

April 28, 2000

U.S. Nuclear Regulatory Commission
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DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT
1999 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

Attached is the Palisades Plant Annual Radiological Environmental Operating Report for 1999. This report was prepared in accordance with the requirements of 10 CFR 50, Appendix I, Sections IV.B.2, IV.B.3, and IV.C, and Plant Technical Specifications 6.6.2. The period covered by the attached report is January 1, 1999 through December 31, 1999.

All trending parameters continue to indicate that the operation of Palisades has minimal environmental impact. Most isotopic activity is at environmental background levels. Evidence of an overall environmental isotopic buildup (attributable to Plant effluents) remains negligible. In most instances, sample analytical results were below previously established environmental background levels. There were no reportable events during this period.

SUMMARY OF COMMITMENTS

This letter contains no new commitments and no revisions to existing commitments.



Nathan L. Haskell
Director, Licensing and Performance Assessment

CC Administrator, Region III, USNRC
Project Manager, NRR, USNRC
NRC Resident Inspector - Palisades

Attachment

JE25

ATTACHMENT

**CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255**

APRIL 28, 2000

**PALISADES NUCLEAR PLANT
1999 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT
JANUARY 1, 1999 THROUGH DECEMBER 31, 1999**

166 Pages

**PALISADES NUCLEAR PLANT
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I. INTRODUCTION

The 1999 Palisades Nuclear Plant Annual Radiological Environmental Operating Report provides a summary and data interpretation of the Palisades Radiological Environmental Monitoring Program as conducted during the 1999 reporting period. Reporting requirements are detailed in Palisades Offsite Dose Calculation Manual, Appendix A, sections III.J and IV.B, Tables E-1 through E-3, and Table F-1.

Detailed sample station identification and location information can be found in Attachment 2 of Health Physics Procedure HP 10.10 (Enclosure C). The results of all environmental samples collected are evaluated as follows:

- A. Air iodine and particulate and thermoluminescent dosimetry (TLDs) (monthly, quarterly and annual) data were statistically evaluated at the 95 percent confidence level by the methodology detailed in Health Physics Procedure HP 10.4. The data were compared against two criteria: the first criterion is the statistical difference which indicates whether the sample results from near sites are greater than those from control sites, and whether or not the difference is significant. The second criterion is the evaluation level (twice the statistical difference) which is the minimum difference in the population means for which a corresponding difference in sample means will exceed the statistical difference with 95 percent confidence. If the evaluation level is exceeded, then correlation of the results with effluent releases is done.
- B. Well water, lake water, sediment, fish and other aquatic biota samples were evaluated using data means comparisons against an appropriate control location (if available) and Palisades Offsite Dose Calculation Manual, Appendix A, limits.

II. REPORTABLE EVENT

No reportable events occurred during this reporting period.

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III. DISCUSSION AND INTERPRETATION OF RESULTS

A. Air Sample

A total of 633 air samples were collected and analyzed for gross beta and a total of 631 air samples were collected and analyzed for I-131 during 1999. One iodine cartridge was collected but not analyzed in 1999 as the sample was lost in transit to the laboratory. One iodine cartridge was not placed in the sample holder during the weekly collection process. Refer to Enclosure A for all sample collection anomaly evaluations.

Comparison of the airborne particulate sample data between the nine near-site indicator locations, and the three control locations did not exceed the statistical difference. In many instances, control location sample values were greater than indicator location samples. The means of gross beta results for indicator and control locations were identical at 0.025 pCi/m³. In 1999, station 7-SD had the highest annual mean for gross beta results at 0.026 pCi/m³. This station is located in the sector with the least prevailing wind direction. No sample analyses identified I-131 activity above minimum detectable levels.

Air iodine/particulate samples are collected on a weekly basis from 12 air sampling locations. Air is metered into the sampling unit at a continuous one cubic foot per minute flow rate (approximately) through a Gelman 47mm air filter (air particulate) and an HI-Q air iodine cartridge. Both filters are in line with each other and housed within the same filter holder.

B. Lake Water

A total of 36 individual monthly lake water composite samples were collected from three locations during 1999. Lake water samples from the indicator locations, Palisades Lake-in (1-ST Intake), and South Haven Municipal Water system intake (25-SH Raw Water), and the control location Ludington Lake-in (32-LP Intake), were collected daily.

Evaluation of the monthly lake water analytical results was based on a data means comparison between the indicator locations and control location. The results were also evaluated against the Palisades ODCM, Appendix A, reporting limits.

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Gross beta analyses were completed for all lake water samples. The means for gross beta indicators and controls were 2.0 pCi/L and 2.3pCi/L, respectively. Tritium was detected only in one indicator sample at 189 pCi/L. No Palisades ODCM reporting limits were exceeded.

Although the Lake-out (discharge) sample was not used as an indicator in the Radiological Environmental Monitoring Program, it is monitored for activity. Monthly gross alpha and tritium results from the Palisades Lake-in were used for comparison data against the Lake-out (discharge) sample results. Gross alpha was detected in several Lake-out and Lake-in samples at slightly above minimum detectable activity levels. Several Lake-out tritium results were positive. On three occasions during 1999, the tritium activity for the discharge was above the ODCM action level of 1000 pCi/L. These elevated levels were all correlated to liquid effluent discharges and were confirmed by comparison to calculated effluent tritium concentrations.

Palisades Lake-in, South Haven Municipal and Ludington Lake-in water samples are collected daily for composite into a monthly sample. One-gallon of Palisades Lake-in water, and Ludington Lake-in water, and two gallons of South Haven Municipal water are sent to Teledyne Brown Engineering for analysis. No treatment of the water samples with preservative is required.

C. Drinking water

A total of 36 individual monthly drinking water samples were collected from three locations in 1999. Lake water samples from the indicator locations, South Haven Municipal Water System (25-SH Raw Water, 25-SH Treated) and the control location, Ludington Lake-in (32-LP Intake), were collected daily and composited into monthly samples.

Evaluation of the drinking water analytical results was based on a data means comparison between the indicator locations and the control location, as well as a comparison to the Palisades ODCM reporting limits. Both of the South Haven Municipal lake water intake and treated drinking water samples require gross beta analyses. A tritium analysis is required for the treated water only. The gross beta means for the indicator and control locations were 2.0 pCi/L and 2.3 pCi/L, respectively. Tritium was not detected in any indicator or control samples in 1999. No special or supplemental analyses were required during 1999.

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South Haven Municipal and Ludington Lake-in water samples are collected daily for composite into a monthly sample. One gallon of Ludington Lake-in water, and two gallons each of South Haven Municipal water are sent to Teledyne Brown Engineering for analysis. No treatment of the water samples with preservative is required.

D. Well Water

A total of 108 monthly well water samples were collected from nine locations during 1999. Evaluation of the well water analytical results was based on a data means comparison between the six indicator locations (1-ST, 39-ST, 40-ST, 41-ST, 42-ST and 43-ST) and the three control locations (8-SP, 9-TP, and 32-LP) as well as with the Palisades ODCM reporting limits.

Tritium and gross beta analyses were completed for all well water samples. The gross beta means for indicator and control locations were 5.3 pCi/L and 1.4 pCi/L, respectively. The tritium means for indicator and control locations were 210 pCi/L and 177 pCi/L, respectively.

No Palisades ODCM reporting limits were exceeded for the 1999 well samples. Evaluation of the gross beta activity between indicator and control locations revealed a statistical difference; however, in a comparison between wells used for Plant drinking water (1-ST, 40-ST) versus the three control samples, the gross beta results were very consistent at 1.7 pCi/L and 1.4 pCi/L respectively. The Steam Generator and Warehouse monitoring wells had a gross beta average of 7.1 pCi/L for 1999, which caused the statistical difference between indicator and control stations.

In 1999, nine well samples exceeded the gross beta ODCM action level of 10 pCi/L. One occurred each at site number 7 (39-ST) and site number 14 (41-ST) both in the winter months, and seven occurred at site number 16 (43-ST) throughout the year. Results ranged from 11.9 to 17.0 pCi/L. The subsequent gamma analysis of these samples showed no detectable activity. The Steam Generator and Warehouse wells typically trend around 4 to 8 pCi/L gross beta and it is not unusual for results to exceed the 10 pCi/L action level during the winter months. These well monitoring stations are located in snow pile-up and run-off areas adjacent to parking areas. It is highly probable that the gross beta results are due to road salt, and supports the conclusion that the elevated gross beta results are not the

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result of plant effluents. Refer to Enclosure A for all sample collection anomaly evaluations.

The Palisades site well (1-ST) location is collected daily and composited into a monthly sample. The other eight well locations consist of monthly grab samples.

Well water samples consisting of two one-gallon quantities for each well are sent to Teledyne Brown Engineering for analysis (Ludington control station consists of a one-gallon sample). No treatment of the water samples with a preservative is necessary.

E. Milk

A total of 48 individual monthly milk samples were collected from four different dairy farms (stations 26-AK, 27-DH, 28-DC and 29-WS) during 1999. The milk samples are obtained as grab samples (from dairy milk holding tanks).

No milk analysis identified activity above the minimum detectable level. No special or supplemental analyses were required, nor were any Palisades ODCM reporting limits exceeded.

Milk samples are required monthly (usually collected the first week of the month) from each designated location. Two one-gallon quantities of raw milk (grab sample) are obtained per sample location in order to meet analytical requirements. Each sample quantity is treated with a sodium bisulfite (40 grams per gallon) preservative prior to being sent to Teledyne Brown Engineering.

F. TLDs - Gamma Dose

There were a total of 348 monthly, 116 quarterly and 29 annual TLDs collected and analyzed during 1999.

The Palisades gamma assessment program consists of 29 locations: one directly on-site, nine near-site and six Steam Generator Storage Facility TLDs for a total of sixteen inner ring TLDs; ten outer ring (1.0 to 5.5 miles out); and, three control TLDs (30 to 55 miles out).

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A thirtieth TLD is placed in a lead storage cave and used as a control for in-transit dose monitoring and subtraction.

The monthly and quarterly TLD data evaluations were accomplished by statistically comparing the inner ring TLDs (site boundary locations 1-ST, 13-21 ST and 33-38 ST) and the outer ring TLDs (locations 2-TH through 9-TP, 23-SN25 and 24-SN22) against the control TLD locations (10-GR, 11-KZ, and 12-DG). The annual TLD data evaluation was done by direct comparison of data points only. No monthly or quarterly statistical differences were exceeded.

For 1999, the average gamma readings (mR) were:

	<u>Monthly</u>	<u>Quarterly</u>	<u>Annual</u>
Inner ring TLDs (site boundary)	3.8	11.5	42.6
Outer ring TLDs (1.0 to 5.5 miles out)	4.4	13.2	50.5
Control TLD locations	4.4	13.6	52.0

The one on-site TLD location (1-ST) serves as an individual reference TLD, however it was evaluated along with the inner ring (site boundary) TLDs in the statistical evaluation.

In evaluating the inner ring TLDs to the control TLDs, control station 11-KZ (35 mi. E) had the greatest monthly, quarterly, and annual mean of 5.1 mR, 15.5 mR, and 57.6 mR respectively.

When the same comparison was made for the outer ring TLDs, 2-TH (Tower Hill, 5 mi. S) had the greatest monthly, quarterly and annual mean for any location of 5.1 mR, 16.5 mR, and 60.4 mR respectively.

Environmental gamma doses are measured monthly, quarterly and annually by the placement of three TLD badges per designated location. Each Teledyne TLD badge contains a 4-zone CaSO₄ wafer (the wafer includes an additional backup/reserve readout zone). Sensitivity for the multi-zone TLDs are 1.0 millirem with a linear response of 0.1 millirem to 1000 rem.

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G. Crops

During 1999, nine crop samples were collected from two stations (4-JS, and 5-PR). Evaluation of sample analytical results was direct. There was no control location used.

Of the radionuclide analyses listed on Table HP 10.4-2, only gross beta analysis resulted in any detectable activity. The gross beta mean for the indicator locations was 1.51 pCi/g. The crop samples at station 4-JS had the greatest individual mean for gross beta activity of 1.69 pCi/g. No Palisades ODCM action or reporting levels were exceeded, nor were any special/supplemental analyses required during 1999.

Food crop samples were collected when available and in season. Two principal area crops, apples and blueberries, are regularly collected as specified in the ODCM. While there are no designated locations where food crops are collected, samples are generally obtained from the same areas where the air monitoring stations are located within the ESE, SE or SSE sectors. The collection of food crops assists in verifying stack effluent deposition patterns. When collected, approximately 1 Kg of sample is placed in a sealable plastic bag for shipment to Teledyne Brown Engineering. No special treatment of the samples with a preservative is necessary.

H. Sediment

A total of 10 individual sediment samples were collected from five locations during 1999. Eight sediment samples were obtained from Palisades (1-ST discharge, 31-STs ½ mile South of discharge, 30-STN ½ mile North of discharge and 25-SH South Haven Beach) locations and two samples from the Ludington Control Station (32-LP).

Evaluation of the sediment analytical results was based on a data means comparison between Palisades and the Ludington control samples as well as the Palisades Offsite Dose Calculation Manual, Appendix A, reporting limits. Of the radionuclide analyses listed on Table HP 10.4-2, only gross beta, and Cs-137 activity were detectable. The gross beta means for indicator and control locations were 7.31 pCi/g and 9.07 pCi/g, respectively. Cs-137 was only detected at the control station at a mean of

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0.025 pCi/g. No Palisades ODCM action or reporting levels were exceeded, nor were any special or supplemental analyses required during 1999.

Sediment samples are collected semi-annually from each designated location. A one liter quantity grab sample usually is obtained off-shore. No treatment of the samples with a preservative is necessary prior to shipment to Teledyne Brown Engineering.

I. Aquatic Biota - Algae

The Palisades Radiological Environmental Monitoring Program does not require algae to be collected, although it is collected when it is available. One algae sample was collected in 1999 from the Palisades discharge (1-ST) indicator location, however, none were obtained (not available in 1999) from the Ludington Plant (32-LP) control location.

The 1999 indicator analytical result was slightly lower than 1998, with the mean gross beta for 1-ST location at 2.82 pCi/g, in comparison to 1998 results of 3.45 pCi/g. This is very consistent to the five year average of 3.01 pCi/g. Cs-137 was the only gamma emitters detected in 1999, at 0.035 pCi/g.

One liter quantities of algae (when available) are prepared for shipment to Teledyne Brown Engineering by treating each sample with 10 ml of a 10% formaldehyde solution for preservation.

J. Fish

A total of 11 individual fish samples were collected from two locations during 1999. Six indicator samples were obtained from Palisades (1-ST discharge) and five control samples from the Ludington Station (32-LP). Two control samples that were collected from the Ludington Station in August 1999 were not analyzed, as they were lost at the Laboratory. Refer to Enclosure A for all sample collection anomaly evaluations.

Evaluation of the fish analytical results was based on a data means comparison between the Palisades and Ludington Control Samples as well as with the Palisades ODCM reporting limits. The gross beta means for indicator and control locations were 1.84 pCi/g and 1.59 pCi/g,

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respectively. Cs-137 was the only gamma emitter detected, and was only detected in one of the six indicator samples at 0.033 pCi/g. No gamma emitters were detected in any control samples.

A comparison of results between similar species (gizzard shad, lake trout and chinook salmon) that were collected at both indicator and control stations in October 1999, resulted in 1.89 pCi/g for indicator samples and 1.59 pCi/g at the control stations. No Palisades ODCM action levels or reporting levels were exceeded nor were any special analyses requested for 1999.

Fish samples are collected semi-annually. If possible, at least two different fish species (i.e., forage, sport fish, etc.) are sampled semi-annually at designated sample locations. When caught, a one liter quantity of fish sample is prepared for shipment to Teledyne Brown Engineering. Each sample is treated with a 10 percent formaldehyde solution for preservation.

K. Broad Leaf Vegetation

No broad leaf vegetation samples were collected from the surrounding Palisades environs during 1999. The collection of broad leaf vegetation samples serves as a backup and/or alternative sampling media in case any milk sampling location(s) become(s) unavailable. There were no problems associated with the quantity or quality of milk samples for the 1999 reporting year.

L. Non-Routine Samples

No non-routine samples were collected during this reporting period.

M. Gaseous and Liquid Radwaste Effluent Composite Samples

Although not a direct reporting component in the Palisades Annual Radiological Environmental Operating report, results of the gaseous and liquid monthly radwaste effluent composite samples are evaluated against overall environmental trending data. This evaluation is the basis for determining isotopic dispersion and deposition patterns within the surrounding environs of Palisades. All gaseous and liquid effluent results

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are compared to Palisades Offsite Dose Calculation Manual, Appendix A, reporting levels. All isotopic LLDs were met.

Both the gaseous and liquid radwaste effluent composite samples are collected monthly and sent to Teledyne Brown Engineering for analysis. No special sample treatment with a preservative is required prior to laboratory analysis. The liquid effluent composite sample is based on a specific amount of sample collected per total batch volume release. As noted in Enclosure A, for months in which there were no liquid batch effluent releases no sample is sent to Teledyne Brown Engineering. The gaseous radwaste effluent weekly composite sample results are based on analyzing weekly stack gas filters.

IV. ASSESSMENT OF PALISADES OPERATION ENVIRONMENTAL IMPACT

In reviewing the 1999 Palisades radiological environmental monitoring data and comparing it to previous operational and pre-operational data, all trending parameters continue to indicate that the operation of Palisades has minimal environmental impact. Most isotopic activity is at environmental background levels. Evidence of an overall environmental isotopic buildup (attributable to Plant effluents) remains negligible as well. In most instances, sample analytical results were below previously established environment background levels.

Palisades Nuclear Plant, Van Buren County, Mi. Docket 50-255
 Annual Radiological Environmental Operating Report
 January 1 to December 31, 1999
 Table HP 10.4-1
 Sampling and Analysis Summary

<u>Medium</u>	<u>Description</u>	<u>Location</u>	<u>Number of Samples Collected</u>	<u>Type of Analysis</u>	<u>Frequency of Analysis</u>
Air	Continuous at Weekly @ 1 CFM	1-ST thru 12-DG	633	Gross Beta, I-131	Weekly
Lake Water	1 Gallon Composite	1-ST Intake 25-SH Raw 32-LP Intake	36	Gross Beta, Gross Alpha(1), Tritium(1)	Monthly
Drinking Water	1 Gallon Composite/Grab	25-SH Raw 25-SH Treated 32-LP Intake	36(2,3)	Gross Beta, Tritium(1)	Monthly
Well Water	1 Gallon Grab	1-ST Well, 8-SP, 9-TP, 32-LP Well, 39-ST, 40-ST, 41-ST, 42-ST, 43-ST	108	Gross Beta, Tritium	Monthly
Milk	2 Gallon Grab	26-AK, 27-DH, 28-DC, 29-WS	48	I-131, Cs-137, Cs-134, BaLa-140	Monthly
TLD	Continuous	1-ST thru 24-ST, 33-ST thru 38-ST	348 116 29	Gamma	Monthly Quarterly Annual
Crops	Grab	4-JS, 5-PR,	14	Gross Beta, Cs-137, Other Gamma	In Season
Sediment	Grab	1-ST, 25-SH, 30-STN 31-STs, 32-LP	10	Gross Beta, Cs-137, Other Gamma	Semi-Annual
Aquatic Biota	Grab	1-ST,	1	Gross beta, Cs-137 Other Gamma	Seasonally if available
Fish	Grab	1-ST, 32-LP	11	Gross Beta, Cs-137 Other Gamma	Seasonally

- (1) Not required for 25-SH Raw
 (2) Same 25-SH Raw water samples as Lake Water
 (3) Same 32-LP Intake water samples as Lake Water

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 Table HP 10.4-2
 Sample Data Summary

Medium or Pathway Sampled Unit of Measurement	Analyses Evaluated/ Analyses Performed	Lower Limit of Detection(a) LLD	All Indicator Locations		Location With Greatest Annual Mean			All Control Locations		Nonroutine Reports(c)
			Mean(b) Range(b)	Name Distance and Direction	Mean(b) Range(b)	Mean(b) Range(b)	Mean(b) Range(b)			
Air (pCi/m ³)	I-131	631/631	0.07	0/476	LLD	N/A	LLD	0/155	LLD	None
	Gross Beta	633/633	0.01	477/477	0.025 (0.011-0.056)	7-SD 6.5 mi NNE	53/53 0.026 (0.015-0.055)	156/156	0.025 (0.013-0.052)	None
Lake Water (pCi/L)	Gross Alpha(f)	12/12	1.0	2/12	0.65 (0.6-0.7)	1-ST Palisades Plant Site	2/12 0.65 (0.6-0.7)	N/A	N/A	None
	Gross Beta	36/36	4.0	24/24	2.0 (1.5-2.8)	32-LP 125 mi N	12/12 2.3 (1.7-3.7)	12/12	2.3 (1.7-3.7)	None
	Tritium(f)	24/24	500.0	1/12	189	1-ST Palisades Plant Site	1/12 189	0/12	LLD	None
Drinking Water (pCi/L)	Gross Beta	36/36	4.0	24/24(1)	2.0 (1.6-2.5)	32-LP 125 mi N	12/12 2.3 (1.7-3.7)	12/12(2)	2.3 (1.7-3.7)	None
	Tritium(f)	24/24	500.0	0/12	LLD	N/A	0/12 LLD	0/12(2)	LLD	None
Well Water (pCi/L)	Gross Beta	108/108	4.0	64/72	5.3 (1.3-17.0)	43-ST Palisades Plant Site	12/12 11.5 (6.6-17.0)	12/36	1.4 (1.0-3.4)	None
	Tritium	108/108	500.0	3/72	210 (166-232)	1-ST Palisades Plant Site	2/12 232 (232-232)	3/36	177 (157-198)	None
Milk (pCi/L)	I-131	48/48	1.0	0/36	LLD	N/A	LLD	0/12	LLD	None
	Cs-137	48/48	18.0	0/36	LLD	N/A	LLD	0/12	LLD	None
	Other Gamma	48/48	15.0	0/36	LLD	N/A	LLD	0/12	LLD	None

(1) 12 of these indicator samples were from the lake water media indicator location (25-SH Raw).

(2) Control samples were from the lake water media control location (32-LP Intake).

