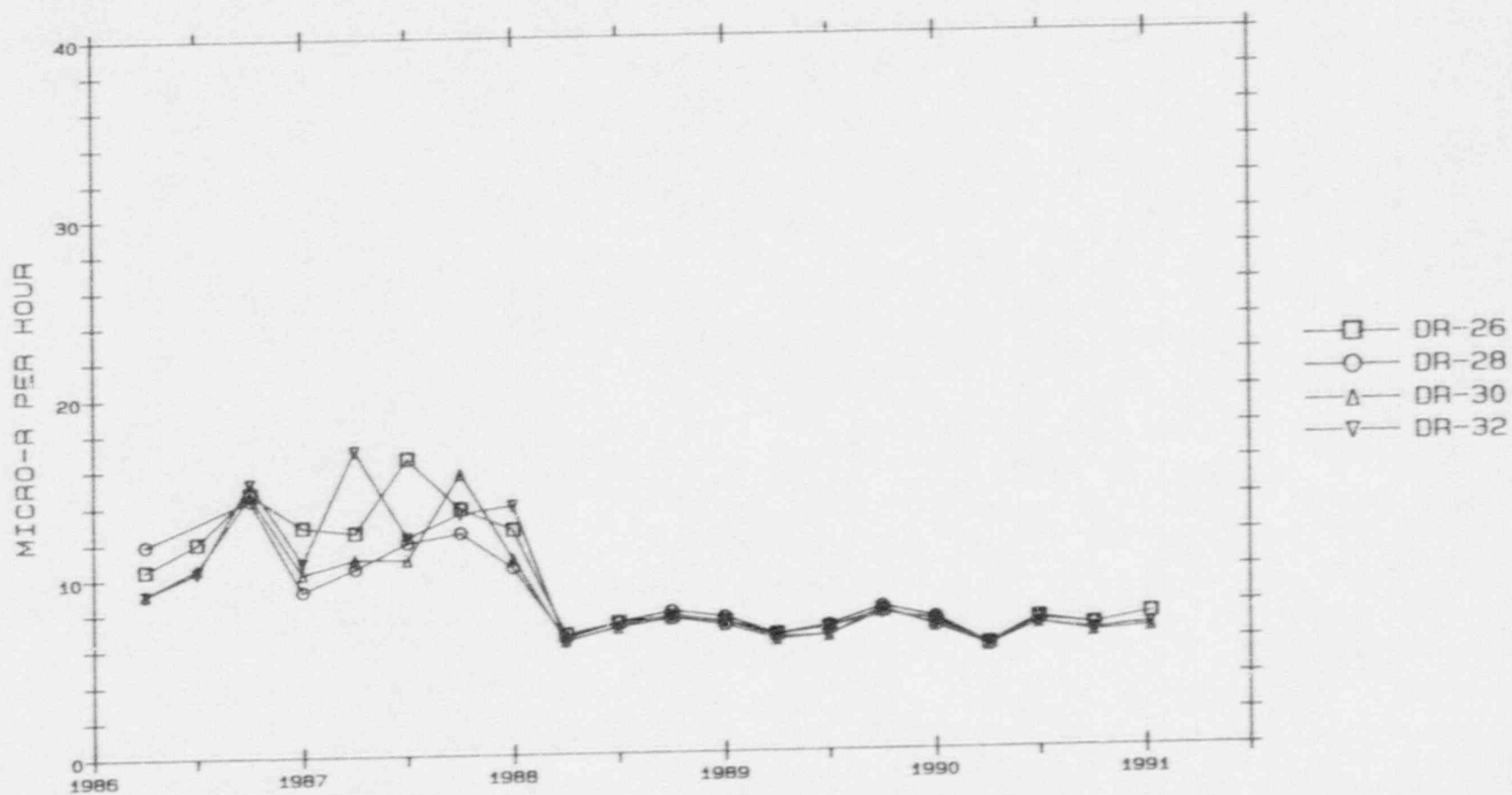


Figure 3.24

EXPOSURE RATE AT OUTER RING TLDS, DR 34-40 (Even)
- VERMONT YANKEE NUCLEAR POWER STATION -

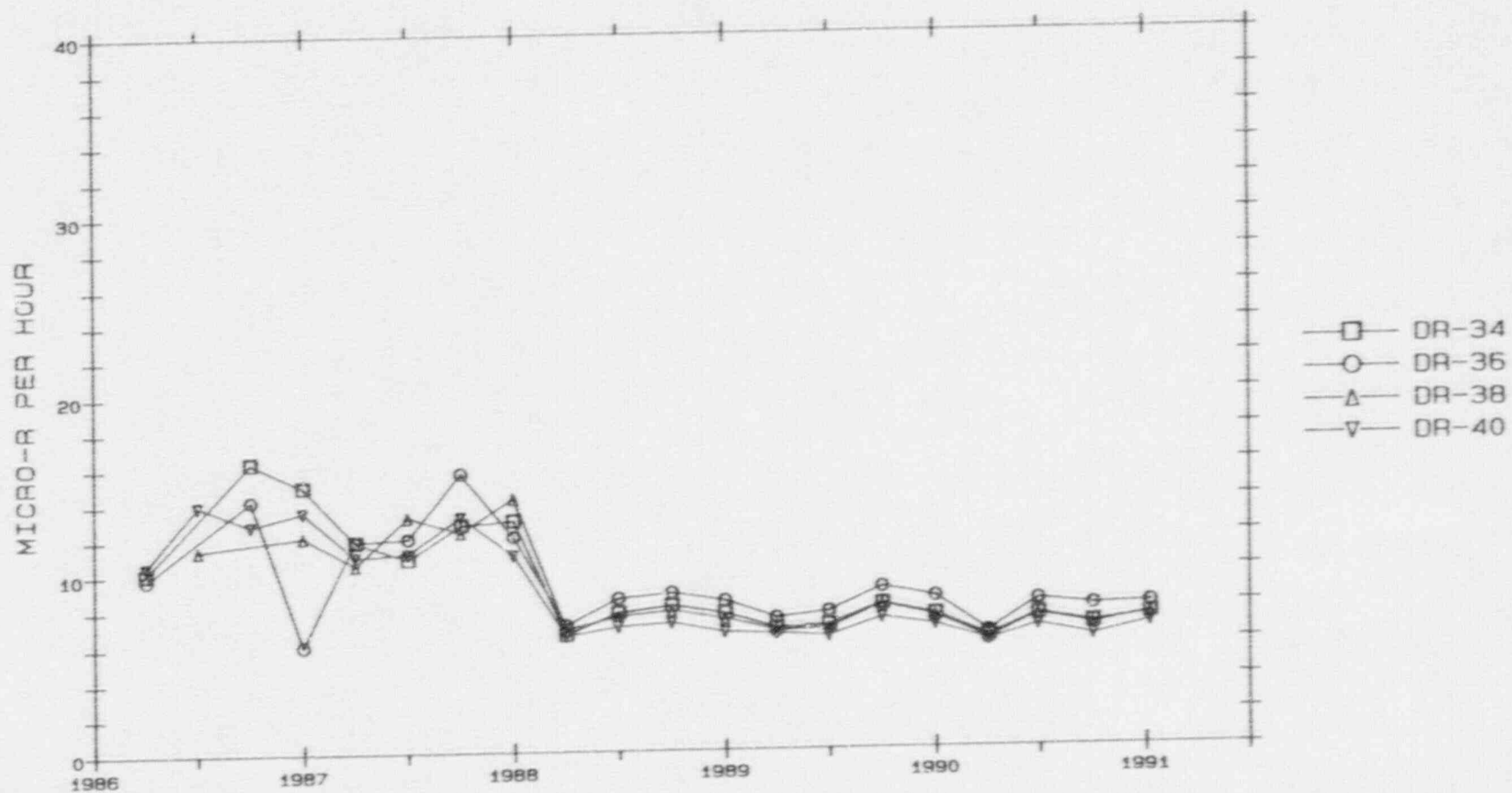
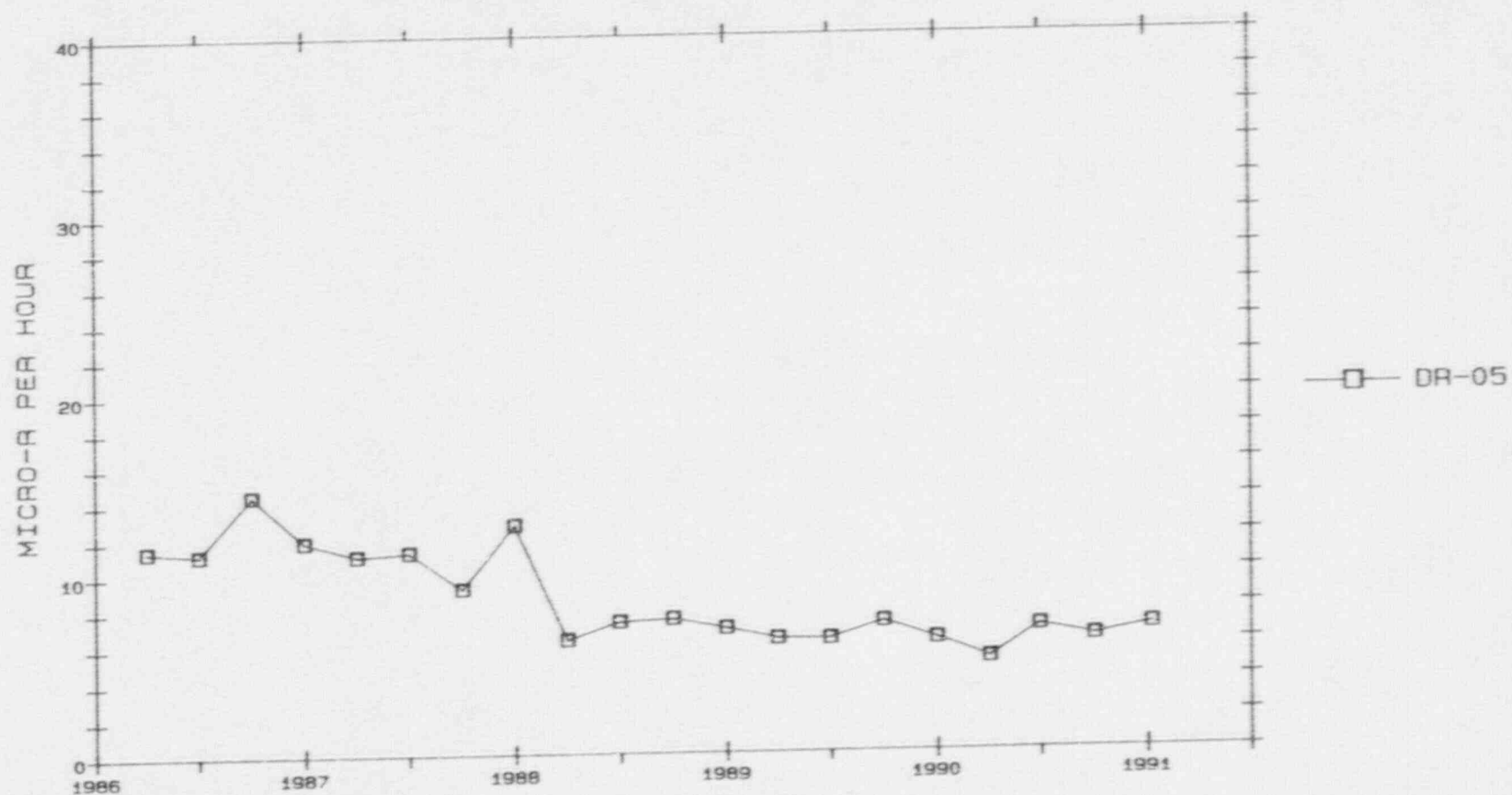