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 Table HP 10.4-2
 Sample Data Summary

Medium or Pathway Sampled Unit of Measurement	Analyses Evaluated/ Analyses Performed	Lower Limit of Detection(a) LLD	All Indicator Locations	Location With Greatest Annual Mean			All Control Locations Mean(b) Range(b)	Nonroutine Reports(c)	
				Name Distance and Direction		Mean(b) Range(b)			
TLD (gamma mR) Inner Ring (Site Boundary)	TLD(monthly)(e) 228/228	1.0	192/192	3.8 (2.4-5.8)	11-KZ 35 mi. E 12/12	5.1 (3.9-6.2)	36/36	4.4 (3.3-6.3)	None
	TLD(quarterly)(e) 76/76	1.0	64/64	11.5 (10.4-13.6)	11-KZ 35 mi. E 4/4	15.5 (13.7-16.4)	12/12	13.6 (11.8-16.4)	None
	TLD(annual) 19/19	1.0	16/16	42.6 (38.1-51.1)	11-KZ 35 mi. E 1/1	57.6	3/3	52.0 (47.2-57.6)	None
TLD (gamma mR) Outer Ring	TLD(monthly)(e) 156/156	1.0	120/120	4.4 (3.1-6.0)	2-TH 5 mi S 12/12	5.1 (3.8-5.9)	36/36(3)	4.4 (3.3-6.3)	None
	TLD(quarterly)(e) 52/52	1.0	40/40	13.2 (10.8-17.7)	2-TH 5 mi S 4/4	16.5 (15.7-17.7)	12/12(3)	13.6 (11.8-16.4)	None
	TLD(annual) 13/13	1.0	10/10	50.5 (45.7-60.4)	2-TH 5 mi S 1/1	60.4	3/3(3)	52.0 (47.2-57.6)	None
Crops	Gross Beta 14/14	1.0	14/14	1.51 (0.87-2.61)	4-JS 3.5 mi SE 10/10	1.69 (0.87-2.61)	N/A		None
	Other Gamma 14/14	0.05-0.10	0/14	LLD	N/A	LLD	N/A		None
Sediment (pCi/g dry)	Gross Beta 10/10	1.0	8/8	7.31 (4.75-11.09)	25-SH 5.5 mi NNE 2/2	10.09 (9.09-11.09)	2/2	9.07 (5.40-12.73)	None
	Cs-137 10/10	0.15	0/8	LLD	32-LP 125 mi S 2/2	0.025 (0.017-0.033)	2/2	0.025 (0.017-0.033)	None
	Other Gamma 10/10	0.05-0.15	0/8	LLD	N/A	LLD	0/2	LLD	None

(3) Same control TLDs as Inner Ring.

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 Table HP 10.4-2
 Sample Data Summary

Medium or Pathway Sampled Unit of Measurement	Analyses Evaluated/ Analyses Performed		Lower Limit of Detection(a)	All Indicator Locations		Location With Greatest Annual Mean			All Control Locations		Nonroutine Reports(c)
			LLD	Mean(b)	Range(b)	Name	Mean(b)	Range(b)	Mean(b)	Range(b)	
Algae (pCi/g wet)	Gross Beta	1/1	1.0	1/1	2.82	1-ST Palisades Plant Site	1/1	2.82	0/0	N/A	None
	Cs-137	1/1	0.15	1/1	0.035	1-ST Palisades Plant Site	1/1	0.035	0/0	N/A	None
	Other Gamma	1/1	0.10-0.26	0/1	LLD	N/A		LLD	0/0	N/A	None
Fish (pCi/g wet)	Gross Beta	9/9	1.0	6/6	1.84 (1.19-2.41)	1-ST Palisades Plant Site	6/6	1.84 (1.19-2.41)	3/3	1.59 (1.41-1.70)	None
	Cs-137	9/9	0.15	1/6	0.033	1-ST Palisades Plant Site	1/6	0.033	0/3	LLD	None
	Other Gamma	9/9	0.10-0.26	0/6	LLD	N/A		LLD	0/3	LLD	None
Broadleaf Vegetation(d) (pCi/g wet)	Gross Beta		1.0	No Samples Collected							
	Cs-137		0.08								
	Other Gamma		0.05-0.10								

- (a) Nominal Lower Limit of Detection (LLD) as defined in MASL-300 (Rev 0/73), pages D-06-01, 02 and 03; Palisades ODCM, Appendix A, Table E-3 and vendor analytical capabilities.
- (b) Mean and range based upon detectable measurements only. Fraction of detectable measurements at specific locations is indicated next to the mean.
- (c) Nonroutine reported measurements are defined in the Palisades ODCM, Appendix A, Section IV.C.
- (d) Supplemental sample when milk is unavailable.
- (e) Monthly TLD results are normalized for 30 days net; Quarterly TLD results are normalized for 91 days net.
- (f) Analysis not required for (25-SH) South Haven Municipal raw water.

Palisades Nuclear Plant, Van Buren County, Mi. Docket 50-255
 Annual Radiological Environmental Operating Report
 January 1 to December 31, 1999
 Table HP 10.4-3
 Greatest Mean Sampling Location

<u>Medium</u>	<u>Type of Analysis</u>	<u>Location</u>	<u>High</u>	<u>Low</u>	<u>Mean</u>
Air (pCi/m ³)	I-131	LLD	-----	-----	<0.07
	Gross Beta	7-SD 6.5 mi NNE	0.055	0.015	0.026
Lake Water (pCi/L)	Gross Alpha	1-ST Palisades Plant Site	0.7	0.60	0.65
	Gross Beta	32-LP Ludington 125 mi N	3.7	1.7	2.3
	Tritium	1-ST Palisades Plant Site	189	189	189
Drinking Water (pCi/L)	Gross Beta	32-LP Ludington 125 mi N	3.7	1.7	2.3
	Tritium	LLD	-----	-----	<500
Well Water (pCi/L)	Gross Beta	43-ST Palisades Plant Site	17.0	6.6	11.5
	Tritium	1-ST Palisades Plant Site	232	232	232
Milk (pCi/L)	I-131	LLD	-----	-----	<1.0
	Cs-137	LLD	-----	-----	<18.0
	Other Gamma	LLD	-----	-----	<15.0
TLD (Gamma-mR) Inner Ring (Site Boundary)	TLD (Monthly)	11-KZ 35 mi E	6.2	3.9	5.1
	TLD (Quarterly)	11-KZ 35 mi E	16.4	13.7	15.5
	TLD (Annual)	11-KZ 35 mi E	N/A	N/A	57.6
TLD (Gamma-mR) Outer Ring	TLD (Monthly)	2-TH 5 mi S	5.9	3.8	5.1
	TLD (Quarterly)	2-TH 5 mi S	17.7	15.7	16.5
	TLD (Annual)	2-TH 5 mi S	N/A	N/A	60.4

Palisades Nuclear Plant, Van Buren County, Mi. Docket 50-255
 Annual Radiological Environmental Operating Report
 January 1 to December 31, 1999
 Table HP 10.4-3
 Greatest Mean Sampling Location

<u>Medium</u>	<u>Type of Analysis</u>	<u>Location</u>	<u>High</u>	<u>Low</u>	<u>Mean</u>
Crops (pCi/g wet)	Gross Beta	4-JS 3.5 mi SE	2.61	0.87	1.69
	Other Gamma	LLD	-----	-----	<0.05-0.10
Sediment (pCi/g dry)	Gross Beta	25-SH 5.5 mi NNE	11.09	9.09	10.09
	Cs-137	32-LP Ludington 125 mi N	0.033	0.017	0.025
	Other Gamma	LLD	-----	-----	<0.05-0.15
Algae (pCi/g wet)	Gross Beta	1-ST Palisades Plant Site	2.82	2.82	2.82
	Cs-137	1-ST Palisades Plant Site	0.035	0.035	0.035
	Other Gamma	LLD	-----	-----	<0.10-0.26
Fish (pCi/g wet)	Gross Beta	1-ST Palisades Plant Site	2.41	1.19	1.84
	Cs-137	1-ST Palisades Plant Site	0.033	0.033	0.033
	Other Gamma	LLD	-----	-----	<0.10-0.26
Broad Leaf Veg (pCi/g wet)	Gross Beta I-131 Other Gamma	No Samples Collected			

ENCLOSURE A

**CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255**

**PALISADES NUCLEAR PLANT
1999 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT
SAMPLE COLLECTION ANOMALIES**

2 Pages

Enclosure A Sample Collection Anomalies

<u>Sample Affected</u>	<u>Location</u>	<u>Date</u>	<u>Problem</u>	<u>Evaluation</u>
AP- I-131	ST-12	4-28-99	Iodine cartridge not installed, no sample collected	Sample collector did not install cartridge in sampler (1)
AP-I-131	ST-9	5-3-99	Iodine cartridge not analyzed	Sample collected, lost in transit to Laboratory (2)
Well Water	39-ST	Feb	Gross beta analysis result exceeded 10 pCi/L	Activity not due to Plant effluents, suspect road de-icer as contaminant. (3)
Well Water	41-ST	Jan	Gross beta analysis result exceeded 10 pCi/L	Activity not due to Plant effluents, suspect road de-icer as contaminant. (3)
Well Water	43-ST	Jan, Mar Apr, May Sep, Oct Dec	Gross beta analysis result exceeded 10 pCi/L	Activity not due to Plant effluents, suspect road de-icer as contaminant. (3)
Fish	32-LP	August	2 fish samples not analyzed	Samples discarded at Laboratory prior to analysis (4)
Liquid Radwaste	Plant Site	Feb, Mar Apr, May July, Aug Sep, Nov Dec	No sample	There were no liquid effluent batch releases during these time periods. Consequently No sample is collected and sent to Teledyne Isotopes.

- (1) Sample collector failed to install iodine cartridge for the week ending 4/28/99. Missed sample due to inattention to detail, deficiency will be trended, this is a first time failure, no further action necessary to prevent recurrence.
- (2) Sample (iodine cartridge) was collected by station personnel, packaged and prepped for shipment, along with the other 11 air samples. Vendor laboratory did not receipt the cartridge upon arrival to the Laboratory. Cartridge either lost in shipment or lost at Laboratory. To prevent recurrence, vendor Laboratory to immediately notify REMP coordinator upon missing samples in the future to aid in the root cause determination.
- (3) Follow up analysis (gamma spectroscopy) showed all isotopes less than LLD. Activity is not due to Plant effluents, suspect road de-icer as contaminant, as higher activity at this well site is only seen in winter months, and sample locations are near road run-offs and Plant parking areas.

- (4) Three fish samples (two from Ludington control station, one from Big Rock Point) were received in the laboratory on August 31, 1999, along with bottom sediment samples. Chain of custody forms were returned to Palisades. Sample preparation sheets were distributed, and apparently the samples were placed in the cooler. Upon start of sample analysis, only the sediment samples were found. A thorough search was made of the entire laboratory with no results. Conclude that the samples were inadvertently disposed of in trash prior to analysis. Appears to be an isolated incident, no corrective action is planned. Should the problem reoccur, modifications to temporary sample storage and chain of custody procedures will be evaluated.

ENCLOSURE B

**CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255**

**PALISADES NUCLEAR PLANT
1999 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT
PALISADES 1999 LAND USE CENSUS**

8 Pages

To TPNeal, Palisades
From *MLG* MLGrogan, Palisades
Date September 24, 1999
Subject PALISADES PLANT -
1999 LAND USE CENSUS
CC JBBurnett, Palisades
REMP/RETS File
ERC: LANUSECEN

CONSUMERS
ENERGY

Internal
Correspondence

MLG99*014

The attached tables and map are the results of the Palisades Land Use Census conducted by MLGrogan and MLSweet on September 22, 1999. Table 10.11-1 references the distance from Palisades to the nearest residence, garden (greater than 500 square feet), beef/dairy cattle, and goat per meteorological sector. Table 10.11-2 identifies the locations of the nearest residence and garden; and of all beef/dairy cattle and goats within a five (5) mile radius of Palisades per meteorological sector. Table 10.11-3 lists the critical receptor locations used in calculation of the offsite doses by the GASPAR computer program. An accompanying map illustrates Table 10.11-2. Prior to conducting the land use census the Van Buren County Agricultural Extension Office was contacted as required by Procedure HP 10.11.

There were no changes to critical receptor locations from the 1998 Land Use Survey.

Tables 10.11-1 and 10.11-3 are required to be updated in the ODCM as Tables 1.4 and 1.4a respectively. Attached to this report are the new revisions of Tables 1.4 and 1.4a.

If you have any questions, please contact me.

Reviewed by *TPNeal*

TPNeal, Senior Technical Analyst

10-7-99

Date

1999 PALISADES LAND USE CENSUS

TABLE 10.11-1

Distance to the nearest residence, garden, dairy/beef cattle and goat in each sector.

<u>SECTOR</u>	<u>RESIDENCE</u>	<u>GARDEN</u>	<u>BEEF CATTLE</u>	<u>DAIRY COW</u>	<u>GOAT</u>
NNE	1.1 mi	1.8 mi	>5 mi	>5 mi	>5 mi
NE	1.2 mi	1.2 mi	2.9 mi	>5 mi	3.2 mi
ENE	1.3 mi	3.3 mi	1.8 mi	>5 mi	4.0 mi
E	1.0 mi	2.1 mi	3.5 mi	>5 mi	>5 mi
ESE	1.0 mi	**1.0 mi	*4.0 mi	>5 mi	>5 mi
SE	1.0 mi	**1.0 mi	*4.0 mi	4.3 mi	4.3 mi
SSE	0.7 mi	1.6 mi	>5 mi	>5 mi	>5 mi
S	0.5 mi	>5 mi	>5 mi	>5 mi	4.7 mi
SSW	0.7 mi	4.9 mi	>5 mi	>5 mi	>5 mi

* Note: Farm bisected by ESE/SE boundary line.

**Note: Garden bisected by ESE/SE sector line.

1999 PALISADES LAND USE CENSUS

TABLE 10.11-2

Verification of Items

<u>Sector</u>	<u>Location Description</u>	<u>Item</u>	<u>Number/Comment</u>
NNE Ruggles Rd	State Park Manager	Residence	1
NNE	Fire Ln N, (off 20th) (East side of road)	Garden	1
NE Blue Star Hwy	L. Swetay, Route 3, Box 133 (East side of highway)	Residence Garden	1 1
NE M-140	18847 M-140, .25 miles N of 20th, west side of road	Cattle	2-Beef
NE M-140	C. Bernt, 18019 M-140	Goats	3
NE M-43	M-43, N side of road, between 12th & 16th, (approximately 0.3 mile outside the 5 mile limit)	Goats	20
ENE 24th Ave	Trailer-West 24th Avenue, dead end at sand dune	Residence	1
ENE 24th	72577 24th Street, 0.3 miles West of 72nd St (North side)	Garden	1
ENE 72nd	Cecil Hodge, 16971 72nd St 0.5 mile South of 16th Ave and 72nd St intersection (West side of 72nd)	Cattle Goats	2-Beef 2
ENE 72nd	72nd St, 0.3 miles N of 20th (East side of road)	Cattle	12-Beef
ENE 76th	22595 76th St, .3 mi N of 24th, East side of road	Cattle	2-Beef

1998 PALISADES LAND USE CENSUS

TABLE 10.11-2

Verification of Items

<u>Sector</u>	<u>Location Description</u>	<u>Item</u>	<u>Number/Comment</u>
ENE 69th	380 & 69th, NE corner	Goat	2
E 77th	77th St, Dead end of 77th St near 28th Ave intersection	Residence	1
E 72nd St	C. Mims, 26200 72nd St intersection of 72nd & 26th Ave (Northwest corner of intersection)	Cattle Garden	8-Beef 1
E 75th	27723 75th, 0.1 mile North of 28th (East side of road)	Garden	1
ESE 77 1/2 St	O. Ashley, 28008 77 1/2th St Northwest corner of 77 1/2th St and 28th Ave intersection	Residence	1
ESE/SE 34th Ave	Herchy House, 72753 34th Ave (South side of road)	Cattle	10-Beef
ESE 69th	A. Karr, 69th St 0.5 mile North of 69th St and 30th Avenue intersection	Cattle	20-Dairy Cow
SE/ESE 28th	77550 28th Avenue	Residence Garden	1 1
SE 36th	72401 36th Avenue, 0.2 mile West from 72nd, South side of road	Cattle Goat	8-Dairy Cow 1
SSE 29th	80119 29th Avenue	Residence	1
SSE 77 1/2	77 1/2 St, 0.3 mile North of 32nd Ave (west side of 77 1/2 th St)	Garden	1

1999 PALISADES LAND USE CENSUS

TABLE 10.11-2

Verification of Items

<u>Sector</u>	<u>Location Description</u>	<u>Item</u>	<u>Number/Comment</u>
SSE M-140	42507 M-140, .25 mi North of 376, East side of road	Cattle	4-Beef
S 29th Ave	Palisades Park, 0.5 mile West of 29th Ave and Blue Star Hwy intersection (North side of 29th)	Residence	1
S CR 376	79911 46th Street (CR 376), at 80th St intersection	Goat	4
SSW 29th	29th Ave, at dead end of Palisades Park	Residence	1
SSW 82nd	Blue Star & 82nd, off of 376th (west side of road)	Garden	1

1999 PALISADES LAND USE CENSUS

TABLE 10.11-3

Critical Receptor Items

<u>Sector</u>	<u>Distance Miles</u>	<u>Location/Description</u>	<u>Item</u>	<u>*X/Q (sec/m³).</u>
SSE	0.48	Site Boundary	N/A	2.13E-06
S	0.50	Residence, Palisades Park; ½ mile West of 29th Avenue and Blue Star intersection.	Residence	1.38E-06
SE	1.0	77550 28th Avenue	Garden	5.87E-07
ENE	1.8	22595 76th Ave, .3 miles N of 24th, East side of road	Beef Cattle	2.14E-07
SE	4.3	72401 36th Ave.	Dairy Cow	6.83E-08
NE	3.2	C. Bernt 18019 M-140	Goat	1.19E-07

*Based on Palisades 5 year composite meteorological data, 1992 -1996.

TABLE 1.4

1999 PALISADES LAND USE CENSUS

Distance to the nearest residence, garden, dairy/beef cattle and goat in each sector.

<u>SECTOR</u>	<u>RESIDENCE</u>	<u>GARDEN</u>	<u>BEEF CATTLE</u>	<u>DAIRY COW</u>	<u>GOAT</u>
NNE	1.1 mi	1.8 mi	>5 mi	>5 mi	>5 mi
NE	1.2 mi	1.2 mi	2.9 mi	>5 mi	3.2 mi
ENE	1.3 mi	3.3 mi	1.8 mi	>5 mi	4.0 mi
E	1.0 mi	2.1 mi	3.5 mi	>5 mi	>5 mi
ESE	1.0 mi	1.0 mi	*4.0 mi	>5 mi	>5mi
SE	1.0 mi	1.0 mi	*4.0 mi	4.3 mi	4.3 mi
SSE	0.7 mi	1.6 mi	>5 mi	>5 mi	>5 mi
S	0.5 mi	>5 mi	>5 mi	>5 mi	4.7 mi
SSW	0.7 mi	4.9 mi	>5 mi	>5 mi	>5 mi

* Note: Farm bisected by ESE/SE boundary line.

** Note: Garden bisected by ESE/SE sector lien.

TABLE 1.4a

1999 PALISADES LAND USE CENSUS

Critical Receptor Items

<u>Sector</u>	<u>Distance Miles</u>	<u>Location/Description</u>	<u>Item</u>	<u>*X/Q (sec/m³).</u>
SSE	0.48	Site Boundary	N/A	2.13E-06
S	0.50	Residence, Palisades Park; ½ mile West of 29th Avenue and Blue Star intersection.	Residence	1.38E-06
SE	1.0	77550 28th Avenue	Garden	5.87E-07
ENE	1.8	22595 76th Ave .3 miles N of 24th, East side of road	Beef Cattle	2.14E-07
SE	4.3	72401 36th Ave.	Dairy Cow	6.83E-08
NE	3.2	C. Bernt 18019 M-140	Goat	1.19E-07

*Based on Palisades 5 year composite meteorological data, 1992 -1996.

ENCLOSURE C

**CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255**

**PALISADES NUCLEAR PLANT
1999 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT
HEALTH PHYSICS PROCEDURE HP 10.10**

34 Pages

TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT

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SAMPLE COLLECTION AND SHIPMENT**

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ATTACHMENTS

- Attachment 1, "Environmental Sample Collection Schedule"
- Attachment 2, "Sample Locations"
- Attachment 3, "Sample Identification"
- Attachment 4, "Sample Packaging and Shipment"
- Attachment 5, "Palisades Sample Collection Forms and Records"

**TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT**

USER ALERT
INFORMATION USE PROCEDURE

The activities covered by this procedure may be performed from memory.

1.0 PURPOSE

To provide methodology for collection of environmental samples in support of the Radiological Environmental Monitoring Program (REMP).

2.0 REFERENCES

2.1 SOURCE DOCUMENTS

2.1.1 Reg Guide 4.15(7)

2.1.2 10CFR50, Appendix I

2.1.3 Palisades Administrative Procedure 7.08, "Nuclear Plants Radiological Environmental Monitoring Program"

2.1.4 REMP Sample Shipping Manual, Teledyne Isotopes Midwest Laboratory

2.1.5 Health Physics Procedure 10.1, "Radiological Environmental Monitoring Program Surveillance" | e

2.2 REFERENCE DOCUMENTS

2.2.1 Palisades ODCM, Appendix A, Sections III.J, IV.C, and Tables E-1 and E-2

2.2.2 Palisades Administrative Procedure 10.46, "Plant Records"

3.0 PREREQUISITES

As indicated in procedure.

TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT

4.0 PRECAUTIONS AND LIMITATIONS

- 4.1 This procedure shall be applicable to Palisades/C&RSD HP, Environmental Department, and any contractual personnel assigned to collect or evaluate REMP samples.
- 4.2 Any revisions to this procedure shall be reviewed against Palisades ODCM Specifications to verify compliance to all requirements.
- 4.3 Deviations from the required sampling schedule shall be documented in the Annual Radiological Environmental Operating Report.
- 4.4 Every effort shall be made to complete corrective action on malfunctioning sampling equipment prior to the end of the next sampling period.
- 4.5 If it is not possible to obtain the required samples, suitable alternative media and locations shall be substituted within 30 days.
- 4.6 Samples shall be collected, prepared, and shipped for analysis in a timely manner to preserve integrity. Other specific handling precautions for sample media are indicated in Section 5.0 as required.
- 4.7 Obtain best available replacement sample for any missing sample. Notify Palisades C&RSD Radiological Environmental contact with description and location of the replacement sample. Some samples are not replaceable (TLDs, air samples, etc), however, water, milk, crop samples, etc, should be.
- 4.8 Document any missing samples or malfunctioning equipment on sample data collection sheets.

**TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT**

5.0 **PROCEDURE**

USER ALERT
INFORMATION USE PROCEDURE

The activities covered by this procedure may be performed from memory.

5.1 **CONTROL AND OVERSIGHT OF SAMPLING FOR THE RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM**

5.1.1 Sampling techniques described by this procedure must be strictly adhered with.

- a. This includes use of forceps for air sample media change out to ensure the collected media is not disturbed.
- b. Recorded data should be verified including verification of transcribed data to avoid errors.
- c. All deviations from performance requirements, unavailable samples, or other sampling anomalies must be reported to the C&RSD Radiological Environmental Contact.

5.1.2 Failure of sample collectors to comply with sampling and reporting requirements may result in remedial training, disciplinary action, or reassignment of sampling duties.

5.1.3 The C&RSD radiological environmental contact shall conduct periodic (annual) audits of sampling activities.

- a. These audits shall include observation of collection techniques, verification of procedural compliance and review of equipment condition.
- b. Audits should specifically address air sample collection and should include observation of all individuals involved in sample changeout.
- c. Audit of collection of other sample media may be performed at the discretion of the C&RSD environmental contact.

**TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT**

- d. Results of the audits and any follow up action should be documented in the REMP file.

Collect samples using the following methodology in accordance with schedule and location data described in Attachments 1 and 2.

5.2 REMP AIR SAMPLE COLLECTION

5.2.1 Precautions

- a. New filters and cartridges should be transported and handled such that potential contamination of them is minimized (ie, placed in clean plastic bags, etc).
- b. If an air sampling unit is discovered not operating, attempt to find the cause and repair. If this cannot be done, replace applicable component and document on air sample collection data sheet.
- c. Airflow meters shall be calibrated annually by General Meter. All in service calibrated meters will have affixed a valid calibration sticker/card stating date of calibration and calibration due date.
- d. Airflow meters shall be changed out prior to the expiration of calibration dates. Replacement air meters are available from Plant C&RSD Environmental contact.
- e. Air station leakage shall be none detectable. If the replacement of air station components is required due to air leakage, document on air sample collection data sheet.

5.2.2 Prerequisites

- a. Glass fiber (particulate) air filters
- b. Charcoal cartridges for iodine sampling (prelabeled for each air sampler)
- c. Glassine or plastic envelopes (prelabeled for each air sampler)
- d. REMP Air Sample Data Sheet (containing installation data)
- e. Replacement air sample meters (as required)

e |

**TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT**

- f. Forceps
- g. Stop Watch
- h. Step Ladder

NOTE: The Control Stations 10-GR, 11-KZ, and 12-DG are changed out weekly by three independent collectors, and mailed in separately. The prelabeling of cartridges and envelopes, detailed below, is not required for these stations as sample mix-up is not possible. In addition, for these control stations, the Palisades Sample Collection Form and Records (Page 1 of Attachment 5) is completed by the Technician changing out the nine local stations by transferring the recorded data provided by the independent collectors.

5.2.3 Perform the following weekly at each sample location:

- a. Open the protective cover on the air sample station and verify the sampling location number written on the inside of the door is the same as the prelabeled sample change-out package.
- b. Verify that the meter serial number and calibration due date are correctly documented on Palisades Plant Environmental Monitor Operability Check and Sample Collection data form (Page 1 of Attachment 5.)
- c. Determine and record the "As Found Flow" rate (seconds for one cubic foot of volume).
- d. Determine and record the "As Found Leak" rate by placing hand over filter housing inlet to form a seal. While holding hand over the inlet, determine if air leakage is evident by checking the air flow meter needle for movement (leakage). If no air leakage, record (N) in the "As Found Leak" column. If air leakage is indicated, determine the cause and repair as soon as possible.
- e. Unplug or turn off the air pump and record the "REMOVED MONTH/DAY/YEAR," "REMOVED TIME," and "GAS METER READING REMOVED."
- f. Remove the prelabeled charcoal cartridge and place in zip lock bag.

**TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT**

- e |
- e |
- g. Using tweezers, carefully remove particulate filter from the sampler head and place in the pre-labeled glassine envelope or plastic envelope.
 - h. Clean out any residue or moisture buildup in sampler head before replacement filter is installed. Check the condition of the sampler head o-rings. Replace cracked o-rings as necessary to prevent air leakage.
 - i. Install new particulate filter and charcoal cartridge and ensure that both are properly centered in sampler head to prevent air leakage. Ensure the fiber side of the particulate filter is facing out (smooth side facing inward).
 - j. Restart air pump. Place hand over the filter housing inlet to form a seal, determine if air leakage is evident by checking air flow meter needle movement. If no air leakage, record (N) in the "As Left Leak" column. If air leakage indicated, determine the cause of the leakage (filter not centered in holder properly or cracked o-ring) and correct problem as soon as possible, restoring system to no air leakage.
 - k. Determine and record "As Left" flow rate. If greater than 90 seconds are required for one cubic foot of volume, the sample pump is degrading. Replace pump as soon as possible to avoid failure to reach minimum sample volume. (5000 ft³).
 - l. If an airflow meter must be replaced, record this in the "Comments" column. Record replacement meter data in the reading on the upcoming week's sample collection data sheet.
 - m. Close the protective cover on the air sample station.
 - n. Calculate and record "SAMPLE VOL (FT3)," ALSO ensure all pertinent data is recorded.
 - o. Proceed to the next station. Date and sign the current weeks data sheet upon completion of the entry of all current data.

**TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT**

- p. Transcribe the "REMOVED MONTH/DAY/YR" and "GAS METER READING REMOVED" taken in Step 5.2.3e to the "INSTALLED" reading columns on the sample collection sheet to be used for the upcoming week's air sample collection. Also transcribe the meter serial number and calibration due date to the upcoming week's sample collection sheet.

5.3 REMP LAKE (DRINKING) WATER SAMPLE COLLECTION-SOUTH HAVEN, MICHIGAN

5.3.1 Prerequisites

- a. Four clean one-gallon plastic containers labeled with sample type, location, amount, and date (or collection period)
- b. REMP Miscellaneous Data Sheet (Attachment 3)

5.3.2 Perform the following sample collection monthly:

- a. Leave four containers with the Plant Superintendent at the South Haven Municipal Water Treatment Plant. New water sample containers should be left at the South Haven Water Treatment Plant upon pickup of end-of-month composite samples.
- b. Instruct the Plant Superintendent to add approximately 300 ml per day of raw water to container labeled "RAW" and approximately 300 ml per day of treated water to container labeled "TREATED," or "TAP."
- c. Return at end of month to collect containers. Obtain verbal verification that Step 5.3.2b was carried out. Note any deviations in "Remarks" column of data sheet.
- d. Label containers with sample type, amount, location, and collection period.
- e. Package and ship samples per Attachment 4.
- f. Record location, sample types (raw and treated), and amount on sample identification data sheet (Attachment 3). Sign and date data sheet.

**TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT**

5.4 REMP WELL WATER SAMPLE COLLECTION

5.4.1 Prerequisites

- a. Clean, one-gallon plastic containers
- b. REMP Miscellaneous Data Sheet (Attachment 3)

5.4.2 Perform the following sample collection monthly:

NOTE: During the winter months, the State and Township Park wells may be out of service. When this occurs, note the unavailability of the water samples and document on sample data sheet.

- a. Turn on water supply (or begin pumping water) and allow water to run for approximately one minute to purge the lines.
- b. Fill two clean, one-gallon plastic containers with well water from each sample location.
- c. Label containers with sample type, amount, location, and collection date.
- d. Package and ship samples per Attachment 4.
- e. Record on data sheet (Attachment 3) location, type, date, amount, and under "Remarks" any pertinent information. Sign form in space provided.

5.5 REMP MILK SAMPLE COLLECTION

5.5.1 Precautions

- a. Milk samples shall be sent to the laboratory as soon as possible because of the short half-life of I-131. Any undue delay may cause ODCM, Appendix A, Table E-3 analytical LLD requirements to be violated.
- b. Obtain best available replacement sample for any missing milk sample(s). Identify new sample location(s) and notify Palisades C&RSD Radiological Environmental contact as soon as possible.

TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT

- c. If milk samples are unavailable, then samples of three different kinds of broad leaf vegetation grown nearest to Palisades in each of two different offsite locations of the highest predicted average ground level D/Q (SE or SSE sectors near site), and one sample of each kind of similar broad leaf vegetation grown 15-30 km distant from Palisades in the least prevalent wind direction (NNE, NE or ENE sectors) may be used as replacement samples. The new sample locations shall be identified and the REMP procedures revised within 30 days to reflect sampling changes. Collect approximately one kilogram (2.2 lb) of each sample type. | e

5.5.2 Prerequisites

- a. Two clean, plastic one-gallon containers for each sample location
- b. Sodium bisulfite preservative (approximately 40 gm per gallon of milk required)
- c. Miscellaneous sample data form (Attachment 3)

5.5.3 Perform the following monthly at each specified sample collection location:

- a. Obtain two one-gallon grab samples of raw milk as specified in Attachments 1 and 2.
- b. If problems are encountered in obtaining a sufficient quantity of milk sample, notify the Palisades C&RSD Radiological Environmental contact.
- c. Add approximately 40 gm of sodium bisulfite to each one-gallon container of milk and thoroughly mix. The sodium bisulfite can either be in prepared packets or "scooped" with a volumetric measure from its container.
- d. Label containers with sample type, amount, location, date, and time.
- e. Package and ship samples as per Attachment 4.
- f. Record on Sample Data Form (Attachment 3), the location, type, date, and amount of samples. Under "Remarks," note any other pertinent information. Sign form in space provided.

**TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT**

5.6 REMP AQUATIC BIOTA COLLECTION

5.6.1 Precautions

- a. Collection to be coordinated between Radiological Services Department RMC Section and the Environmental Department. At least one individual in the collection party is required to have MDNR Cultural and Scientific Fish Collectors Permit.
- b. If logistical problems prevent use of a boat to set gill nets from the lake side of Palisades, then the nets can be set offshore from the site boundary (by wading). Notify Security prior to using offshore wading method for beach access.

5.6.2 Prerequisites

- a. Boat with required safety equipment, or waders
- b. Gill nets (of varying size mesh) and weights and floats
- c. Plastic one-liter wide-mouth bottles
- d. REMP Miscellaneous Data Sheet (Attachment 3)
- e. 10% formaldehyde solution
- f. Fillet knives
- g. Black permanent felt markers for sample identification on containers
- h. Notify district MDNR Fisheries biologist prior to sample collection

**TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT**

- 5.6.3 Collect samples twice during the season of greatest abundance (typically May through October) as follows:
- a. Gill nets are placed at the locations specified in Attachment 1 to collect at least two species of commercially and/or recreationally important fish in the vicinity of the Plant discharge area and the same species in an area not influenced by the Plant discharge (Ludington Pump Storage Plant). One liter of flesh should be collected for each species caught for analysis accuracy. | e
 - b. Normally fish will be collected first from the vicinity of the discharge. REMP coordinator will then collect at least two of the same species at Ludington (control station). Or REMP coordinator will provide the Ludington collector with a list of the species collected in the vicinity of the discharge, with instructions to collect at least two of the same species. | e
 - c. Label all containers with sample type, amount, location, and date.
 - d. Package and ship samples per Attachment 4.
 - e. Record on data sheet (Attachment 3) location, type, date, amount, and under "Remarks" indicate any pertinent information. Sign form in space provided.

**TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT**

5.7 REMP SEDIMENT SAMPLE COLLECTION

5.7.1 Prerequisites

- a. One-liter, wide-mouth plastic sample bottles
- b. Miscellaneous Data Sheet (Attachment 3)

5.7.2 Collect sediment samples semiannually at collection locations specified in Attachment 1 (includes control sample at the Ludington Pump Storage Plant). Palisades C&RSD and/or Environmental Department personnel shall collect these sediment samples.

- a. Label containers with sample type, amount, location, and date.
- b. Package and ship samples per Attachment 4.
- c. Record on Sample Data Sheet (Attachment 3) location, type, date, and amount of sample. Note any other pertinent information in the "Remarks" section. Sign form in space provided.

5.8 REMP FOOD PRODUCT SAMPLE COLLECTION

- a. Sample containers
- b. Miscellaneous Data Sheet (Attachment 3)

5.8.1 Collect food samples monthly during the harvest season, as per ODCM, Appendix A, Table E-1. One sample each of the two principal fruit crops blueberries and apples must be collected.

- a. Collect approximately one kilogram (2.2 lb) of each sample type. Samples are not to be washed, shaken, or cleaned. Samples should not be collected from a single source, but at random from the entire orchard or field.
- b. Label all containers with sample type, amount, location, and date.
- c. Package and ship samples per Attachment 4.
- d. Record on data sheet (Attachment 3) location, type, date, amount, and under "Remarks" note any unusual conditions. Sign form in space provided.

**TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT**

5.9 REMP TLD SAMPLE COLLECTION

5.9.1 Prerequisites

- a. TLDs
- b. TLD Data Sheet (Attachment 5)

5.9.2 Monthly TLDs are to be changed each month; quarterly TLDs during January, April, July, and October; and annual TLDs during January.

5.9.3 Monthly, quarterly, and annually at each sample location perform the following:

- a. Upon receipt of TLDs from the laboratory contractor, all TLDs shall be inventoried and immediately placed in the lead cave (at offsite sample collector's residence). Note date of receipt and inventory on TLD data sheet.
- b. Field TLDs shall only be removed from the lead cave for delivery to their proper locations. All control TLDs remain in the lead cave throughout the entire exposure period.
- c. Remove and replace TLDs at each sample location.
- d. For any missing TLDs, perform the following:
 - 1. Search immediate area.
 - 2. If lost TLD is found, collect it and perform standard change out procedure.
 - 3. If lost TLD is not found, post the new TLD in proper location.
 - 4. Record in "Remarks" column of data sheet any of the above circumstances.
- e. Store collected field TLDs in lead cave along with control TLDs until ready for mailing to laboratory contractor. Mark "Do not x-ray" on TLD package.

**TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT**

- f. Transportation control TLDs are to be stored in a special lead shield provided by laboratory contractor after the field TLDs are posted.

Ensure that designated transportation control TLDs are included with the correct TLD package being mailed to laboratory contractor. Also ensure that laboratory contractor's TLD data sheet is completed and enclosed with shipment.

- g. Record TLD collection date and the date that the TLDs are returned to the vendor. Initial/sign the data sheet (Attachment 5). Record the installation date for the new TLDs on the appropriate data sheet.

- h. Package and ship samples per Attachment 4.

5.10 MISCELLANEOUS SAMPLES

5.10.1 Ludington - Control Station

NOTE: Aquatic Biota and Sediment samples are also collected at Ludington Pump Storage Plant per Sections 5.6 and 5.7 of this procedure.

- a. Ludington Lake In & Well Water composites are collected daily and shipped to Palisades on a monthly basis.
- b. Palisades RETS/REMP personnel record appropriate data on the Sample Identification Form (Attachment 3), and deliver samples to the local Teledyne sample collector for shipment to Teledyne Midwest Laboratory.

5.10.2 Palisades Daily Samples

- a. Palisades Lake In, Lake Out, Site Well Water, Service Water, and Turbine Sump effluent samples are collected on a daily basis per Palisades per Health Physics Procedure HP 6.52, "Palisades (Onsite) Radiological Environmental Program Sample Collection."
- b. Palisades RETS/REMP personnel record appropriate data on the Sample Identification Form (Attachment 3), label all samples, and deliver samples to the local Teledyne sample collector for shipment to Teledyne Midwest Laboratory.

TITLE: PALISADES RADIOLOGICAL ENVIRONMENTAL PROGRAM
SAMPLE COLLECTION AND SHIPMENT

6.0 ACCEPTANCE CRITERIA

Proper completion of procedure.

7.0 ATTACHMENTS AND RECORDS

7.1 ATTACHMENTS

7.1.1 Attachment 1, "Environmental Sample Collection Schedule"

7.1.2 Attachment 2, "Sample Locations"

7.1.3 Attachment 3, "Sample Identification"

7.1.4 Attachment 4, "Sample Packaging and Shipment"

7.1.5 Attachment 5, "Palisades Sample Collection Forms and Records"

7.2 RECORDS

7.2.1 Distribution of Sample Collection Data Sheet as per Attachment 4.

7.2.2 All Radiological Environmental Monitoring Program Records shall be considered complete when the Annual Radiological Environmental Operating Report is submitted to the NRC. Records shall be retained in accordance with Palisades Administrative Procedure 10.46, "Plant Records."

PAL 950/24*03*10LP

ENVIRONMENTAL SAMPLE COLLECTION SCHEDULEProc No HP 10.10
Attachment 1
Revision 5
Page 1 of 2**Palisades Nuclear Plant**

<u>Exposure Pathway and/or Sample</u>	<u>Number of Samples and Locations*</u>	<u>Sample Type</u>	<u>Collection Frequency</u>
Airborne: Particulates	1 - Onsite 8 - Within a 10 km Radius 3 - 25 to 89 km Distant	Continuous at approximately 1 cfm (may be less due to dust loading)	Weekly
Iodines	Same as Particulates	Same as particulates	Weekly
Waterborne: Lake Water	1 - Intake 1 - Discharge 1 - Intake (Ludington Control)	Daily composite to obtain a two-gallon sample	Monthly
Drinking Water	1 - S Haven Municipal System - Raw 1 - S Haven Municipal System - Treated		
Well Water	6 - Plant Site Locations 1 - State Park 1 - Township park 1 - Ludington Control	Two-gallon grab sample	Monthly
Sediment	1 - Within 152.4 m of discharge (500 ft) 1 - 0.8 km North of discharge 1 - 0.8 km South of discharge 1 - 8.9 km North 1 - Ludington control (2 recommended)	One-liter grab sample	Semiannually
Ingestion: Milk	3 - From 5 to 13 km 1 - Control from 15 to 30 km	Two-gallon grab sample	Monthly

NOTE: If milk samples are unavailable, see Step 5.5.1c.

*If samples are unavailable at the specified location, an attempt should be made to sample at an alternate location (Refer to Step 4.5).

ENVIRONMENTAL SAMPLE COLLECTION SCHEDULE

Palisades Nuclear Plant

<u>Exposure Pathway and/or Sample</u>	<u>Number of Samples and Locations*</u>	<u>Sample Type</u>	<u>Collection Frequency</u>
Food Products	1 - Each of two principal fruit crops (blueberries and apples).	Two-pound grab sample	At time of harvest
Fish and Invertebrates	2 - Location in vicinity of Plant discharge 2 - Ludington control	One-liter fish flesh from each available species, two species required. Obtain the same species from the control location.	Twice in season
Direct: TLD	1 - Onsite 16 - Site boundary 9 - Within 12 km radius 3 - Control stations 1 - Control in lead cave (Contractor's House)	Continuous	Monthly Quarterly and Annually

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*If samples are unavailable at the specified location, an attempt should be made to sample at an alternate location (Refer to Step 4.5).

SAMPLE LOCATIONS
Palisades Nuclear Plant

Station	Code	Location	Air Particulates	Air Iodine	Lake Water	Well Water	Milk	Crops	Sediment	TLD	Fish
*1	ST	Palisades Nuclear Plant	Mounted onsite, 500 ft east of main gate. 25 ft south of access road next to well.	X	X	X	X		X	X	X
2	TH	RR 3 Coloma, MI 5.6 miles S	Along 48th Ave, 500 ft east of 80th St, 25 ft off north side of road.	X	X					X	
3	HS	76182 48th Ave Covert, MI 5.8 miles SSE	Along 48th Ave, 1/4 mile west of 76th St. In barnyard 50 yds off north side of road.	X	X					X	
4	JS	36197 M-140 Hwy Covert, MI 3-1/2 miles SE	Along 36th Ave, 1/2 mile east of M-140 15 ft off south side of road.	X	X			X		X	
5	PR	72723 CR 378 Covert, MI 3-1/2 miles ESE	Along CR 378, 3/4 mile east of M-140, 30 ft off north side of road.	X	X			X		X	
6	RB	RR 3 South Haven, MI 4-1/2 miles NE	Along 12th Ave, 1/4 mile west of M-43, 30 ft off south side of road.	X	X					X	
7	SD	Sherman Dairy South Haven, MI 6.5 miles NNE	Along Phoenix Rd, directly behind Sherman Dairy. 1/4 mile east of I-196 and Phoenix Rd on north side.	X	X						
7a	SN35	Emergency Siren 35 4-3/4 miles NNE	On Monroe Blvd.							X	
8	SP	State Park 1 mile N	Onsite along the dump road, north of Plant. One mile from main gate. Near State Park boundary, on side of road as road turns west.	X	X		X			X	

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*Plant Site Well #2 or #3

SAMPLE LOCATIONS
Palisades Nuclear Plant

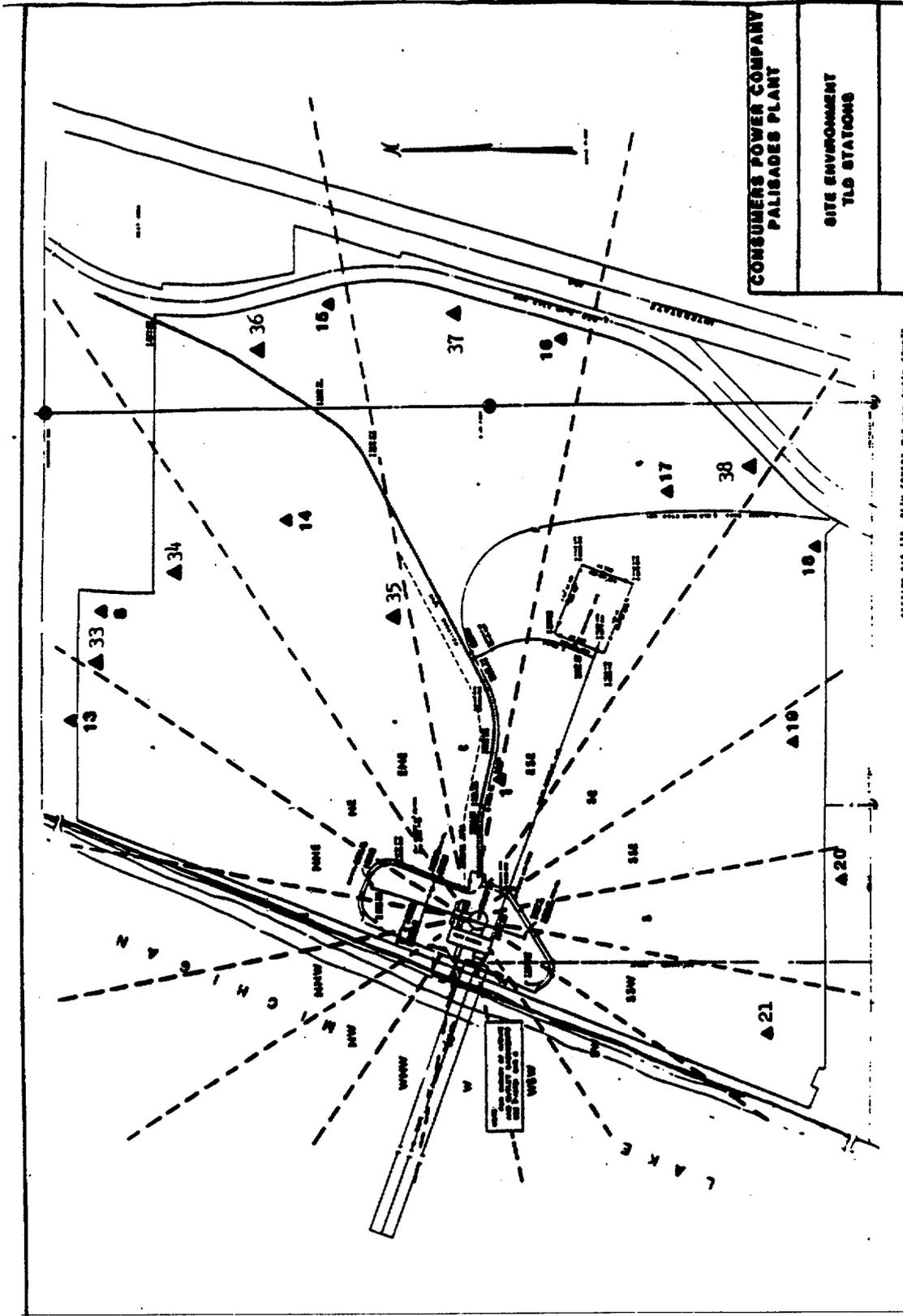
Station	Code	Location	Air Particulates	Air Iodine	Lake Water	Well Water	Milk	Crops	Sediment	TLD	Fish
9	TP	Covert Township Park 1.5 miles SSW	Along 32nd Ave, 1/4 mile west of Blue Star Hwy. 5 ft off south side of road.	X	X		X			X	
10	GR	Grand Rapids, MI 55 miles NNE	Control TLD and air sample.	X	X					X	
11	KZ	Kalamazoo, MI 35 miles E	Control TLD and air sample.	X	X					X	
12	DG	Dowagiac, MI 30 miles SSE	Control TLD and air sample.	X	X					X	
13	ST	Perimeter of Palisades	Past #8 along dump road. Proceed west up dune path at right of containment test structure. At first crest, turn north and proceed up adjacent hill to #13 at top (approx 50 yds from crest). Near State Park fence line.							X	
14	ST	Perimeter of Palisades	Along dump road to point where fence divides old Blue Star Hwy, 25 yds to east of road.							X	