Figure 3.25

EXPOSURE RATE AT CONTROL TLD DR-05
- VERMONT YANKEE NUCLEAR POWER STATION -



4.0 QUALITY ASSURANCE PROGRAM

Three separate Quality Assurance programs were performed during 1990 to demonstrate the validity of laboratory analyses by the Yankee Atomic Environmental Laboratory (Yael).

Yael maintains an extensive intralaboratory quality control program to assure the validity and reliability of the data. This program includes: instrument calibrations and control checks, process control checks comprised of known activity concentration, blind duplicates, and blank samples. The process control checks comprise approximately ten to fifteen percent of the laboratory sample throughput. The records of the quality control program are reviewed by the responsible cognizant individual, and corrective measures are taken whenever applicable.

To further verify the accuracy and precision of the laboratory analyses via an independent outside third party, Yael participates in the U.S. Environmental Protection Agency's Environmental Radioactivity Laboratory Intercomparison Studies Program for those available species and matrices routinely analyzed by the laboratory. 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, as appropriate. Yael also participates in independent third party performance testing for environmental TLDs through the University of Michigan.

A blind duplicate program is also conducted in which paired samples from five nuclear plants, including Vermont Yankee, are prepared from 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 in 1990 for intralaboratory analyses and EPA interlaboratory cross-check analyses.

The results of the EPA Interlaboratory Comparison Program, when considered apart from the remainder of the Quality Assurance program, were satisfactory with respect to accuracy and precision in 1990. One hundred and eighty-four analyses were performed on air particulate filters, milk, and water. The three sample analyses which failed to meet the EPA control limit range involved gross-beta analyses made on one performance evaluation intercomparison water sample. Each of the gross-beta measurements in this set narrowly missed the upper end of the control limit range due to a mean bias of +20.3% and an investigation was initiated. It should be noted that this sample contained a mix of activity including Cs-134, Cs-137, Sr-89, and Sr-90. Since the Yael gross-beta calibration in water is presently based on Cs-137, a positive gross-beta bias is likely whenever mixed higher energy beta activity is present. All the specific radiochemistry analyses performed on the EPA performance evaluation intercomparison sample set in question for Sr-89/90 and Cs-134 and Cs-137 met Yael QA performance criteria and EPA control limits.