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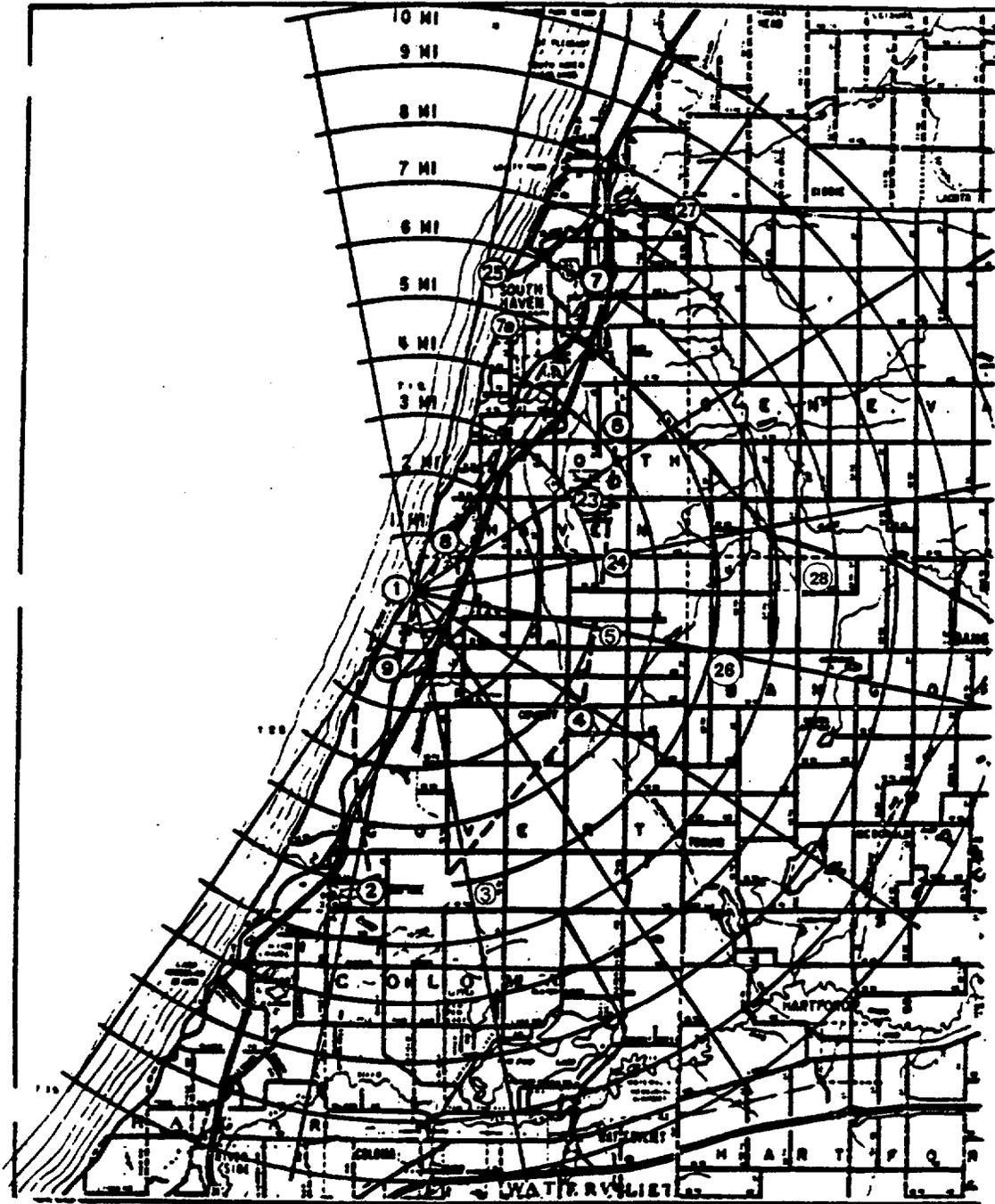
SAMPLE LOCATIONS
Palisades Nuclear Plant

Station	Code	Location	Air Particulates	Air Iodine	Lake Water	Well Water	Milk	Crops	Sediment	TLD	Fish
34	ST	Perimeter of Palisades Along dump road to area where fence divides old Blue Star Hwy, 25 yards east of road, near Station 14								X	
35	ST	Perimeter of Palisades Located on the main post directly across the storeroom, near Training Building								X	
36	ST	Perimeter of Palisades North along Blue Star Hwy, 0.9 miles from access road, 50 Ft off West side of road								X	
37	ST	Perimeter of Palisades North along Blue Star Hwy, 0.6 miles from access road, 50 Ft off West side of road								X	
38	ST	Perimeter of Palisades North along Blue Star Hwy, 0.15 miles from access road, near old RR spur, 50 Ft off West side of road								X	
39	ST	Plant Site Wells #7 or #9 (Warehouse)				X					
40	ST	Plant Site Wells #11, 12, 13 (Outage Building)				X					
41	ST	Plant Site Monitoring Well #14				X					
42	ST	Plant Site Monitoring Well #15				X					
43	ST	Plant Site Monitoring Well #16				X					

SAMPLE LOCATIONS
Palisades Nuclear Plant



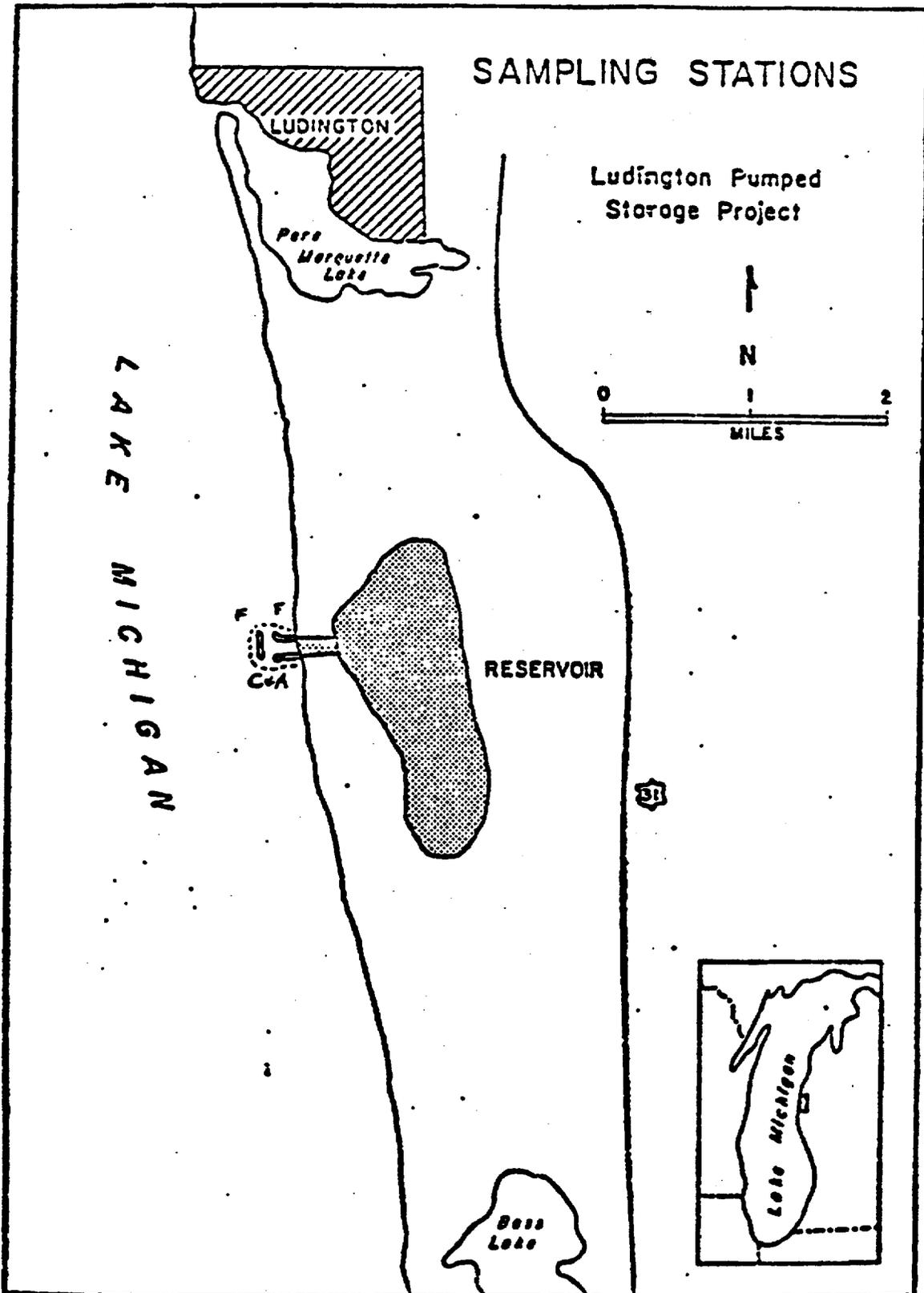
SAMPLE LOCATIONS
Palisades Nuclear Plant



NOT SHOWN (Control Locations)

- 10 Grand Rapids (55 mi NNE)
- 11 Kalamazoo (35 mi E)
- 12 Dowagiac (30 mi SSE)
- 22 Control TLD placed in lead cave at Location 4
- 29 William Shine (WS - 10 mi E)

SAMPLE LOCATIONS
Palisades Nuclear Plant

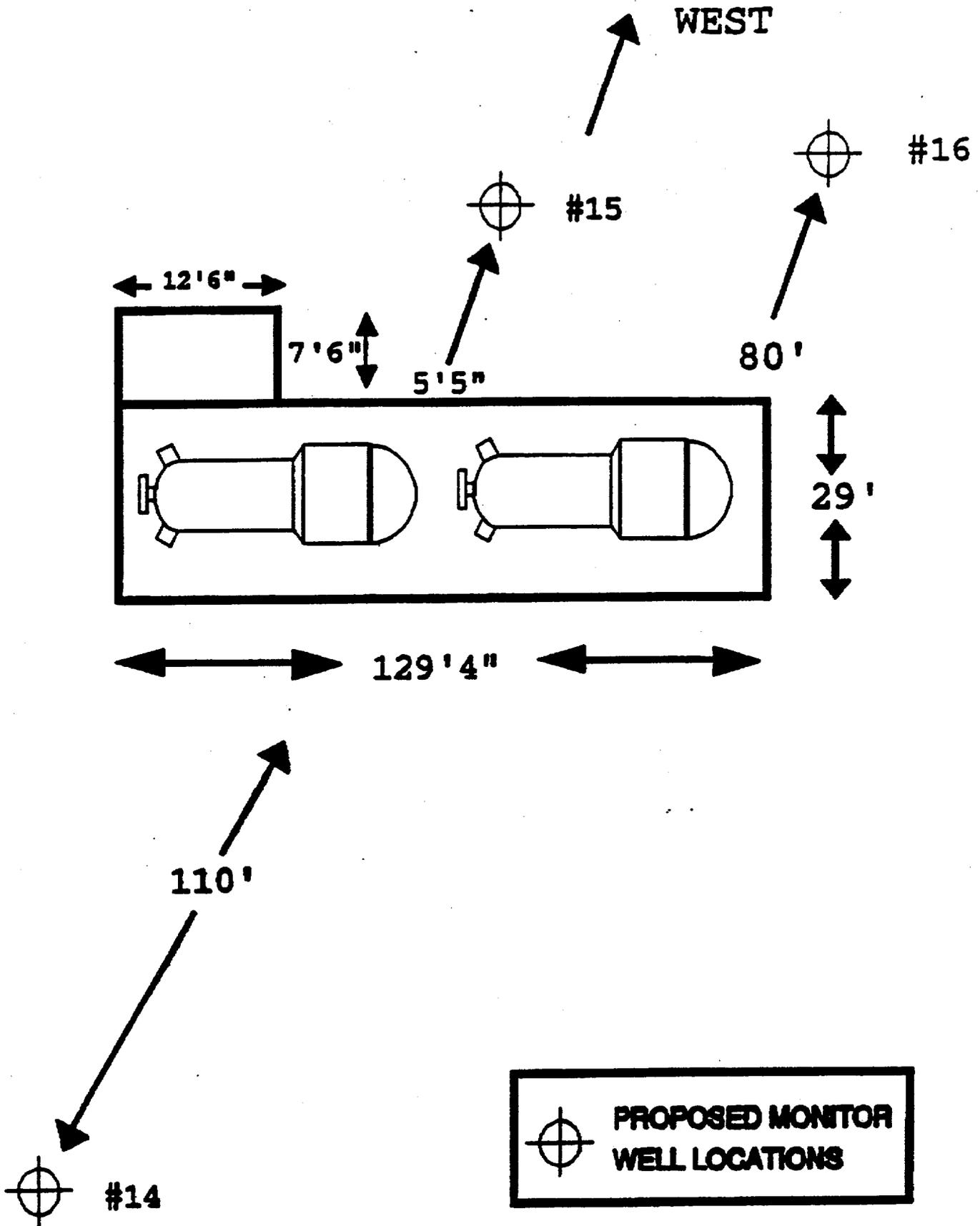


SAMPLE LOCATIONS
Palisades Nuclear Plant

<u>REMP SAMPLING</u>	<u>NUMBER</u>	<u>WELL STATUS</u>	<u>LOCATION</u>
NO	#1	Abandon	NA
YES	#2	In Service	North side of Support Building. Supports Plant site.
YES (Note 1)	#3	Active	Across from East-Radwaste (South Side) backup for well #2.
NO	#4	Abandon	NA
NO	#5	Abandon	NA
NO	#6	Active	Located ~ 145 ft west of Blue Star Hwy. Used for training trailers, well capped when not in service and well is outside of Westerly Groundwater Flow to Plant and interim storage facility.
YES	#7	In Service	Just to the west & between outage building and interim storage facility: Water is nonpotable and used in warehouse restrooms (later to be used for fire system only).
NO	#8	Abandon	NA
YES (Note 2)	#9	Active	Located at junction of access and warehouse road, domestic water supply for warehouse when it is put in service.
NO	#10	Abandon	NA
YES (Note 3)	#11 #12 #13	In Service In Service In Service	North of access road and east of construction road, supplies domestic water for outage building, all in one tie-in.
YES	#14	Active	East of Interim Storage Facility, used for REMP monitoring well.
YES	#15	Active	Southwest of Interim Storage Facility, used for REMP monitoring well.
YES	#16	Active	Northwest of Interim Storage Facility, used for REMP monitoring well.

- NOTES:**
1. When well #2 is out of service, well #3 is put in service with same sample point as well #2, only one sample required in combination of wells #2 and #3.
 2. Sample point will be same as well #7 (in warehouse restroom) when well is put in service.
 3. Wells #11, #12, and #13 all have a common line which supplies domestic water to outage building, only one sample required in conjunction with all 3 wells.

SAMPLE LOCATIONS
Palisades Nuclear Plant



SAMPLE PACKAGING AND SHIPMENT

1. Label samples clearly per Attachment 3.
2. Seal all liquid, biota, fish, and sediment sample containers with tape to prevent leakage.
3. Ship liquid samples separately from air particulate and air iodine samples and TLDs.
4. Use sufficient packing material (ie, crumpled newspaper) to avoid possible sample container damage during shipment.
5. Package air filters in glassine or plastic envelopes.
6. For TLD shipments, make sure that Laboratory contractor's own TLD data sheet is enclosed with package.
7. Ship milk samples as soon as possible. Be sure to add a sufficient amount of sodium bisulfite (40 grams) as preservative to each sample.
8. Ship food products as soon as possible after collection.
9. Ship fish and biota samples with a 10% formaldehyde solution added (preservative). Only 10 milliliters is required per sample. Samples should be shipped as soon as possible after processing.
10. Distribute copies of the Sample Collection Data Sheet(s) to the:

Analytical Laboratory
Radiological Services Department Environmental Contact (Palisades)
Sample Collector
11. Send samples to the following address:

Teledyne Brown Engineering Services Midwest Laboratory
Att: Laboratory Manager
700 Landwehr Road
Northbrook, IL 60062
12. Ship all samples to the Laboratory contractor with minimal delay after collection so as to avoid elevated analytical levels of detection.

PALISADES SAMPLE COLLECTION FORMS AND RECORDS

**PALISADES PLANT
 ENVIRONMENTAL MONITOR OPERABILITY CHECK
 AND SAMPLE COLLECTION**

			REMOVED TIME	GAS METER READING		METER SERIAL NO CAL DUE DATE	FLOW TEST				REPLACEMENT METER		SAMPLE VOL (Ft 3)	COMMENTS
	INSTALLED (MO/DA/YR)	REMOVED (MO/DA/YR)		INSTALLED (Ft 3)	REMOVED (Ft 3)		AS FOUND		AS LEFT		SERIAL NUMBER CAL DUE DATE	CALIB ACCURACY ACCEPTABLE		
							FLOW (SEC/Ft3)	LEAK (Y/N)	FLOW (SEC/Ft3)	LEAK (Y/N)				
1ST														
2TH														
3HS														
4JS														
5PR														
6RB														
7SD														
8SP														
9TP														
10GR														
11KZ														
12DG														

TEST PERFORMED BY: _____ DATE: _____

REVIEWED BY: _____ DATE: _____

PALISADES SAMPLE COLLECTION FORMS AND RECORDS

CONSUMERS ENERGY
 PALISADES ENVIRONMENTAL TLD REPORT

- MONTHLY
 QUARTERLY
 ANNUAL

Collector _____

STATION - LOCATION	INSTALLED		COLLECTED		REMARKS
	DATE	TIME	DATE	TIME	
C-1					
C-2					
ST22	ST				
ST5	PR				
ST6	RB				
ST24	SN21				
ST23	SN25				
ST7a	SN35				
ST16	ST				
ST15	ST				
ST1	ST				
ST14	ST				
ST8	SP				
ST13	ST				
ST17	ST				
ST18	ST				
ST19	ST				
ST20	ST				
ST21	ST				
ST9	TP				
ST12	DG				
ST3	HS				
ST2	TH				
ST4	JS				
ST10	GR				
ST11	KZ				
ST-33	ST				
ST-34	ST				
ST-35	ST				
ST-36	ST				
ST-37	ST				
ST-38	ST				
Date Received From Vendor (With Intransit TLDs) and Initials		Date TLDs Inventoried and Placed in Lead Cave (With Intransit TLDs) and Initials		Date TLDs Returned to Vendor For Analysis (With Intransit TLDs) and Initials	

ENCLOSURE D

**CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255**

**PALISADES NUCLEAR PLANT
1999 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT
1999 PALISADES FINAL MONTHLY PROGRESS REPORT**

48 Pages



TELEDYNE

**Brown Engineering
Environmental Services**

MIDWEST LABORATORY

700 LANDWEHR ROAD
NORTHBROOK, ILLINOIS 60062-2310
(847) 564-0700 FAX (847) 564-4517

MONTHLY PROGRESS REPORT
TO
CONSUMERS ENERGY COMPANY
JACKSON, MICHIGAN

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)
FOR
PALISADES NUCLEAR GENERATING PLANT

PREPARED AND SUBMITTED
BY
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES
MIDWEST LABORATORY

Project Number: 8022

Reporting Period: January - December, 1999

Reviewed and
Approved by



B. Grob
Technical Lead

Date 02-17-2000

Distribution: M. Grogan (1 copy)

PALISADES

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PALISADES

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1.0 INTRODUCTION

The following constitutes the final, 1999 Monthly Progress Report for the Radiological Environmental Monitoring Program conducted at the Consumers Energy Company, Palisades Nuclear Generating Plant. Results of completed analyses are presented in the attached tables

For gamma isotopic analyses, a spectrum is collected covering an energy range from 80 to 2048 KeV. Specifically included are Mn-54, Fe-59, Co-58, Co-60, Zn-65, Zr-95, Nb-95, I-131, Ba-La-140, Cs-134 and Cs-137. Naturally-occurring gamma-emitters, such as K-40 and Ra daughters, are frequently detected but not listed here. Data listed as "<" are at the 4.66 sigma level, others are 2 sigma.

All concentrations, except gross alpha and gross beta, are decay corrected to the time of collection.

All samples were collected within the scheduled period unless noted otherwise in the Listing of Missed Samples.

PALISADES

2.0 LISTING OF MISSED SAMPLES

Sample Type	Location	Expected Collection Date	Reason
Airborne Iodine	PA-9	04-26-99	
Airborne Iodine	PA-12	04-28-99	

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Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: 1ST - Palisades

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
<u>Required LLD</u>		<u>0.010</u>	<u>0.070</u>			<u>0.010</u>	<u>0.070</u>
01-05-99	379	0.021 ± 0.003	< 0.009	07-06-99	377	0.022 ± 0.003	< 0.009
01-11-99	312	0.029 ± 0.004	< 0.017	07-12-99	283	0.022 ± 0.003	< 0.016
01-18-99	360	0.029 ± 0.003	< 0.011	07-19-99	331	0.036 ± 0.004	< 0.020
01-25-99	351	0.020 ± 0.003	< 0.010	07-26-99	329	0.026 ± 0.003	< 0.009
02-01-99	351	0.026 ± 0.003	< 0.012	08-02-99	323	0.029 ± 0.004	< 0.008
02-08-99	351	0.025 ± 0.003	< 0.013	08-09-99	337	0.019 ± 0.003	< 0.010
02-15-99	354	0.021 ± 0.003	< 0.011	08-16-99	331	0.021 ± 0.003	< 0.014
02-22-99	354	0.019 ± 0.003	< 0.012	08-23-99	331	0.021 ± 0.003	< 0.007
03-01-99	348	0.025 ± 0.003	< 0.009	08-30-99	331	0.035 ± 0.004	< 0.021
03-08-99	357	0.022 ± 0.003	< 0.014	09-07-99	377	0.030 ± 0.003	< 0.007
03-15-99	354	0.023 ± 0.003	< 0.012	09-13-99	286	0.027 ± 0.004	< 0.015
03-22-99	351	0.021 ± 0.003	< 0.013	09-20-99	337	0.022 ± 0.003	< 0.006
03-29-99	348	0.018 ± 0.003	< 0.008	09-27-99	337	0.023 ± 0.003	< 0.015
1st Qtr. Mean ± s.d.		0.023 ± 0.004	< 0.017	3rd Qtr. Mean ± s.d.		0.026 ± 0.005	< 0.021
04-05-99	337	0.022 ± 0.003	< 0.010	10-04-99	343	0.018 ± 0.003	< 0.008
04-12-99	340	0.022 ± 0.003	< 0.013	10-11-99	337	0.031 ± 0.003	< 0.010
04-19-99	346	0.015 ± 0.003	< 0.013	10-18-99	346	0.027 ± 0.004	< 0.008
04-26-99	343	0.017 ± 0.003	< 0.011	10-25-99	346	0.015 ± 0.003	< 0.009
05-03-99	340	0.019 ± 0.003	< 0.007	11-01-99	340	0.053 ± 0.004	< 0.011
05-10-99	331	0.022 ± 0.003	< 0.009	11-08-99	346	0.027 ± 0.003	< 0.014
05-17-99	334	0.023 ± 0.003	< 0.007	11-15-99	317	0.046 ± 0.004	< 0.012
05-24-99	337	0.019 ± 0.003	< 0.013	11-22-99	346	0.039 ± 0.004	< 0.004
06-01-99	382	0.025 ± 0.003	< 0.013	11-29-99	346	0.037 ± 0.004	< 0.006
06-07-99	283	0.017 ± 0.003	< 0.010	12-06-99	343	0.030 ± 0.003	< 0.009
06-14-99	326	0.025 ± 0.004	< 0.011	12-13-99	348	0.029 ± 0.004	< 0.008
06-21-99	337	0.012 ± 0.003	< 0.013	12-20-99	354	0.030 ± 0.003	< 0.008
06-28-99	323	0.029 ± 0.003	< 0.015	12-27-99	354	0.033 ± 0.004	< 0.012
				01-03-00	351	0.029 ± 0.003	< 0.012
2nd Qtr. Mean ± s.d.		0.021 ± 0.005	< 0.015	4th Qtr. Mean ± s.d.		0.032 ± 0.010	< 0.014
Cumulative Average						0.025	
Previous Annual Average						0.024	

PALISADES

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
 Location: 2TH - Coloma (5.6 mi. S)
 Units: pCi/m³
 Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
<u>Required LLD</u>		<u>0.010</u>	<u>0.070</u>			<u>0.010</u>	<u>0.070</u>
01-05-99	425	0.024 ± 0.003	< 0.008	07-06-99	377	0.022 ± 0.003	< 0.009
01-11-99	309	0.030 ± 0.004	< 0.017	07-12-99	283	0.023 ± 0.003	< 0.016
01-18-99	363	0.033 ± 0.003	< 0.011	07-19-99	329	0.036 ± 0.004	< 0.021
01-25-99	346	0.020 ± 0.003	< 0.010	07-26-99	323	0.022 ± 0.003	< 0.010
02-01-99	360	0.029 ± 0.003	< 0.011	08-02-99	323	0.030 ± 0.004	< 0.008
02-08-99	351	0.020 ± 0.003	< 0.013	08-09-99	331	0.015 ± 0.003	< 0.010
02-15-99	360	0.023 ± 0.003	< 0.011	08-16-99	326	0.023 ± 0.003	< 0.014
02-22-99	357	0.022 ± 0.003	< 0.012	08-23-99	326	0.024 ± 0.003	< 0.007
03-01-99	354	0.021 ± 0.003	< 0.009	08-30-99	326	0.034 ± 0.004	< 0.021
03-08-99	363	0.022 ± 0.003	< 0.013	09-07-99	377	0.029 ± 0.003	< 0.007
03-15-99	360	0.023 ± 0.003	< 0.012	09-13-99	286	0.027 ± 0.003	< 0.015
03-22-99	357	0.021 ± 0.003	< 0.012	09-20-99	334	0.022 ± 0.003	< 0.006
03-29-99	354	0.019 ± 0.003	< 0.008	09-27-99	337	0.024 ± 0.003	< 0.015
1st Qtr. Mean ± s.d.		0.024 ± 0.004	< 0.017	3rd Qtr. Mean ± s.d.		0.025 ± 0.006	< 0.021
04-05-99	337	0.020 ± 0.003	< 0.010	10-04-99	337	0.021 ± 0.003	< 0.008
04-12-99	346	0.022 ± 0.003	< 0.013	10-11-99	337	0.029 ± 0.003	< 0.010
04-19-99	351	0.014 ± 0.003	< 0.013	10-18-99	340	0.022 ± 0.004	< 0.009
04-26-99	346	0.018 ± 0.003	< 0.011	10-25-99	343	0.015 ± 0.003	< 0.009
05-03-99	343	0.020 ± 0.003	< 0.007	11-01-99	337	0.056 ± 0.004	< 0.011
05-10-99	337	0.018 ± 0.003	< 0.009	11-08-99	343	0.025 ± 0.003	< 0.014
05-17-99	337	0.022 ± 0.003	< 0.007	11-15-99	340	0.045 ± 0.004	< 0.011
05-24-99	334	0.019 ± 0.003	< 0.013	11-22-99	346	0.037 ± 0.004	< 0.004
06-01-99	385	0.024 ± 0.003	< 0.013	11-29-99	346	0.039 ± 0.004	< 0.006
06-07-99	283	0.016 ± 0.003	< 0.010	12-06-99	346	0.031 ± 0.003	< 0.008
06-14-99	329	0.023 ± 0.003	< 0.011	12-13-99	343	0.034 ± 0.004	< 0.008
06-21-99	337	0.011 ± 0.003	< 0.013	12-20-99	354	0.029 ± 0.003	< 0.008
06-28-99	320	0.027 ± 0.003	< 0.015	12-27-99	354	0.031 ± 0.004	< 0.012
				01-03-00	351	0.028 ± 0.003	< 0.012
2nd Qtr. Mean ± s.d.		0.020 ± 0.004	< 0.015	4th Qtr. Mean ± s.d.		0.032 ± 0.010	< 0.014
Cumulative Average						0.025	
Previous Annual Average						0.025	

PALISADES

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
 Location: 3HS - Covert (5.8 mi. SE)
 Units: pCi/m³
 Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
<u>Required LLD</u>		<u>0.010</u>	<u>0.070</u>			<u>0.010</u>	<u>0.070</u>
01-05-99	411	0.025 ± 0.003	< 0.009	07-06-99	363	0.022 ± 0.003	< 0.009
01-11-99	306	0.031 ± 0.004	< 0.017	07-12-99	278	0.022 ± 0.003	< 0.016
01-18-99	351	0.032 ± 0.003	< 0.011	07-19-99	320	0.033 ± 0.003	< 0.021
01-25-99	346	0.020 ± 0.003	< 0.010	07-26-99	317	0.026 ± 0.003	< 0.010
02-01-99	331	0.031 ± 0.003	< 0.013	08-02-99	312	0.029 ± 0.004	< 0.008
02-08-99	343	0.020 ± 0.003	< 0.013	08-09-99	323	0.018 ± 0.003	< 0.010
02-15-99	348	0.020 ± 0.003	< 0.011	08-16-99	320	0.021 ± 0.003	< 0.015
02-22-99	346	0.021 ± 0.003	< 0.012	08-23-99	320	0.027 ± 0.004	< 0.007
03-01-99	348	0.023 ± 0.003	< 0.009	08-30-99	317	0.035 ± 0.004	< 0.022
03-08-99	348	0.022 ± 0.003	< 0.014	09-07-99	363	0.030 ± 0.003	< 0.008
03-15-99	348	0.022 ± 0.003	< 0.012	09-13-99	280	0.026 ± 0.004	< 0.015
03-22-99	343	0.023 ± 0.003	< 0.013	09-20-99	323	0.020 ± 0.003	< 0.006
03-29-99	343	0.015 ± 0.003	< 0.008	09-27-99	326	0.024 ± 0.004	< 0.016
1st Qtr. Mean ± s.d.		0.023 ± 0.005	< 0.017	3rd Qtr. Mean ± s.d.		0.026 ± 0.005	< 0.022
04-05-99	326	0.021 ± 0.003	< 0.010	10-04-99	329	0.018 ± 0.003	< 0.008
04-12-99	337	0.019 ± 0.003	< 0.013	10-11-99	329	0.030 ± 0.003	< 0.011
04-19-99	340	0.014 ± 0.003	< 0.013	10-18-99	326	0.023 ± 0.004	< 0.009
04-26-99	334	0.019 ± 0.003	< 0.011	10-25-99	334	0.014 ± 0.003	< 0.009
05-03-99	331	0.021 ± 0.003	< 0.007	11-01-99	329	0.054 ± 0.004	< 0.011
05-10-99	329	0.021 ± 0.003	< 0.009	11-08-99	331	0.027 ± 0.004	< 0.015
05-17-99	329	0.024 ± 0.003	< 0.007	11-15-99	329	0.044 ± 0.004	< 0.012
05-24-99	326	0.021 ± 0.003	< 0.013	11-22-99	334	0.040 ± 0.004	< 0.005
06-01-99	377	0.024 ± 0.003	< 0.013	11-29-99	337	0.043 ± 0.004	< 0.007
06-07-99	275	0.018 ± 0.004	< 0.011	12-06-99	334	0.030 ± 0.003	< 0.009
06-14-99	320	0.026 ± 0.004	< 0.011	12-13-99	340	0.033 ± 0.004	< 0.008
06-21-99	329	0.013 ± 0.003	< 0.013	12-20-99	343	0.031 ± 0.003	< 0.008
06-28-99	317	0.031 ± 0.003	< 0.016	12-27-99	346	0.032 ± 0.004	< 0.012
				01-03-00	340	0.028 ± 0.003	< 0.012
2nd Qtr. Mean ± s.d.		0.021 ± 0.005	< 0.016	4th Qtr. Mean ± s.d.		0.032 ± 0.011	< 0.015
Cumulative Average						0.026	
Previous Annual Average						0.024	

PALISADES

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
 Location: 4JS - Covert (3.5 mi. SE)
 Units: pCi/m³
 Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
<u>Required LLD</u>		<u>0.010</u>	<u>0.070</u>			<u>0.010</u>	<u>0.070</u>
01-05-99	422	0.025 ± 0.003	< 0.008	07-06-99	377	0.022 ± 0.003	< 0.009
01-11-99	323	0.030 ± 0.004	< 0.016	07-12-99	272	0.023 ± 0.003	< 0.016
01-18-99	368	0.031 ± 0.003	< 0.011	07-19-99	331	0.031 ± 0.003	< 0.020
01-25-99	368	0.019 ± 0.003	< 0.010	07-26-99	323	0.020 ± 0.003	< 0.010
02-01-99	354	0.030 ± 0.003	< 0.012	08-02-99	326	0.029 ± 0.004	< 0.008
02-08-99	360	0.025 ± 0.003	< 0.013	08-09-99	331	0.019 ± 0.003	< 0.010
02-15-99	363	0.020 ± 0.003	< 0.011	08-16-99	331	0.022 ± 0.003	< 0.014
02-22-99	360	0.018 ± 0.003	< 0.012	08-23-99	329	0.024 ± 0.003	< 0.007
03-01-99	363	0.025 ± 0.003	< 0.009	08-30-99	329	0.033 ± 0.004	< 0.021
03-08-99	363	0.024 ± 0.003	< 0.013	09-07-99	377	0.028 ± 0.003	< 0.007
03-15-99	363	0.024 ± 0.003	< 0.012	09-13-99	289	0.027 ± 0.003	< 0.015
03-22-99	360	0.022 ± 0.003	< 0.012	09-20-99	334	0.021 ± 0.003	< 0.006
03-29-99	357	0.016 ± 0.003	< 0.008	09-27-99	343	0.023 ± 0.003	< 0.015
1st Qtr. Mean ± s.d.		0.024 ± 0.005	< 0.016	3rd Qtr. Mean ± s.d.		0.025 ± 0.004	< 0.021
04-05-99	343	0.022 ± 0.003	< 0.010	10-04-99	343	0.019 ± 0.003	< 0.008
04-12-99	351	0.021 ± 0.003	< 0.013	10-11-99	343	0.029 ± 0.003	< 0.010
04-19-99	351	0.014 ± 0.003	< 0.013	10-18-99	346	0.023 ± 0.004	< 0.008
04-26-99	351	0.019 ± 0.003	< 0.011	10-25-99	348	0.017 ± 0.003	< 0.009
05-03-99	348	0.019 ± 0.003	< 0.007	11-01-99	346	0.051 ± 0.004	< 0.011
05-10-99	340	0.020 ± 0.003	< 0.008	11-08-99	348	0.025 ± 0.003	< 0.014
05-17-99	340	0.023 ± 0.003	< 0.007	11-15-99	348	0.042 ± 0.004	< 0.011
05-24-99	343	0.020 ± 0.003	< 0.013	11-22-99	351	0.039 ± 0.004	< 0.004
06-01-99	385	0.024 ± 0.003	< 0.013	11-29-99	357	0.034 ± 0.004	< 0.006
06-07-99	286	0.016 ± 0.003	< 0.010	12-06-99	354	0.029 ± 0.003	< 0.008
06-14-99	331	0.025 ± 0.004	< 0.011	12-13-99	357	0.035 ± 0.004	< 0.008
06-21-99	340	0.011 ± 0.003	< 0.013	12-20-99	363	0.029 ± 0.003	< 0.007
06-28-99	326	0.029 ± 0.003	< 0.015	12-27-99	365	0.030 ± 0.004	< 0.012
				01-03-00	360	0.030 ± 0.003	< 0.011
2nd Qtr. Mean ± s.d.		0.020 ± 0.005	< 0.015	4th Qtr. Mean ± s.d.		0.031 ± 0.009	< 0.014
Cumulative Average						0.025	
Previous Annual Average						0.023	

PALISADES

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: 5PR - Covert (3.5 mi. ESE)

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
<u>Required LLD</u>		<u>0.010</u>	<u>0.070</u>			<u>0.010</u>	<u>0.070</u>
01-05-99	422	0.021 ± 0.003	< 0.008	07-06-99	382	0.021 ± 0.003	< 0.009
01-11-99	320	0.031 ± 0.004	< 0.016	07-12-99	283	0.025 ± 0.003	< 0.016
01-18-99	368	0.030 ± 0.003	< 0.011	07-19-99	334	0.031 ± 0.003	< 0.020
01-25-99	360	0.018 ± 0.003	< 0.010	07-26-99	331	0.023 ± 0.003	< 0.009
02-01-99	363	0.030 ± 0.003	< 0.011	08-02-99	306	0.027 ± 0.004	< 0.008
02-08-99	363	0.024 ± 0.003	< 0.012	08-09-99	323	0.018 ± 0.003	< 0.010
02-15-99	365	0.024 ± 0.003	< 0.011	08-16-99	326	0.023 ± 0.003	< 0.014
02-22-99	360	0.020 ± 0.003	< 0.012	08-23-99	323	0.022 ± 0.003	< 0.007
03-01-99	365	0.022 ± 0.003	< 0.009	08-30-99	320	0.033 ± 0.004	< 0.022
03-08-99	365	0.022 ± 0.003	< 0.013	09-07-99	371	0.028 ± 0.003	< 0.007
03-15-99	368	0.022 ± 0.003	< 0.011	09-13-99	280	0.029 ± 0.004	< 0.015
03-22-99	363	0.022 ± 0.003	< 0.012	09-20-99	326	0.022 ± 0.003	< 0.006
03-29-99	360	0.016 ± 0.003	< 0.008	09-27-99	331	0.027 ± 0.004	< 0.015
1st Qtr. Mean ± s.d.		0.023 ± 0.005	< 0.016	3rd Qtr. Mean ± s.d.		0.025 ± 0.004	< 0.022
04-05-99	346	0.022 ± 0.003	< 0.009	10-04-99	331	0.019 ± 0.003	< 0.008
04-12-99	354	0.020 ± 0.003	< 0.013	10-11-99	331	0.029 ± 0.003	< 0.011
04-19-99	357	0.014 ± 0.003	< 0.013	10-18-99	334	0.021 ± 0.004	< 0.009
04-26-99	354	0.017 ± 0.003	< 0.011	10-25-99	337	0.014 ± 0.003	< 0.009
05-03-99	351	0.018 ± 0.003	< 0.007	11-01-99	334	0.056 ± 0.004	< 0.011
05-10-99	343	0.018 ± 0.003	< 0.008	11-08-99	340	0.027 ± 0.004	< 0.014
05-17-99	346	0.022 ± 0.003	< 0.007	11-15-99	334	0.045 ± 0.004	< 0.012
05-24-99	343	0.018 ± 0.003	< 0.013	11-22-99	343	0.040 ± 0.004	< 0.004
06-01-99	388	0.023 ± 0.003	< 0.012	11-29-99	340	0.034 ± 0.004	< 0.006
06-07-99	292	0.016 ± 0.003	< 0.010	12-06-99	346	0.029 ± 0.003	< 0.008
06-14-99	334	0.024 ± 0.003	< 0.010	12-13-99	348	0.032 ± 0.004	< 0.008
06-21-99	346	0.012 ± 0.003	< 0.013	12-20-99	351	0.031 ± 0.003	< 0.008
06-28-99	329	0.028 ± 0.003	< 0.015	12-27-99	354	0.031 ± 0.003	< 0.012
				01-03-00	348	0.028 ± 0.003	< 0.012
2nd Qtr. Mean ± s.d.		0.019 ± 0.004	< 0.015	4th Qtr. Mean ± s.d.		0.031 ± 0.011	< 0.014
Cumulative Average						0.025	
Previous Annual Average						0.024	

PALISADES

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: 6RB - South Haven (4.75 mi. NE)

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
<u>Required LLD</u>		<u>0.010</u>	<u>0.070</u>			<u>0.010</u>	<u>0.070</u>
01-05-99	413	0.023 ± 0.003	< 0.009	07-06-99	371	0.021 ± 0.003	< 0.009
01-11-99	314	0.026 ± 0.003	< 0.017	07-12-99	280	0.023 ± 0.003	< 0.016
01-18-99	357	0.029 ± 0.003	< 0.011	07-19-99	326	0.033 ± 0.003	< 0.020
01-25-99	351	0.019 ± 0.003	< 0.010	07-26-99	326	0.023 ± 0.003	< 0.010
02-01-99	351	0.029 ± 0.003	< 0.012	08-02-99	320	0.029 ± 0.004	< 0.008
02-08-99	354	0.021 ± 0.003	< 0.013	08-09-99	329	0.017 ± 0.003	< 0.010
02-15-99	354	0.020 ± 0.003	< 0.011	08-16-99	329	0.021 ± 0.003	< 0.014
02-22-99	363	0.019 ± 0.003	< 0.012	08-23-99	326	0.023 ± 0.003	< 0.007
03-01-99	351	0.023 ± 0.003	< 0.009	08-30-99	326	0.033 ± 0.004	< 0.021
03-08-99	360	0.022 ± 0.003	< 0.014	09-07-99	374	0.029 ± 0.003	< 0.007
03-15-99	357	0.023 ± 0.003	< 0.012	09-13-99	286	0.027 ± 0.003	< 0.015
03-22-99	351	0.020 ± 0.003	< 0.013	09-20-99	331	0.022 ± 0.003	< 0.006
03-29-99	351	0.017 ± 0.003	< 0.008	09-27-99	340	0.024 ± 0.003	< 0.015
1st Qtr. Mean ± s.d.		0.022 ± 0.004	< 0.017	3rd Qtr. Mean ± s.d.		0.025 ± 0.005	< 0.021
04-05-99	334	0.021 ± 0.003	< 0.010	10-04-99	340	0.019 ± 0.003	< 0.008
04-12-99	343	0.020 ± 0.003	< 0.013	10-11-99	340	0.030 ± 0.003	< 0.010
04-19-99	343	0.015 ± 0.003	< 0.013	10-18-99	340	0.022 ± 0.004	< 0.009
04-26-99	343	0.017 ± 0.003	< 0.011	10-25-99	346	0.014 ± 0.003	< 0.009
05-03-99	337	0.018 ± 0.003	< 0.007	11-01-99	340	0.054 ± 0.004	< 0.011
05-10-99	334	0.019 ± 0.003	< 0.009	11-08-99	348	0.026 ± 0.003	< 0.014
05-17-99	329	0.020 ± 0.003	< 0.007	11-15-99	340	0.044 ± 0.004	< 0.011
05-24-99	331	0.018 ± 0.003	< 0.013	11-22-99	348	0.033 ± 0.003	< 0.004
06-01-99	377	0.024 ± 0.003	< 0.013	11-29-99	348	0.036 ± 0.004	< 0.006
06-07-99	283	0.014 ± 0.003	< 0.010	12-06-99	351	0.029 ± 0.003	< 0.008
06-14-99	323	0.024 ± 0.004	< 0.011	12-13-99	351	0.031 ± 0.004	< 0.008
06-21-99	334	0.015 ± 0.003	< 0.013	12-20-99	357	0.029 ± 0.003	< 0.008
06-28-99	317	0.028 ± 0.003	< 0.016	12-27-99	357	0.030 ± 0.003	< 0.012
				01-03-00	351	0.028 ± 0.003	< 0.012
2nd Qtr. Mean ± s.d.		0.019 ± 0.004	< 0.016	4th Qtr. Mean ± s.d.		0.030 ± 0.010	< 0.014
Cumulative Average						0.024	
Previous Annual Average						0.023	

PALISADES

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
 Location: 7SD - South Haven (6.5 mi. NNE)
 Units: pCi/m³
 Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
<u>Required LLD</u>		<u>0.010</u>	<u>0.070</u>			<u>0.010</u>	<u>0.070</u>
01-05-99	382	0.023 ± 0.003	< 0.005	07-06-99	329	0.021 ± 0.003	< 0.013
01-11-99	289	0.030 ± 0.004	< 0.014	07-12-99	252	0.026 ± 0.004	< 0.012
01-18-99	331	0.032 ± 0.003	< 0.010	07-19-99	289	0.035 ± 0.004	< 0.023
01-25-99	323	0.020 ± 0.002	< 0.011	07-26-99	286	0.024 ± 0.003	< 0.011
02-01-99	323	0.031 ± 0.004	< 0.007	08-02-99	286	0.029 ± 0.004	< 0.008
02-08-99	326	0.025 ± 0.003	< 0.011	08-09-99	292	0.018 ± 0.003	< 0.011
02-15-99	326	0.025 ± 0.003	< 0.010	08-16-99	286	0.023 ± 0.003	< 0.008
02-22-99	323	0.023 ± 0.003	< 0.009	08-23-99	289	0.027 ± 0.004	< 0.014
03-01-99	323	0.025 ± 0.004	< 0.005	08-30-99	286	0.034 ± 0.004	< 0.017
03-08-99	329	0.021 ± 0.003	< 0.006	09-07-99	329	0.030 ± 0.003	< 0.010
03-15-99	329	0.023 ± 0.003	< 0.007	09-13-99	249	0.028 ± 0.004	< 0.025
03-22-99	323	0.021 ± 0.003	< 0.011	09-20-99	292	0.024 ± 0.003	< 0.015
03-29-99	323	0.017 ± 0.003	< 0.007	09-27-99	295	0.028 ± 0.004	< 0.017
1st Qtr. Mean ± s.d.		0.024 ± 0.004	< 0.014	3rd Qtr. Mean ± s.d.		0.027 ± 0.005	< 0.025
04-05-99	306	0.024 ± 0.003	< 0.014	10-04-99	295	0.024 ± 0.004	< 0.010
04-12-99	317	0.023 ± 0.003	< 0.010	10-11-99	295	0.030 ± 0.004	< 0.009
04-19-99	317	0.018 ± 0.003	< 0.014	10-18-99	295	0.022 ± 0.004	< 0.012
04-26-99	314	0.016 ± 0.003	< 0.008	10-25-99	300	0.015 ± 0.003	< 0.008
05-03-99	309	0.019 ± 0.003	< 0.015	11-01-99	292	0.055 ± 0.005	< 0.006
05-10-99	306	0.021 ± 0.003	< 0.017	11-08-99	300	0.028 ± 0.004	< 0.015
05-17-99	303	0.020 ± 0.004	< 0.005	11-15-99	295	0.044 ± 0.004	< 0.013
05-24-99	303	0.022 ± 0.003	< 0.008	11-22-99	334	0.036 ± 0.004	< 0.017
06-01-99	346	0.025 ± 0.003	< 0.005	11-29-99	351	0.036 ± 0.004	< 0.011
06-07-99	258	0.015 ± 0.004	< 0.011	12-06-99	351	0.028 ± 0.003	< 0.012
06-14-99	289	0.025 ± 0.004	< 0.010	12-13-99	354	0.041 ± 0.004	< 0.012
06-21-99	303	0.015 ± 0.003	< 0.010	12-20-99	360	0.028 ± 0.003	< 0.011
06-28-99	289	0.027 ± 0.003	< 0.007	12-27-99	363	0.032 ± 0.004	< 0.012
				01-03-00	360	0.035 ± 0.003	< 0.011
2nd Qtr. Mean ± s.d.		0.021 ± 0.004	< 0.017	4th Qtr. Mean ± s.d.		0.032 ± 0.010	< 0.017
				Cumulative Average		0.026	
				Previous Annual Average		0.024	