The above EPA Interlaboratory Comparison Program results are provided in compliance with Technical Specification 4.9.E.

Blind Duplicate Program

A total of 52 paired samples were submitted by the five participating plants for analysis during 1990. The data base used for the duplicate analyses 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 used. If the paired measurements fall within ± 15 percent of their average value, then agreement between the measurements has been met. If the value falls outside of the ± 15 percent, then a two standard deviation range (95 percent confidence level) is established for each of the analyses. If the ranges overlap, agreement is obtained.

One thousand three hundred and twenty one paired duplicate measurements were analyzed for 1990. A total of 99.8 percent of all measurements fell within the established criteria discussed above. The two measurements that did not meet the criteria were measurements of Th-232 in marine algae and K-40

in estuary water. (In both cases, the three standard deviation ranges of the paired samples overlapped.) In the case of the Th-232 measurement, there was no radioactivity present in the sample at the three standard deviation level. In the case of the K-40, this radionuclide was present at the three standard deviation level. For the initial pair of K-40 analyses, the two samples had been analyzed for different MDC levels. Upon re-analysis, at equal MDCs, the acceptance criteria was met. No trend was evident with respect to repeated failings of measurements for the above radionuclides.

TABLE 4.1

Intralaboratory and EPA Interlaboratory Results - 1990

<u>Total Number of Measurements</u>	<u>Accuracy</u>		
	<u>0 to 5%</u>	<u>0 to 10%</u>	<u>0 to 15%*</u>
762	519 (68.1%)	672 (88.2%)	728 (95.5%)

<u>Total Number of Measurements</u>	<u>Precision</u>		
	<u>0 to 5%</u>	<u>0 to 10%</u>	<u>0 to 15%*</u>
763	644 (84.4%)	741 (97.1%)	761 (99.7%)

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

5.0 LAND USE CENSUS

Vermont Yankee Technical Specification 3/4.9.D requires that a Land Use Census be conducted annually between June 1 and October 1 of each year. The census identifies the location of the nearest milk animal and the nearest residence in each of the 16 meteorological sectors within 5 miles of the plant. It also identifies the 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 due to elevated releases from the plant stack. Dosimetric analyses are then carried out to determine whether any identified milk animal represents a significantly better milk sampling location than those currently being used.

The 1990 Land Use Census at Vermont Yankee was carried out between the dates of June 1 and October 1, as required by Technical Specifications. The identified locations can be found in Table 5.1. As a result of the dosimetric comparisons and an assessment of sample availability at specific farms, no changes were made in the milk sampling program. Due to the relatively high calculated dose potential, however, samples have been collected regularly following the census at Station TM-19 (NNE sector, 4.0 km). This location was not added to the sampling program as defined in the Off-Site Dose Calculation Manual (ODCM), Table 4.1, however, due to an anticipated irregularity in the ability to supply samples due to the small size of the goat herd. Samples will continue to be collected there as long as available, or until replaced by a preferable location pursuant to Technical Specification 3/4.9.D.

TABLE 5.1

1990 Land Use Census Results
Vermont Yankee Nuclear Power Station

Sector	Nearest Residence (km)	Milk Animals*	
		km	Cow or Goat
N	1.6	**	---
NNE	1.6	4.0	Goats
NE	1.3	**	---
ENE	1.0	**	---
E	1.0	5.2	Goats
ESE	2.8	**	---
SE	1.8	3.4	Cows
SSE	2.0	5.1	Cows
S	0.5	**	---
SSW	0.5	2.1	Cows
SW	0.5	7.2	Cows
WSW	0.5	**	---
W	0.5	**	---
WNW	0.6	0.8	Cows
WNW	---	4.7	Cows
NW	1.2	4.7	Cows
NNW	2.1	**	---

* Identified in accordance with Technical Specification 3.9.D.1

** No milk animals found within 5 miles.

6.0 SUMMARY

During 1990, samples collected as a part of the radiological environmental monitoring program at Vermont Yankee showed detectable levels of man-made radionuclides in cow milk, mixed vegetation, fish, and sediment. As reported in the past for sediment, low levels of Co-60 were detected in the immediate vicinity of the North Storm Drain Outfall. The radioactivity from this drain has been detected only at this location. In all other cases, the low levels detected were shown to originate from fallout from atmospheric nuclear weapons tests conducted during the 1970s and 1980, or from fallout from the Chernobyl nuclear plant accident in 1986. The radiological environmental monitoring program has therefore demonstrated that plant operations have had no significant radiological impact on the environment.