PALISADES

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
 Location: 8SP - State Park (1.0 mi. N)
 Units: pCi/m³
 Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
<u>Required LLD</u>		<u>0.010</u>	<u>0.070</u>			<u>0.010</u>	<u>0.070</u>
01-05-99	354	0.024 ± 0.003	< 0.005	07-06-99	314	0.018 ± 0.003	< 0.014
01-11-99	263	0.031 ± 0.004	< 0.016	07-12-99	229	0.024 ± 0.004	< 0.013
01-18-99	303	0.033 ± 0.004	< 0.011	07-19-99	275	0.038 ± 0.004	< 0.024
01-25-99	295	0.017 ± 0.003	< 0.012	07-26-99	272	0.026 ± 0.004	< 0.012
02-01-99	295	0.029 ± 0.004	< 0.008	08-02-99	266	0.029 ± 0.004	< 0.009
02-08-99	297	0.022 ± 0.004	< 0.012	08-09-99	278	0.017 ± 0.003	< 0.012
02-15-99	292	0.023 ± 0.003	< 0.011	08-16-99	272	0.023 ± 0.003	< 0.009
02-22-99	295	0.023 ± 0.003	< 0.010	08-23-99	278	0.023 ± 0.004	< 0.014
03-01-99	295	0.023 ± 0.004	< 0.005	08-30-99	269	0.034 ± 0.004	< 0.018
03-08-99	297	0.025 ± 0.004	< 0.006	09-07-99	309	0.029 ± 0.004	< 0.011
03-15-99	297	0.023 ± 0.003	< 0.008	09-13-99	238	0.027 ± 0.004	< 0.026
03-22-99	289	0.024 ± 0.003	< 0.013	09-20-99	278	0.021 ± 0.003	< 0.016
03-29-99	292	0.019 ± 0.004	< 0.008	09-27-99	269	0.023 ± 0.004	< 0.019
1st Qtr. Mean ± s.d.		0.024 ± 0.004	< 0.016	3rd Qtr. Mean ± s.d.		0.026 ± 0.006	< 0.026
04-05-99	278	0.022 ± 0.003	< 0.015	10-04-99	323	0.018 ± 0.003	< 0.009
04-12-99	286	0.024 ± 0.003	< 0.011	10-11-99	323	0.027 ± 0.003	< 0.008
04-19-99	292	0.017 ± 0.003	< 0.015	10-18-99	326	0.020 ± 0.004	< 0.011
04-26-99	286	0.018 ± 0.004	< 0.009	10-25-99	329	0.015 ± 0.003	< 0.007
05-03-99	283	0.017 ± 0.003	< 0.016	11-01-99	326	0.053 ± 0.004	< 0.006
05-10-99	278	0.022 ± 0.003	< 0.019	11-08-99	329	0.026 ± 0.004	< 0.014
05-17-99	275	0.020 ± 0.004	< 0.005	11-15-99	326	0.045 ± 0.004	< 0.012
05-24-99	283	0.020 ± 0.003	< 0.009	11-22-99	331	0.040 ± 0.004	< 0.017
06-01-99	317	0.028 ± 0.003	< 0.005	11-29-99	329	0.035 ± 0.004	< 0.012
06-07-99	238	0.015 ± 0.004	< 0.012	12-06-99	334	0.031 ± 0.003	< 0.013
06-14-99	275	0.026 ± 0.004	< 0.011	12-13-99	334	0.031 ± 0.004	< 0.013
06-21-99	283	0.016 ± 0.003	< 0.011	12-20-99	340	0.031 ± 0.003	< 0.012
06-28-99	269	0.028 ± 0.004	< 0.007	12-27-99	340	0.031 ± 0.004	< 0.012
				01-03-00	337	0.030 ± 0.003	< 0.012
2nd Qtr. Mean ± s.d.		0.021 ± 0.004	< 0.019	4th Qtr. Mean ± s.d.		0.031 ± 0.010	< 0.017
				Cumulative Average		0.026	
				Previous Annual Average		0.025	

PALISADES

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
 Location: 9TP - Covert Township Park (1.5 mi. SSW)
 Units: pCi/m³
 Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
<u>Required LLD</u>		<u>0.010</u>	<u>0.070</u>			<u>0.010</u>	<u>0.070</u>
01-05-99	405	0.029 ± 0.003	< 0.004	07-06-99	374	0.020 ± 0.003	< 0.012
01-11-99	306	0.030 ± 0.003	< 0.014	07-12-99	269	0.023 ± 0.003	< 0.011
01-18-99	348	0.031 ± 0.003	< 0.009	07-19-99	326	0.034 ± 0.004	< 0.020
01-25-99	346	0.019 ± 0.003	< 0.010	07-26-99	320	0.023 ± 0.003	< 0.010
02-01-99	340	0.028 ± 0.003	< 0.007	08-02-99	320	0.027 ± 0.004	< 0.008
02-08-99	348	0.022 ± 0.003	< 0.011	08-09-99	329	0.017 ± 0.003	< 0.010
02-15-99	348	0.019 ± 0.003	< 0.009	08-16-99	317	0.022 ± 0.003	< 0.007
02-22-99	346	0.023 ± 0.003	< 0.008	08-23-99	326	0.022 ± 0.003	< 0.012
03-01-99	340	0.025 ± 0.003	< 0.005	08-30-99	326	0.031 ± 0.004	< 0.015
03-08-99	343	0.023 ± 0.003	< 0.005	09-07-99	374	0.029 ± 0.003	< 0.009
03-15-99	343	0.028 ± 0.003	< 0.007	09-13-99	286	0.026 ± 0.003	< 0.022
03-22-99	337	0.022 ± 0.003	< 0.011	09-20-99	331	0.021 ± 0.003	< 0.013
03-29-99	340	0.016 ± 0.003	< 0.007	09-27-99	337	0.022 ± 0.003	< 0.015
1st Qtr. Mean ± s.d.		0.024 ± 0.005	< 0.014	3rd Qtr. Mean ± s.d.		0.024 ± 0.005	< 0.022
04-05-99	326	0.021 ± 0.003	< 0.013	10-04-99	334	0.022 ± 0.004	< 0.009
04-12-99	331	0.024 ± 0.003	< 0.009	10-11-99	334	0.029 ± 0.003	< 0.008
04-19-99	337	0.016 ± 0.003	< 0.013	10-18-99	337	0.024 ± 0.004	< 0.011
04-26-99	331	0.017 ± 0.003	< 0.011	10-25-99	323	0.014 ± 0.003	< 0.007
05-03-99	331	0.020 ± 0.003	NS ^a	11-01-99	337	0.056 ± 0.004	< 0.006
05-10-99	323	0.017 ± 0.003	< 0.016	11-08-99	340	0.026 ± 0.003	< 0.013
05-17-99	326	0.022 ± 0.003	< 0.004	11-15-99	337	0.047 ± 0.004	< 0.012
05-24-99	329	0.020 ± 0.003	< 0.007	11-22-99	295	0.039 ± 0.004	< 0.019
06-01-99	374	0.022 ± 0.003	< 0.004	11-29-99	286	0.039 ± 0.004	< 0.013
06-07-99	280	0.014 ± 0.003	< 0.011	12-06-99	280	0.031 ± 0.004	< 0.015
06-14-99	326	0.022 ± 0.003	< 0.010	12-13-99	283	0.035 ± 0.004	< 0.016
06-21-99	331	0.015 ± 0.003	< 0.010	12-20-99	289	0.033 ± 0.004	< 0.014
06-28-99	323	0.026 ± 0.003	< 0.007	12-27-99	286	0.033 ± 0.004	< 0.015
				01-03-00	283	0.030 ± 0.004	< 0.014
2nd Qtr. Mean ± s.d.		0.020 ± 0.004	< 0.016	4th Qtr. Mean ± s.d.		0.033 ± 0.011	< 0.019
Cumulative Average						0.025	
Previous Annual Average						0.023	

^aNS=No sample; Sample collected but lost in transit.

PALISADES

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
 Location: 10GR - Grand Rapids (55 mi. NNE)
 Units: pCi/m³
 Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
		<u>0.010</u>	<u>0.070</u>			<u>0.010</u>	<u>0.070</u>
<u>Required LLD</u>							
01-07-99	368	0.023 ± 0.003	< 0.015	07-08-99	317	0.023 ± 0.003	< 0.014
01-14-99	354	0.029 ± 0.003	< 0.013	07-15-99	326	0.025 ± 0.003	< 0.029
01-21-99	363	0.026 ± 0.003	< 0.014	07-22-99	320	0.030 ± 0.003	< 0.014
01-28-99	351	0.020 ± 0.003	< 0.010	07-29-99	329	0.023 ± 0.003	< 0.010
02-04-99	348	0.025 ± 0.003	< 0.015	08-05-99	317	0.022 ± 0.004	< 0.015
02-11-99	346	0.024 ± 0.003	< 0.013	08-12-99	329	0.020 ± 0.003	< 0.010
02-18-99	354	0.019 ± 0.003	< 0.011	08-19-99	329	0.021 ± 0.003	< 0.017
02-25-99	357	0.038 ± 0.003	< 0.006	08-26-99	329	0.025 ± 0.003	< 0.020
				09-02-99	326	0.027 ± 0.003	< 0.016
03-04-99	351	0.016 ± 0.003	< 0.007				
03-11-99	360	0.021 ± 0.003	< 0.009	09-09-99	320	0.032 ± 0.004	< 0.028
03-18-99	348	0.023 ± 0.003	< 0.015	09-16-99	331	0.023 ± 0.003	< 0.018
03-26-99	394	0.017 ± 0.003	< 0.007	09-23-99	334	0.018 ± 0.003	< 0.022
04-01-99	292	0.023 ± 0.004	< 0.020	09-30-99	331	0.030 ± 0.003	< 0.013
1st Qtr. Mean ± s.d.		0.023 ± 0.006	< 0.020	3rd Qtr. Mean ± s.d.		0.025 ± 0.004	< 0.029
04-08-99	326	0.019 ± 0.003	< 0.013	10-07-99	340	0.019 ± 0.003	< 0.011
04-15-99	348	0.022 ± 0.003	< 0.018	10-14-99	334	0.030 ± 0.003	< 0.015
04-22-99	340	0.014 ± 0.003	< 0.010	10-21-99	340	0.022 ± 0.003	< 0.010
04-29-99	340	0.021 ± 0.003	< 0.011	10-28-99	340	0.019 ± 0.003	< 0.008
05-06-99	326	0.023 ± 0.004	< 0.022	11-05-99	388	0.050 ± 0.004	< 0.015
05-13-99	334	0.016 ± 0.003	< 0.006	11-11-99	286	0.038 ± 0.004	< 0.019
05-20-99	331	0.020 ± 0.003	< 0.010	11-18-99	337	0.035 ± 0.004	< 0.017
05-27-99	334	0.018 ± 0.003	< 0.007	11-24-99	295	0.048 ± 0.005	< 0.020
06-03-99	326	0.025 ± 0.003	< 0.013	12-02-99	394	0.033 ± 0.003	< 0.015
06-10-99	326	0.025 ± 0.003	< 0.013	12-09-99	343	0.036 ± 0.004	< 0.018
06-17-99	320	0.019 ± 0.003	< 0.013	12-16-99	348	0.029 ± 0.004	< 0.016
06-24-99	326	0.027 ± 0.003	< 0.008	12-23-99	346	0.027 ± 0.003	< 0.017
07-01-99	320	0.019 ± 0.003	< 0.020	12-30-99	357	0.023 ± 0.003	< 0.016
2nd Qtr. Mean ± s.d.		0.021 ± 0.004	< 0.022	4th Qtr. Mean ± s.d.		0.031 ± 0.010	< 0.020
				Cumulative Average		0.025	
				Previous Annual Average		0.024	

PALISADES

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
 Location: 11KZ - Kalamazoo (35 mi. E)
 Units: pCi/m³
 Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
<u>Required LLD</u>		<u>0.010</u>	<u>0.070</u>			<u>0.010</u>	<u>0.070</u>
01-08-99	450	0.026 ± 0.003	< 0.012	07-08-99	312	0.025 ± 0.003	< 0.014
01-14-99	269	0.040 ± 0.004	< 0.017	07-15-99	312	0.025 ± 0.003	< 0.030
01-21-99	351	0.020 ± 0.003	< 0.014	07-22-99	326	0.028 ± 0.003	< 0.013
01-28-99	329	0.026 ± 0.003	< 0.010	07-29-99	303	0.027 ± 0.003	< 0.011
02-04-99	337	0.023 ± 0.003	< 0.015	08-05-99	309	0.023 ± 0.004	< 0.015
02-11-99	314	0.025 ± 0.003	< 0.014	08-12-99	329	0.020 ± 0.003	< 0.010
02-18-99	337	0.021 ± 0.003	< 0.012	08-19-99	312	0.023 ± 0.003	< 0.018
02-25-99	343	0.023 ± 0.003	< 0.007	08-27-99	374	0.027 ± 0.003	< 0.017
				09-02-99	258	0.038 ± 0.004	< 0.021
03-04-99	337	0.017 ± 0.003	< 0.008				
03-11-99	340	0.022 ± 0.003	< 0.010	09-09-99	312	0.035 ± 0.004	< 0.028
03-18-99	343	0.024 ± 0.003	< 0.015	09-15-99	329	0.025 ± 0.003	< 0.018
03-29-99	515	0.016 ± 0.002	< 0.010	09-23-99	326	0.020 ± 0.003	< 0.022
04-01-99	187	0.043 ± 0.006	< 0.031	09-30-99	320	0.031 ± 0.003	< 0.013
1st Qtr. Mean ± s.d.		0.025 ± 0.008	< 0.031	3rd Qtr. Mean ± s.d.		0.027 ± 0.005	< 0.030
04-08-99	309	0.020 ± 0.003	< 0.014	10-07-99	326	0.020 ± 0.003	< 0.011
04-15-99	323	0.024 ± 0.003	< 0.019	10-14-99	329	0.034 ± 0.004	< 0.015
04-22-99	320	0.013 ± 0.003	< 0.011	10-21-99	331	0.024 ± 0.003	< 0.010
04-29-99	334	0.018 ± 0.003	< 0.014	10-28-99	326	0.019 ± 0.003	< 0.008
05-07-99	351	0.019 ± 0.003	< 0.019	11-05-99	374	0.047 ± 0.004	< 0.015
05-13-99	280	0.017 ± 0.004	< 0.007	11-12-99	445	0.025 ± 0.003	< 0.012
05-20-99	320	0.024 ± 0.003	< 0.011	11-18-99	235	0.043 ± 0.005	< 0.024
05-26-99	252	0.023 ± 0.004	< 0.011	11-24-99	272	0.050 ± 0.005	< 0.011
06-03-99	374	0.022 ± 0.003	< 0.011	12-02-99	388	0.030 ± 0.003	< 0.016
06-10-99	326	0.025 ± 0.003	< 0.013	12-09-99	329	0.029 ± 0.003	< 0.019
06-17-99	320	0.019 ± 0.003	< 0.013	12-16-99	348	0.030 ± 0.004	< 0.016
06-24-99	326	0.027 ± 0.003	< 0.008	12-23-99	340	0.034 ± 0.004	< 0.017
07-01-99	320	0.017 ± 0.003	< 0.020	12-30-99	340	0.026 ± 0.003	< 0.017
2nd Qtr. Mean ± s.d.		0.021 ± 0.004	< 0.020	4th Qtr. Mean ± s.d.		0.032 ± 0.010	< 0.024
Cumulative Average						0.026	
Previous Annual Average						0.024	

PALISADES

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
 Location: 12DG - Dowagiac (30 mi. SSE)
 Units: pCi/m³
 Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
<u>Required LLD</u>		<u>0.010</u>	<u>0.070</u>			<u>0.010</u>	<u>0.070</u>
01-06-99	371	0.031 ± 0.003	< 0.017	07-07-99	292	0.025 ± 0.003	< 0.016
01-14-99	396	0.036 ± 0.003	< 0.011	07-14-99	326	0.024 ± 0.003	< 0.031
01-20-99	331	0.024 ± 0.003	< 0.016	07-22-99	314	0.032 ± 0.004	< 0.016
01-27-99	346	0.022 ± 0.003	< 0.010	07-28-99	314	0.023 ± 0.003	< 0.011
02-03-99	363	0.022 ± 0.003	< 0.015	08-04-99	329	0.022 ± 0.004	< 0.015
02-10-99	337	0.032 ± 0.003	< 0.014	08-11-99	309	0.019 ± 0.003	< 0.011
02-18-99	385	0.019 ± 0.003	< 0.010	08-18-99	323	0.023 ± 0.003	< 0.018
02-24-99	329	0.021 ± 0.003	< 0.007	08-25-99	317	0.025 ± 0.004	< 0.023
03-03-99	346	0.020 ± 0.003	< 0.008	09-01-99	317	0.025 ± 0.003	< 0.018
03-10-99	320	0.020 ± 0.003	< 0.011	09-08-99	320	0.031 ± 0.004	< 0.029
03-17-99	351	0.028 ± 0.003	< 0.015	09-15-99	312	0.025 ± 0.003	< 0.021
03-24-99	351	0.021 ± 0.003	< 0.010	09-23-99	379	0.019 ± 0.003	< 0.019
03-31-99	351	0.018 ± 0.003	< 0.018	09-29-99	275	0.033 ± 0.004	< 0.016
1st Qtr. Mean ± s.d.		0.024 ± 0.006	< 0.018	3rd Qtr. Mean ± s.d.		0.025 ± 0.004	< 0.031
04-07-99	343	0.020 ± 0.003	< 0.014	10-06-99	323	0.018 ± 0.003	< 0.012
04-14-99	351	0.021 ± 0.003	< 0.019	10-13-99	323	0.030 ± 0.004	< 0.016
04-21-99	354	0.014 ± 0.003	< 0.010	10-20-99	317	0.022 ± 0.003	< 0.011
04-28-99	334	0.021 ± 0.003	NS ^a	10-28-99	340	0.019 ± 0.003	< 0.008
05-05-99	331	0.019 ± 0.003	< 0.023	11-03-99	320	0.052 ± 0.004	< 0.021
05-12-99	340	0.017 ± 0.003	< 0.005	11-10-99	323	0.032 ± 0.004	< 0.018
05-20-99	365	0.021 ± 0.003	< 0.009	11-17-99	317	0.036 ± 0.004	< 0.019
05-26-99	320	0.020 ± 0.003	< 0.009	11-24-99	329	0.040 ± 0.004	< 0.018
06-02-99	329	0.025 ± 0.003	< 0.013	12-01-99	337	0.031 ± 0.003	< 0.019
06-09-99	323	0.021 ± 0.003	< 0.014	12-08-99	323	0.026 ± 0.003	< 0.020
06-16-99	323	0.023 ± 0.003	< 0.014	12-15-99	329	0.037 ± 0.004	< 0.019
06-23-99	329	0.023 ± 0.003	< 0.009	12-22-99	337	0.030 ± 0.004	< 0.019
07-01-99	354	0.019 ± 0.003	< 0.018	12-29-99	337	0.016 ± 0.003	< 0.018
2nd Qtr. Mean ± s.d.		0.020 ± 0.003	< 0.023	4th Qtr. Mean ± s.d.		0.030 ± 0.010	< 0.021
Cumulative Average						0.025	
Previous Annual Average						0.025	

^aNS=No sample; Charcoal canister missing.

PALISADES

Table 2. Gamma radiation, as measured by TLDs, monthly exposure.

Units: mR/30 days^a

	<u>January</u>	<u>February</u>	<u>March</u>
Date Placed	12-23-98	01-30-99	02-28-99
Date Removed	01-30-99	02-28-99	03-27-99
Intransit (mR)	6.1 ± 0.1	5.3 ± 0.2	3.9 ± 0.2
ST-01	3.7 ± 0.3	3.4 ± 0.2	5.3 ± 0.2
ST-02	3.8 ± 0.3	4.9 ± 0.2	5.9 ± 0.3
ST-03	3.7 ± 0.2	4.1 ± 0.2	5.3 ± 0.2
ST-04	4.4 ± 0.2	4.9 ± 0.2	5.8 ± 0.2
ST-05	4.4 ± 0.3	4.8 ± 0.2	5.3 ± 0.2
ST-06	4.4 ± 0.3	4.0 ± 0.2	5.0 ± 0.2
ST-07A	4.1 ± 0.2	4.1 ± 0.2	5.0 ± 0.2
ST-08	3.7 ± 0.3	4.0 ± 0.2	4.5 ± 0.2
ST-09	3.1 ± 0.3	3.6 ± 0.2	4.2 ± 0.2
ST-10	3.6 ± 0.3	3.3 ± 0.2	4.4 ± 0.2
ST-11	3.9 ± 0.2	6.1 ± 0.2	4.9 ± 0.2
ST-12	3.7 ± 0.2	3.6 ± 0.2	4.4 ± 0.2
ST-13	3.5 ± 0.3	3.2 ± 0.2	4.3 ± 0.2
ST-14	3.6 ± 0.2	3.2 ± 0.2	3.9 ± 0.2
ST-15	4.3 ± 0.3	3.7 ± 0.2	4.4 ± 0.2
ST-16	3.1 ± 0.3	3.6 ± 0.2	4.4 ± 0.2
ST-17	3.4 ± 0.2	3.6 ± 0.2	4.3 ± 0.3
ST-18	3.6 ± 0.2	3.9 ± 0.2	4.5 ± 0.2
ST-19	3.2 ± 0.2	3.6 ± 0.2	4.4 ± 0.3
ST-20	3.1 ± 0.2	3.6 ± 0.2	4.4 ± 0.2
ST-21	3.2 ± 0.3	3.5 ± 0.2	4.4 ± 0.2
ST-22	2.5 ± 0.2	1.6 ± 0.2	1.9 ± 0.2
ST-23	4.3 ± 0.3	4.0 ± 0.2	4.6 ± 0.2
ST-24	3.7 ± 0.2	3.6 ± 0.2	4.4 ± 0.2
ST-33	4.1 ± 0.2	3.6 ± 0.2	4.5 ± 0.2
ST-34	3.5 ± 0.3	3.6 ± 0.2	4.4 ± 0.2
ST-35	4.9 ± 0.3	4.5 ± 0.2	5.3 ± 0.2
ST-36	3.2 ± 0.2	4.0 ± 0.2	3.6 ± 0.2
ST-37	3.2 ± 0.3	4.0 ± 0.2	3.9 ± 0.2
ST-38	2.5 ± 0.2	3.6 ± 0.2	3.5 ± 0.2
Mean ± s.d.	3.6 ± 0.6	3.8 ± 0.7	4.5 ± 0.8
Control 1	1.8 ± 0.3	1.5 ± 0.2	1.9 ± 0.2
Control 2	1.9 ± 0.3	1.5 ± 0.2	1.9 ± 0.2

^a Intransit exposure has been subtracted.

PALISADES

Table 2. Gamma radiation, as measured by TLDs, monthly exposure.

Units: mR/30 days^a

	<u>April</u>	<u>May</u>	<u>June</u>
Date Placed	03-27-99	05-02-99	05-30-99
Date Removed	05-02-99	05-30-99	06-27-99
Intransit (mR)	3.0 ± 0.2	5.6 ± 0.2	5.5 ± 0.2
ST-01	3.2 ± 0.2	4.0 ± 0.2	4.1 ± 0.3
ST-02	4.5 ± 0.2	5.5 ± 0.2	5.4 ± 0.2
ST-03	3.8 ± 0.2	4.6 ± 0.2	5.0 ± 0.3
ST-04	4.4 ± 0.2	5.0 ± 0.2	5.7 ± 0.2
ST-05	4.3 ± 0.2	4.6 ± 0.2	5.3 ± 0.2
ST-06	3.5 ± 0.2	4.2 ± 0.2	4.6 ± 0.2
ST-07A	3.5 ± 0.2	4.5 ± 0.2	4.4 ± 0.3
ST-08	3.8 ± 0.2	4.1 ± 0.2	4.9 ± 0.2
ST-09	3.2 ± 0.2	3.7 ± 0.2	4.5 ± 0.2
ST-10	3.5 ± 0.3	3.8 ± 0.2	3.6 ± 0.2
ST-11	5.4 ± 0.3	5.2 ± 0.2	4.7 ± 0.2
ST-12	3.5 ± 0.2	4.4 ± 0.2	4.8 ± 0.2
ST-13	3.1 ± 0.2	3.6 ± 0.2	4.4 ± 0.2
ST-14	2.9 ± 0.2	3.2 ± 0.2	4.1 ± 0.3
ST-15	3.8 ± 0.2	4.0 ± 0.2	4.5 ± 0.2
ST-16	3.1 ± 0.2	3.7 ± 0.2	4.5 ± 0.2
ST-17	3.2 ± 0.2	3.6 ± 0.2	4.5 ± 0.3
ST-18	3.5 ± 0.2	4.1 ± 0.2	4.4 ± 0.2
ST-19	3.7 ± 0.2	4.1 ± 0.3	4.8 ± 0.2
ST-20	3.2 ± 0.2	3.7 ± 0.2	4.4 ± 0.3
ST-21	3.1 ± 0.2	3.6 ± 0.2	4.3 ± 0.2
ST-22	2.1 ± 0.2	2.0 ± 0.2	1.9 ± 0.2
ST-23	3.8 ± 0.2	4.1 ± 0.2	4.8 ± 0.2
ST-24	3.2 ± 0.3	3.6 ± 0.2	4.0 ± 0.3
ST-33	2.8 ± 0.2	4.1 ± 0.2	3.8 ± 0.2
ST-34	3.1 ± 0.2	4.1 ± 0.2	4.5 ± 0.2
ST-35	4.1 ± 0.2	4.6 ± 0.2	5.4 ± 0.2
ST-36	3.4 ± 0.2	3.6 ± 0.2	4.5 ± 0.2
ST-37	3.4 ± 0.2	3.2 ± 0.2	4.5 ± 0.3
ST-38	3.1 ± 0.2	2.8 ± 0.2	4.1 ± 0.3
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Mean ± s.d.	3.5 ± 0.6	4.0 ± 0.7	4.5 ± 0.7
Control 1	1.8 ± 0.2	1.9 ± 0.2	1.6 ± 0.2
Control 2	1.8 ± 0.2	1.9 ± 0.2	1.6 ± 0.2

^a Intransit exposure has been subtracted.

PALISADES

Table 2. Gamma radiation, as measured by TLDs, monthly exposure.

Units: mR/30 days^a

	<u>July</u>	<u>August</u>	<u>September</u>
Date Placed	06-27-99	08-01-99	08-29-99
Date Removed	08-01-99	08-29-99	10-03-99
Intransit (mR)	4.4 ± 0.2	6.1 ± 0.2	4.2 ± 0.2
ST-01	4.4 ± 0.2	4.3 ± 0.2	3.7 ± 0.2
ST-02	5.1 ± 0.2	4.7 ± 0.2	5.4 ± 0.2
ST-03	4.4 ± 0.2	5.1 ± 0.2	4.4 ± 0.2
ST-04	4.7 ± 0.2	6.0 ± 0.3	4.5 ± 0.2
ST-05	4.9 ± 0.2	6.0 ± 0.2	4.4 ± 0.2
ST-06	4.0 ± 0.2	5.2 ± 0.2	4.4 ± 0.2
ST-07A	3.8 ± 0.2	5.1 ± 0.2	4.4 ± 0.2
ST-08	3.8 ± 0.2	5.1 ± 0.2	4.1 ± 0.2
ST-09	3.3 ± 0.2	4.6 ± 0.2	3.5 ± 0.2
ST-10	4.5 ± 0.2	4.3 ± 0.3	3.8 ± 0.2
ST-11	4.1 ± 0.2	6.2 ± 0.3	5.8 ± 0.2
ST-12	3.7 ± 0.2	6.3 ± 0.3	3.7 ± 0.2
ST-13	3.3 ± 0.2	4.2 ± 0.3	3.4 ± 0.2
ST-14	2.9 ± 0.2	4.1 ± 0.2	3.0 ± 0.2
ST-15	3.8 ± 0.2	5.1 ± 0.2	3.4 ± 0.2
ST-16	3.3 ± 0.2	4.3 ± 0.3	3.4 ± 0.2
ST-17	3.3 ± 0.2	4.3 ± 0.2	3.4 ± 0.2
ST-18	4.7 ± 0.2	4.7 ± 0.2	4.4 ± 0.2
ST-19	3.9 ± 0.2	4.8 ± 0.2	3.8 ± 0.2
ST-20	3.7 ± 0.2	4.3 ± 0.2	3.4 ± 0.2
ST-21	3.7 ± 0.2	4.0 ± 0.2	3.7 ± 0.2
ST-22	2.2 ± 0.2	1.7 ± 0.2	2.1 ± 0.2
ST-23	4.4 ± 0.2	4.9 ± 0.3	4.4 ± 0.2
ST-24	3.6 ± 0.3	4.3 ± 0.2	3.7 ± 0.2
ST-33	3.8 ± 0.2	4.3 ± 0.3	3.7 ± 0.2
ST-34	3.6 ± 0.2	4.7 ± 0.3	3.6 ± 0.2
ST-35	4.3 ± 0.2	5.8 ± 0.3	4.3 ± 0.2
ST-36	3.0 ± 0.2	3.9 ± 0.3	3.0 ± 0.2
ST-37	3.3 ± 0.2	3.8 ± 0.2	3.0 ± 0.2
ST-38	3.0 ± 0.2	4.3 ± 0.2	2.9 ± 0.3
Mean ± s.d.	3.8 ± 0.7	4.7 ± 0.9	3.8 ± 0.7
Control 1	1.9 ± 0.3	1.8 ± 0.2	1.6 ± 0.2
Control 2	1.9 ± 0.2	1.7 ± 0.2	1.6 ± 0.2

^a Intransit exposure has been subtracted.

PALISADES

Table 2. Gamma radiation, as measured by TLDs, monthly exposure.

Units: mR/30 days^a

	<u>October</u>	<u>November</u>	<u>December</u>
Date Placed	10-03-99	10-31-99	11-28-99
Date Removed	10-31-99	11-28-99	01-02-00
Intransit (mR)	4.3 ± 0.1	4.7 ± 0.2	4.3 ± 0.2
ST-01	3.3 ± 0.1	3.8 ± 0.2	3.7 ± 0.2
ST-02	4.9 ± 0.1	5.5 ± 0.3	5.3 ± 0.2
ST-03	4.2 ± 0.1	4.6 ± 0.2	4.5 ± 0.2
ST-04	4.5 ± 0.1	5.0 ± 0.3	4.9 ± 0.2
ST-05	4.2 ± 0.1	5.0 ± 0.3	4.7 ± 0.2
ST-06	3.6 ± 0.2	4.2 ± 0.2	4.0 ± 0.2
ST-07A	4.1 ± 0.1	4.6 ± 0.2	4.0 ± 0.2
ST-08	4.2 ± 0.1	4.0 ± 0.2	4.1 ± 0.2
ST-09	3.9 ± 0.2	3.7 ± 0.2	3.7 ± 0.2
ST-10	3.6 ± 0.1	3.8 ± 0.2	3.3 ± 0.2
ST-11	4.8 ± 0.1	4.8 ± 0.3	4.7 ± 0.2
ST-12	4.4 ± 0.1	4.1 ± 0.2	4.0 ± 0.2
ST-13	3.6 ± 0.1	3.5 ± 0.2	3.5 ± 0.2
ST-14	3.6 ± 0.2	3.2 ± 0.2	3.4 ± 0.2
ST-15	3.8 ± 0.2	3.8 ± 0.2	3.7 ± 0.2
ST-16	3.9 ± 0.1	5.0 ± 0.2	3.3 ± 0.2
ST-17	4.0 ± 0.1	5.0 ± 0.2	3.6 ± 0.2
ST-18	4.1 ± 0.1	4.7 ± 0.2	3.9 ± 0.2
ST-19	4.2 ± 0.1	4.6 ± 0.3	4.0 ± 0.2
ST-20	3.7 ± 0.2	4.0 ± 0.2	3.7 ± 0.2
ST-21	3.6 ± 0.1	3.7 ± 0.3	3.1 ± 0.3
ST-22	1.9 ± 0.1	1.9 ± 0.3	1.8 ± 0.2
ST-23	4.2 ± 0.1	5.1 ± 0.3	4.0 ± 0.2
ST-24	4.0 ± 0.1	3.8 ± 0.2	3.7 ± 0.2
ST-33	3.6 ± 0.2	3.7 ± 0.2	3.3 ± 0.2
ST-34	4.1 ± 0.1	4.0 ± 0.2	3.6 ± 0.2
ST-35	4.9 ± 0.1	4.3 ± 0.2	4.3 ± 0.2
ST-36	4.3 ± 0.1	3.3 ± 0.2	3.7 ± 0.2
ST-37	4.0 ± 0.1	3.2 ± 0.2	3.6 ± 0.2
ST-38	3.7 ± 0.2	2.4 ± 0.2	3.3 ± 0.2
Mean ± s.d.	4.0 ± 0.6	4.1 ± 0.8	3.8 ± 0.6
Control 1	1.9 ± 0.1	1.5 ± 0.2	1.5 ± 0.2
Control 2	1.9 ± 0.1	1.5 ± 0.2	1.5 ± 0.2

^a Intransit exposure has been subtracted.

PALISADES

Table 3. Gamma radiation, as measured by TLDs, quarterly exposure.

Units: mR/91 days^a

	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>
Date Placed	01-10-99	03-27-99	06-27-99	10-03-99
Date Removed	03-27-99	06-27-99	10-03-99	01-02-00
Intransit (mR)	6.9 ± 0.5	4.7 ± 0.6	4.6 ± 0.7	4.7 ± 0.6
ST-01	12.2 ± 0.6	11.7 ± 0.6	12.3 ± 0.6	12.5 ± 0.6
ST-02	16.0 ± 0.8	15.7 ± 0.7	17.7 ± 0.6	16.7 ± 0.6
ST-03	14.3 ± 0.6	13.6 ± 0.6	14.5 ± 0.7	14.1 ± 0.6
ST-04	14.6 ± 0.6	14.4 ± 0.6	14.3 ± 0.6	15.0 ± 0.6
ST-05	13.8 ± 0.6	14.0 ± 0.6	13.5 ± 0.6	14.6 ± 0.6
ST-06	13.1 ± 0.6	12.7 ± 0.6	13.1 ± 0.6	12.9 ± 0.6
ST-07A	12.6 ± 0.6	12.8 ± 0.6	12.0 ± 0.6	12.8 ± 0.6
ST-08	12.2 ± 0.6	12.0 ± 0.6	11.7 ± 0.6	12.2 ± 0.6
ST-09	11.0 ± 0.7	11.6 ± 0.6	11.5 ± 0.6	10.8 ± 0.6
ST-10	11.8 ± 0.6	12.2 ± 0.6	11.8 ± 0.6	12.0 ± 0.7
ST-11	13.7 ± 0.7	16.3 ± 0.7	16.4 ± 0.7	15.4 ± 0.6
ST-12	13.2 ± 0.6	13.9 ± 0.6	12.7 ± 0.6	13.3 ± 0.6
ST-13	11.7 ± 0.6	11.9 ± 0.7	11.2 ± 0.6	12.0 ± 0.6
ST-14	11.0 ± 0.7	10.8 ± 0.6	10.5 ± 0.7	10.4 ± 0.6
ST-15	11.2 ± 0.6	11.5 ± 0.6	10.8 ± 0.6	11.5 ± 0.7
ST-16	11.1 ± 0.8	11.2 ± 0.8	10.8 ± 0.6	11.4 ± 0.7
ST-17	11.2 ± 0.6	11.0 ± 0.6	10.6 ± 0.7	11.2 ± 0.6
ST-18	12.2 ± 0.6	11.5 ± 0.6	11.5 ± 0.6	11.7 ± 0.6
ST-19	12.6 ± 0.6	12.4 ± 0.6	11.9 ± 0.6	12.6 ± 0.6
ST-20	12.6 ± 0.6	11.5 ± 0.7	11.9 ± 0.6	11.5 ± 0.7
ST-21	11.7 ± 0.6	10.7 ± 0.6	10.8 ± 0.6	10.8 ± 0.6
ST-22	6.1 ± 0.6	5.9 ± 0.7	5.8 ± 0.6	6.1 ± 0.6
ST-23	12.7 ± 0.6	12.2 ± 0.6	12.2 ± 0.6	12.3 ± 0.6
ST-24	12.0 ± 0.6	12.0 ± 0.6	10.8 ± 0.6	12.1 ± 0.6
ST-33	11.3 ± 0.7	11.4 ± 0.7	10.4 ± 0.6	11.5 ± 0.7
ST-34	11.0 ± 0.7	11.4 ± 0.7	10.9 ± 0.6	11.5 ± 0.7
ST-35	13.6 ± 0.6	12.7 ± 0.6	13.0 ± 0.6	12.9 ± 0.6
ST-36	11.5 ± 0.7	11.4 ± 0.7	11.0 ± 0.6	11.6 ± 0.6
ST-37	12.2 ± 0.6	11.6 ± 0.6	11.6 ± 0.6	11.5 ± 0.6
ST-38	11.1 ± 0.6	11.2 ± 0.7	10.7 ± 0.7	11.3 ± 0.6
Mean ± s.d.	12.2 ± 1.7	12.1 ± 1.8	11.9 ± 2.1	12.2 ± 1.9
Control 1	4.9 ± 0.6	6.2 ± 0.6	5.3 ± 0.6	6.2 ± 0.6
Control 2	5.0 ± 0.6	6.2 ± 0.6	5.3 ± 0.6	6.2 ± 0.6

^a Intransit exposure has been subtracted.

PALISADES

Table 4. Gamma radiation, as measured by TLDs, annual exposure.
Units: mR/365 days^a

	<u>1999</u>
Date Placed	12-23-98
Date Removed	01-02-00
Intransit (mR)	3.1 ± 2.4
ST-01	42.7 ± 2.5
ST-02	60.4 ± 2.5
ST-03	52.2 ± 2.4
ST-04	53.3 ± 2.4
ST-05	53.2 ± 2.4
ST-06	48.7 ± 2.4
ST-07A	49.5 ± 2.4
ST-08	46.8 ± 2.4
ST-09	45.7 ± 2.4
ST-10	47.2 ± 2.4
ST-11	57.6 ± 2.4
ST-12	51.3 ± 2.4
ST-13	43.1 ± 2.4
ST-14	38.1 ± 2.4
ST-15	39.3 ± 2.4
ST-16	42.0 ± 2.4
ST-17	40.4 ± 2.4
ST-18	43.8 ± 2.4
ST-19	45.5 ± 2.4
ST-20	43.4 ± 2.4
ST-21	44.2 ± 2.4
ST-22	23.0 ± 2.4
ST-23	49.4 ± 2.4
ST-24	45.7 ± 2.4
ST-33	40.5 ± 2.4
ST-34	42.0 ± 2.4
ST-35	51.1 ± 2.4
ST-36	41.1 ± 2.4
ST-37	41.9 ± 2.4
ST-38	42.7 ± 2.4
Mean ± s.d.	45.5 ± 6.9
Control 1	22.3 ± 2.4
Control 2	22.3 ± 2.4

^a Intransit exposure has been subtracted.

PALISADES

Table 5. Lake Water, analyses for gross alpha, gross beta and tritium.

Collection: Monthly composites of daily collections.

Units: pCi/L

Location Date Collected	Discharge			
	Lab Code	Gross Alpha	Gross Beta	H-3
<u>Required LLD</u>		<u>1.0</u>	<u>4.0</u>	<u>500</u>
01-31-99	PALW -745	0.6 ± 0.4	2.6 ± 0.4	6006 ± 227
02-28-99	-1468	< 1.3	2.8 ± 0.8	< 162
03-31-99	-2404	< 0.6	2.9 ± 0.5	< 158
04-30-99	-3146	< 0.4	2.6 ± 0.4	< 207
05-31-99	-3925	< 0.6	2.0 ± 0.4	< 182
06-30-99	-5037	< 0.8	2.3 ± 0.5	4379 ± 196
08-09-99	-5849	< 0.6	2.5 ± 0.4	175 ± 94
08-31-99	-6602	1.0 ± 0.4	3.1 ± 0.4	< 188
09-30-99	-7734	< 0.7	2.5 ± 0.5	< 185
10-31-99	-8747, 8	< 0.7	2.1 ± 0.3	4269 ± 140
12-01-99	-9351	< 0.5	2.6 ± 0.5	< 160
12-31-99	-10066	< 0.8	2.5 ± 0.5	< 152

Location Date Collected	Intake			
	Lab Code	Gross Alpha	Gross Beta	H-3
<u>Required LLD</u>		<u>1.0</u>	<u>4.0</u>	<u>500</u>
01-31-99	PALW -746	< 0.6	2.4 ± 0.4	< 163
02-28-99	-1469	< 1.3	2.5 ± 0.7	< 162
03-31-99	-2405,6	< 0.8	2.8 ± 0.3	< 158
04-30-99	-3147	< 1.0	1.7 ± 0.6	< 165
05-31-99	-3926	< 0.5	2.0 ± 0.4	< 182
06-30-99	-5038	< 0.7	1.9 ± 0.5	189 ± 86
08-09-99	-5848	< 0.6	2.5 ± 0.5	< 174
08-31-99	-6603	0.6 ± 0.3	2.0 ± 0.3	< 188
09-30-99	-7733	< 0.6	2.1 ± 0.4	< 185
10-31-99	-8746	< 0.5	2.2 ± 0.5	< 175
12-01-99	-9350	< 0.7	1.5 ± 0.5	< 160
12-31-99	-10065	0.7 ± 0.5	2.0 ± 0.5	< 152

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Table 6. Lake Water, drinking, analyses for gross beta and tritium^a.

Collection: Monthly composites of daily collections.

Units: pCi/L

Location Date Collected	South Haven Municipal System (Raw)		
	Lab Code	Gross Beta	H-3
<u>Required LLD</u>		<u>4.0</u>	<u>500</u>
01-31-99	PALW - 536	1.7 ± 0.6	-
02-28-99	- 1522	2.5 ± 0.6	-
03-31-99	- 2408	1.6 ± 0.6	-
04-30-99	- 3149,50	2.1 ± 0.4	-
05-31-99	- 4155	1.6 ± 0.6	-
06-30-99	- 5041	2.3 ± 0.6	-
07-31-99	- 5758	1.8 ± 0.6	-
08-31-99	- 6604,5	2.0 ± 0.4	-
09-30-99	- 7737	1.8 ± 0.6	-
10-31-99	- 8672	2.1 ± 0.7	-
11-30-99	- 9258	2.0 ± 0.6	-
12-31-99	- 9961	1.8 ± 0.6	-

Location Date Collected	South Haven Municipal System (Treated)		
	Lab Code	Gross Beta	H-3
<u>Required LLD</u>		<u>4.0</u>	<u>500</u>
01-31-99	PALW - 537	2.2 ± 0.6	< 176
02-28-99	- 1523,4	2.1 ± 0.4	< 167
03-31-99	- 2409	2.1 ± 0.6	< 158
04-30-99	- 3151	1.9 ± 0.6	< 165
05-31-99	- 4156	1.5 ± 0.5	< 182
06-30-99	- 5042	2.1 ± 0.6	< 175
07-31-99	- 5759	2.1 ± 0.6	< 169
08-31-99	- 6606	2.2 ± 0.6	< 188
09-30-99	- 7736	1.8 ± 0.6	< 185
10-31-99	- 8673	1.7 ± 0.6	< 175
11-30-99	- 9259	1.9 ± 0.6	< 160
12-31-99	- 9962	2.0 ± 0.6	< 152

^a Tritium analysis required on treated samples only.

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Table 7. Well water, analyses for gross beta and tritium.
 Collection: Monthly composites of daily collections.
 Units: pCi/L

Location	Site Wells No. 2 and 3 (Domestic)			
	Date Collected	Lab Code	Gross Beta	H-3
<u>Required LLD</u>			<u>4.0</u>	<u>500</u>
01-31-99	PAWW -744		1.6 ± 0.6	232 ± 91
02-28-99	-1467		2.0 ± 0.6	< 162
03-31-99	-2410		2.2 ± 0.7	< 158
04-30-99	-3152		2.2 ± 0.6	< 165
05-31-99	-3928		2.2 ± 0.6	< 182
06-30-99	-5043		1.6 ± 0.6	< 175
08-09-99	-5846		1.8 ± 0.6	< 169
08-31-99	-6607		3.1 ± 0.6	< 188
09-30-99	-7739		2.2 ± 0.7	232 ± 101
10-31-99	-8749		1.8 ± 0.7	< 175
11-30-99	-9429		2.0 ± 0.6	< 160
12-31-99	10069, 70		2.4 ± 0.4	< 152

Location	State Park			
	Date Collected	Lab Code	Gross Beta	H-3
<u>Required LLD</u>			<u>4.0</u>	<u>500</u>
01-13-99	PAWW -189		< 0.9	< 162
02-01-99	-538		< 0.9	< 163
03-11-99	-1577		1.3 ± 0.6	< 167
04-07-99	-2208		1.4 ± 0.6	< 163
05-04-99	-3154		< 0.9	< 207
06-08-99	-3933		< 1.0	176 ± 93
06-30-99	-5045		2.4 ± 0.6	157 ± 85
08-05-99	-5750		3.2 ± 0.6	< 169
09-08-99	-6608		3.4 ± 0.6	< 187
10-05-99	-7740		< 1.0	< 185
11-03-99	-8664		1.9 ± 0.7	< 183
12-01-99	-9260		< 1.0	< 160

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Table 7. Well water, analyses for gross beta and tritium.
 Collection: Monthly composites of daily collections.
 Units: pCi/L

Location	Township Park		
Date Collected	Lab Code	Gross Beta	H-3
<u>Required LLD</u>		<u>4.0</u>	<u>500</u>
01-13-99	PAWW -188	1.7 ± 0.6	198 ± 89
02-01-99	-539	3.0 ± 0.7	< 163
03-11-99	-1578	3.4 ± 0.7	< 167
04-07-99	-2209	3.1 ± 0.7	< 163
05-04-99	-3155	< 1.0	< 165
06-07-99	-4157	< 1.0	< 182
06-30-99	-5046	< 1.0	< 156
08-04-99	-5751	< 0.9	< 169
09-07-99	-6609	< 1.0	< 187
10-04-99	-7741	< 0.9	< 185
11-03-99	-8665	1.3 ± 0.7	< 183
11-30-99	-9261	< 1.0	< 160

Location	Warehouse (Site Well #7)		
Date Collected	Lab Code	Gross Beta	H-3
<u>Required LLD</u>		<u>4.0</u>	<u>500</u>
01-15-99	PAWW -269	< 1.8	< 165
02-01-99	-542	12.8 ± 1.5	< 163
03-11-99	-1583	4.5 ± 1.3	< 167
04-07-99	-2214	5.2 ± 1.3	< 163
05-04-99	-3160	2.9 ± 0.7	< 207
06-07-99	-4158	2.6 ± 0.7	< 182
07-07-99	-5051	2.9 ± 1.2	< 156
08-04-99	-5755	5.2 ± 1.2	< 169
09-07-99	-6614	5.2 ± 1.3	< 187
10-05-99	-7742	6.5 ± 1.3	< 185
11-03-99	-8671	3.6 ± 1.5	< 183
12-08-99	-9436	3.0 ± 1.2	< 160

NOTE: Gamma isotopic analysis required if gross beta exceeds 10 pCi/L. Results listed in Appendix C.

PALISADES

Table 7. Well water, analyses for gross beta and tritium.
 Collection: Monthly composites of daily collections.
 Units: pCi/L

Location Date Collected	Outage Buildings (Site Wells #11, 12 and 13)		
	Lab Code	Gross Beta	H-3
<u>Required LLD</u>		<u>4.0</u>	<u>500</u>
01-15-99	PAWW -265	1.7 ± 0.6	166 ± 89
02-01-99	-540	1.4 ± 0.5	< 176
03-11-99	-1579	< 0.9	< 167
04-07-99	-2210	1.3 ± 0.5	< 163
05-04-99	-3156	< 0.9	< 165
06-08-99	-3934	1.5 ± 0.6	< 164
07-07-99	-5047	< 1.0	< 156
08-04-99	-5756, 7	2.1 ± 0.4	< 169
09-07-99	-6610	1.3 ± 0.5	< 187
10-05-99	-7743	< 0.9	< 185
11-03-99	-8666, 7	< 1.1	< 183
12-08-99	-9437	< 1.0	< 160

Location Date Collected	Site Well #14		
	Lab Code	Gross Beta	H-3
<u>Required LLD</u>		<u>4.0</u>	<u>500</u>
01-15-99	PAWW -266	12.7 ± 1.0	< 165
02-01-99	-580	4.9 ± 0.7	< 163
03-11-99	-1580	5.8 ± 0.8	< 167
04-07-99	-2211	7.0 ± 0.8	< 163
05-04-99	-3157	5.0 ± 0.8	< 207
06-07-99	-3935	4.4 ± 0.7	< 182
07-07-99	-5048	3.3 ± 0.7	< 156
08-04-99	-5752	4.6 ± 0.7	< 169
09-07-99	-6611	6.1 ± 0.8	< 187
10-05-99	-7744	3.6 ± 0.7	< 185
11-03-99	-8668	4.1 ± 0.8	< 183
12-08-99	-9438	7.5 ± 0.8	< 156

NOTE: Gamma isotopic analysis required if gross beta exceeds 10 pCi/L. Results listed in Appendix C.

PALISADES

Table 7. Well water, analyses for gross beta and tritium.
 Collection: Monthly composites of daily collections.
 Units: pCi/L

Location Date Collected	Site Well #15		
	Lab Code	Gross Beta	H-3
<u>Required LLD</u>		<u>4.0</u>	<u>500</u>
01-15-99	PAWW -267	6.5 ± 0.8	< 165
02-01-99	-581	5.3 ± 0.7	< 159
03-11-99	-1581	5.6 ± 0.8	< 167
04-07-99	-2212	5.5 ± 0.8	< 163
05-04-99	-3158	5.1 ± 0.8	< 207
06-07-99	-3936	6.7 ± 0.8	< 186
07-07-99	-5049	6.1 ± 0.8	< 156
08-04-99	-5753	6.1 ± 0.8	< 169
09-07-99	-6612	9.2 ± 0.9	< 187
10-05-99	-7745	6.8 ± 0.8	< 185
11-03-99	-8669	8.5 ± 1.0	< 183
12-08-99	-9439	7.4 ± 0.9	< 158

Location Date Collected	Site Well #16		
	Lab Code	Gross Beta	H-3
<u>Required LLD</u>		<u>4.0</u>	<u>500</u>
01-15-99	PAWW -268	12.9 ± 1.1	< 165
02-01-99	-541	6.6 ± 1.0	< 163
03-11-99	-1582	17.0 ± 1.1	< 167
04-07-99	-2213	13.5 ± 1.1	< 163
05-04-99	-3159	14.2 ± 1.1 ^a	< 207
06-07-99	-3937	9.3 ± 1.0	< 186
07-07-99	-5050	7.8 ± 0.9	< 156
08-04-99	-5754	8.6 ± 0.9	< 169
09-07-99	-6613	14.4 ± 1.1	< 187
10-05-99	-7746	11.9 ± 1.0	< 185
11-03-99	-8670	6.6 ± 0.9	< 183
12-08-99	-9440	15.1 ± 1.2	< 158

NOTE: Gamma isotopic analysis required if gross beta exceeds 10 pCi/L. Results listed in Appendix C.

^a Analysis was repeated; result of reanalysis 12.0±1.1 pCi/L.

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Table 8. Water, Ludington controls, analyses for gross beta and tritium.

Collection: Monthly composites of daily collections.

Units: pCi/L

Location Date Collected	Ludington (Lake In)		
	Lab Code	Gross Beta	H-3
<u>Required LLD</u>		<u>4.0</u>	<u>500</u>
01-31-99	PALW -747	3.7 ± 0.6	< 163
02-28-99	-1470	2.1 ± 0.6	< 162
03-31-99	-2407	2.2 ± 0.6	< 158
05-03-99	-3148	1.7 ± 0.6	< 165
05-31-99	-3927	2.2 ± 0.6	< 164
06-30-99	-5039, 40	2.1 ± 0.4	< 157
08-09-99	-5847	2.4 ± 0.6	< 169
08-31-99	-6676	2.4 ± 0.6	< 188
10-04-99	-7735	1.9 ± 0.5	< 185
11-01-99	-8751	2.8 ± 0.7	< 174
12-01-99	-9349	1.8 ± 0.5	< 160
12-31-99	-10067	2.3 ± 0.6	< 152

Location Date Collected	Ludington (Well water)		
	Lab Code	Gross Beta	H-3
<u>Required LLD</u>		<u>4.0</u>	<u>500</u>
01-31-99	PAWW -748	< 0.9	< 163
02-28-99	-1471	< 1.0	< 162
03-31-99	-2411	< 1.0	< 158
05-03-99	-3153	< 0.9	< 233
05-31-99	-3929	< 1.0	< 182
06-30-99	-5044	< 1.0	< 157
08-09-99	-5845	1.0 ± 0.5	< 169
08-31-99	-6677, 8	< 1.0	< 188
10-04-99	-7738	< 0.9	< 185
11-01-99	-8752	< 1.2	< 174
12-01-99	-9352	< 1.0	< 160
12-31-99	-10068	< 1.0	< 152

PALISADES

Table 9. In-Plant water, analyses for gross alpha, gross beta, strontium-89, strontium-90, tritium and gamma emitting isotopes.

Collection: Monthly composites

Units: uCi/mL

Location		Service Water			
Date Collected	Required	01-31-99	02-28-99	03-31-99	
Lab Code	LLD	PACW-749	PACW-1472	PACW-2403	
Gross Alpha	1.0 E-09	6.5 ± 4.6 E-10	< 1.3 E-09	< 6.8 E-10	
Gross Beta	1.0 E-09	2.7 ± 0.4 E-09	2.2 ± 0.7 E-09	2.0 ± 0.5 E-09	
H-3	5.0 E-07	1.8 ± 0.9 E-07	< 1.6 E-07	< 1.6 E-07	
Sr-89	5.0 E-09	< 6.5 E-10	< 5.4 E-10	< 8.5 E-10	
Sr-90	1.0 E-09	< 5.5 E-10	< 4.7 E-10	< 6.3 E-10	
Cs-137	1.0 E-08	< 6.8 E-09	< 2.9 E-09	< 6.8 E-09	
Others ^a	1.0 E-08	< 3.8 E-09	< 3.1 E-09	< 4.6 E-09	
Date Collected	Required	04-30-99	05-31-99	06-30-99	
Lab Code	LLD	PACW-3144	PACW-3924	PACW-5035	
Gross Alpha	1.0 E-09	< 4.6 E-10	< 5.4 E-10	< 9.6 E-10	
Gross Beta	1.0 E-09	1.8 ± 0.4 E-09	2.4 ± 0.5 E-09	2.2 ± 0.5 E-09	
H-3	5.0 E-07	< 2.1 E-07	< 1.2 E-07	< 1.6 E-07	
Sr-89	5.0 E-09	< 5.3 E-10	< 6.0 E-10	< 6.6 E-10	
Sr-90	1.0 E-09	< 5.1 E-10	< 6.1 E-10	8.1 ± 3.5 E-10	
Cs-137	1.0 E-08	< 6.2 E-09	< 4.4 E-09	< 5.1 E-09	
Others ^a	1.0 E-08	< 4.4 E-09	< 3.2 E-09	< 2.4 E-09	

^a See Introduction

PALISADES

Table 9. In-Plant water, analyses for gross alpha, gross beta, strontium-89, strontium-90, tritium and gamma emitting isotopes.

Collection: Monthly composites

Units: uCi/mL

Location	Service Water			
Date Collected	Required	08-09-99	08-31-99	09-30-99
Lab Code	LLD	PACW-5844	PACW-6601	PACW-7732
Gross Alpha	1.0 E-09	7.2 ± 5.2 E-10	< 8.0 E-10	7.1 ± 4.8 E-10
Gross Beta	1.0 E-09	2.4 ± 0.4 E-09	2.7 ± 0.5 E-09	3.9 ± 0.4 E-09
H-3	5.0 E-07	< 1.7 E-07	< 2.4 E-07	< 1.8 E-07
Sr-89	5.0 E-09	< 6.2 E-10	< 6.3 E-10	< 7.4 E-10
Sr-90	1.0 E-09	9.2 ± 3.4 E-10	< 4.9 E-10	< 7.0 E-10
Cs-137	1.0 E-08	< 2.9 E-09	< 3.8 E-09	< 6.3 E-09
Others ^a	1.0 E-08	< 2.6 E-09	< 6.6 E-09	< 3.5 E-09
Date Collected	Required	10-31-99	12-01-99	12-31-99
Lab Code	LLD	PACW-8750	PACW-9348	PACW-10064
Gross Alpha	1.0 E-09	< 6.5 E-10	< 5.9 E-10	6.7 ± 3.8 E-10
Gross Beta	1.0 E-09	2.2 ± 0.4 E-09	2.1 ± 0.5 E-09	2.2 ± 0.5 E-09
H-3	5.0 E-07	< 1.8 E-07	< 1.6 E-07	< 1.5 E-07
Sr-89	5.0 E-09	< 7.6 E-10	< 8.5 E-10	< 6.2 E-10
Sr-90	1.0 E-09	< 5.8 E-10	5.3 ± 3.0 E-10	7.4 ± 3.5 E-10
Cs-137	1.0 E-08	< 4.3 E-09	< 5.3 E-09	< 2.4 E-09
Others ^a	1.0 E-08	< 5.0 E-09	< 4.4 E-09	< 2.2 E-09

^a See Introduction

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Table 9. In-Plant water, analyses for gross alpha, gross beta, strontium-89, strontium-90, tritium and gamma emitting isotopes.

Collection: Monthly composites

Units: uCi/mL

Location		Turbine Sump		
Date Collected	Required	01-31-99	02-28-99	03-31-99
Lab Code	LLD	PACW-655	PACW-1421	PACW-2397
Gross Alpha	1.0 E-09	7.1 ± 3.4 E-10	< 7.0 E-10	< 3.5 E-10
Gross Beta	1.0 E-09	1.2 ± 0.1 E-08	< 1.2 E-09	9.5 ± 3.9 E-10
H-3	5.0 E-07	1.1 ± 0.1 E-06	3.3 ± 0.2 E-06	1.3 ± 0.1 E-05
Sr-89	5.0 E-09	< 1.1 E-09	< 6.2 E-10	< 5.9 E-10
Sr-90	1.0 E-09	< 6.2 E-10	< 5.9 E-10	< 5.9 E-10
Cs-137	1.0 E-08	1.3 ± 0.4 E-08	< 3.7 E-09	< 5.1 E-09
Others ^a	1.0 E-08	< 3.0 E-09	< 3.3 E-09	< 2.2 E-09
Date Collected	Required	04-30-99	05-31-99	06-30-99
Lab Code	LLD	PACW-3145	PACW-3943	PACW-5036
Gross Alpha	1.0 E-09	3.3 ± 2.8 E-10	1.6 ± 0.7 E-09	< 4.0 E-10
Gross Beta	1.0 E-09	8.7 ± 3.5 E-10	< 8.6 E-10	3.3 ± 0.4 E-09
H-3	5.0 E-07	1.7 ± 0.1 E-05	8.3 ± 0.3 E-06	8.1 ± 0.3 E-06
Sr-89	5.0 E-09	< 6.2 E-10	< 8.3 E-10	< 6.8 E-10
Sr-90	1.0 E-09	< 7.4 E-10	< 4.8 E-10	< 5.4 E-10
Cs-137	1.0 E-08	< 4.6 E-09	< 6.4 E-09	< 4.7 E-09
Others ^a	1.0 E-08	< 5.0 E-09	< 3.2 E-09	< 2.4 E-09

^a See Introduction

PALISADES

Table 9. In-Plant water, analyses for gross alpha, gross beta, strontium-89, strontium-90, tritium and gamma emitting isotopes.

Collection: Monthly composites

Units: uCi/mL

Location	Turbine Sump			
	Date Collected Lab Code	Required LLD	07-31-99 PACW-6012	08-31-99 PACW-6711
Gross Alpha	1.0 E-09	< 7.2 E-10	1.2 ± 0.4 E-09	< 4.7 E-10
Gross Beta	1.0 E-09	2.2 ± 0.5 E-09	1.8 ± 0.4 E-09	9.1 ± 0.4 E-10
H-3	5.0 E-07	3.6 ± 0.2 E-06	1.3 ± 0.1 E-05	1.8 ± 0.1 E-05
Sr-89	5.0 E-09	< 5.8 E-10	< 6.3 E-10	< 6.0 E-10
Sr-90	1.0 E-09	7.5 ± 3.5 E-10	< 5.0 E-10	< 1.0 E-09
Cs-137	1.0 E-08	< 3.2 E-09	< 2.9 E-09	< 7.1 E-09
Others ^a	1.0 E-08	< 2.8 E-09	< 2.0 E-09	< 3.6 E-09
Date Collected Lab Code	Required LLD	10-31-99 PACW-8903	12-01-99 PACW-9358, 9	12-31-99 PACW-10118
Gross Alpha	1.0 E-09	< 5.7 E-10	< 4.4 E-10	< 4.3 E-10
Gross Beta	1.0 E-09	2.4 ± 0.5 E-09	3.9 ± 0.3 E-09	1.9 ± 0.4 E-09
H-3	5.0 E-07	1.6 ± 0.1 E-05	1.5 ± 0.1 E-05	3.8 ± 0.2 E-06
Sr-89	5.0 E-09	< 5.9 E-10	< 6.2 E-10	< 8.6 E-10
Sr-90	1.0 E-09	< 5.3 E-10	< 4.5 E-10	< 6.2 E-10
Cs-137	1.0 E-08	< 4.0 E-09	< 4.7 E-09	< 3.5 E-09
Others ^a	1.0 E-08	< 3.4 E-09	< 3.8 E-09	< 2.0 E-09

^a See Introduction

PALISADES

Table 10. Milk, analyses for iodine-131 and gamma emitting isotopes,
Collection: Monthly

Location		AK - Allen Karr Farm				
Date Collected	Lab Code	Concentration (pCi/L)				
		I-131	K-40	Cs-134	Cs-137	Ba-La-140
<u>Required LLD</u>		<u>1.0</u>	-	<u>15.0</u>	<u>18.0</u>	<u>15.0</u>
01-11-99	PAMI -129	< 0.3	1223 ± 155	< 4.2	< 5.4	< 7.1
02-08-99	-743	< 0.3	1315 ± 132	< 2.8	< 4.3	< 2.4
03-08-99	-1449	< 0.4	1409 ± 136	< 7.3	< 6.3	< 2.3
04-12-99	-2374	< 0.2	1106 ± 153	< 3.1	< 4.9	< 3.9
05-10-99	-3143	< 0.3	1392 ± 158	< 3.5	< 6.6	< 2.9
06-07-99	-3923	< 0.4	1254 ± 124	< 2.6	< 3.8	< 7.0
07-12-99	-5006	< 0.2	1323 ± 173	< 5.1	< 7.2	< 4.5
08-09-99	-5840	< 0.2	1450 ± 140	< 5.7	< 4.3	< 3.7
08-31-99	-6675	< 0.4	1326 ± 171	< 7.1	< 6.3	< 3.1
10-05-99	-7725	< 0.3	1211 ± 146	< 6.9	< 4.2	< 4.8
11-08-99	-8745	< 0.2	1205 ± 145	< 5.1	< 6.2	< 4.2
12-06-99	-9392	< 0.3	1308 ± 148	< 5.5	< 6.5	< 2.9

Location		DC - Danny Carpenter Farm				
Date Collected	Lab Code	Concentration (pCi/L)				
		I-131	K-40	Cs-134	Cs-137	Ba-La-140
<u>Required LLD</u>		<u>1.0</u>	-	<u>15.0</u>	<u>18.0</u>	<u>15.0</u>
01-13-99	PAMI -181	< 0.4	1371 ± 110	< 3.4	< 2.8	< 1.4
02-01-99	-533	< 0.3	1312 ± 111	< 3.5	< 3.9	< 2.1
03-11-99	-1519	< 0.3	1324 ± 142	< 5.2	< 4.6	< 5.8
04-07-99	-2137	< 0.4	1279 ± 167	< 4.4	< 4.1	< 2.9
05-05-99	-3000	< 0.3	1470 ± 110	< 2.7	< 4.3	< 3.5
06-08-99	-3930	< 0.4	1325 ± 149	< 2.7	< 4.1	< 2.2
07-08-99	-4860	< 0.3	1352 ± 182	< 4.1	< 5.9	< 5.3
08-05-99	-5760	< 0.2	1355 ± 164	< 2.9	< 4.1	< 5.3
09-08-99	-6570	< 0.3	1316 ± 143	< 5.3	< 5.4	< 1.7
10-05-99	-7528, 9	< 0.5	1520 ± 106	< 2.4	< 2.1	< 3.2
11-03-99	-8661	< 0.3	1333 ± 198	< 14.2	< 11.6	< 6.9
12-01-99	-9262	< 0.4	1475 ± 124	< 2.2	< 4.2	< 2.5

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Table 10. Milk, analyses for iodine-131 and gamma emitting isotopes,
Collection: Monthly

Location		DS - Dennis Hessey Farm				
Date Collected	Lab Code	Concentration (pCi/L)				
		I-131	K-40	Cs-134	Cs-137	Ba-La-140
<u>Required LLD</u>		<u>1.0</u>	-	<u>15.0</u>	<u>18.0</u>	<u>15.0</u>
01-13-99	PAMI -183	< 0.3	1404 ± 172	< 7.0	< 4.6	< 2.7
02-01-99	-535	< 0.4	1268 ± 162	< 6.3	< 4.6	< 2.2
03-11-99	-1521	< 0.3	1165 ± 141	< 6.3	< 5.4	< 2.5
04-07-99	-2138	< 0.3	1394 ± 103	< 4.0	< 3.7	< 1.8
05-05-99	-3001,2	< 0.3	1525 ± 108	< 5.0	< 3.4	< 4.3
06-08-99	-3932	< 0.3	1351 ± 151	< 7.1	< 6.3	< 3.0
07-08-99	-4862	< 0.5	1437 ± 171	< 3.0	< 7.4	< 4.9
08-05-99	-5761	< 0.2	1212 ± 104	< 3.8	< 4.6	< 3.7
09-08-99	-6571	< 0.3	1489 ± 184	< 3.3	< 3.9	< 4.1
10-05-99	-7727	< 0.3	1287 ± 169	< 3.5	< 3.4	< 12.6
11-03-99	-8662	< 0.4	1413 ± 145	< 10.1	< 5.8	< 8.0
12-01-99	-9263	< 0.4	1342 ± 209	< 7.1	< 9.7	< 5.8

Location		WS - William Shine Farm				
Date Collected	Lab Code	Concentration (pCi/L)				
		I-131	K-40	Cs-134	Cs-137	Ba-La-140
<u>Required LLD</u>		<u>1.0</u>	-	<u>15.0</u>	<u>18.0</u>	<u>15.0</u>
01-13-99	PAMI -182	< 0.3	1452 ± 125	< 4.7	< 4.0	< 2.8
02-01-99	-534	< 0.3	1325 ± 127	< 2.7	< 4.9	< 1.9
03-11-99	-1520	< 0.3	1424 ± 169	< 5.6	< 5.0	< 3.5
04-07-99	-2136	< 0.3	1305 ± 153	< 4.1	< 6.6	< 2.1
05-05-99	-3003	< 0.3	1553 ± 151	< 2.9	< 5.8	< 6.6
06-08-99	-3931	< 0.3	1572 ± 118	< 4.5	< 3.3	< 4.3
07-08-99	-4861	< 0.3	1315 ± 172	< 5.8	< 6.8	< 6.8
08-05-99	-5762	< 0.2	1556 ± 190	< 4.4	< 3.8	< 5.1
09-08-99	-6572	< 0.4	1405 ± 179	< 6.9	< 7.5	< 3.9
10-05-99	-7726	< 0.3	1470 ± 193	< 6.3	< 6.5	< 8.4
11-03-99	-8663	< 0.3	1416 ± 108	< 2.1	< 4.0	< 2.8
12-01-99	-9264	< 0.4	1614 ± 114	< 4.6	< 4.1	< 2.8

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Table 11. Food Crops, analyses for gross beta and gamma-emitting isotopes.
 Collection: Semiannually, at the time of harvest.
 Units: pCi/g wet

Location		Paul Rood Farm				
Lab Code	PAVE-5315	PAVE-6784	PAVE-6785	PAVE-6786		Req. LLD
Date Collected	7/17/99	9/14/99	9/14/99	9/14/99		
Sample Type	Blueberries	Pears	Apples	Apples		
Gross Beta	0.92 ± 0.02	0.96 ± 0.03	1.04 ± 0.03	1.33 ± 0.05		1.00
Mn-54	< 0.010	< 0.009	< 0.017	< 0.018		0.08
Fe-59	< 0.008	< 0.017	< 0.026	< 0.017		0.10
Co-58	< 0.008	< 0.008	< 0.018	< 0.011		0.08
Co-60	< 0.008	< 0.014	< 0.018	< 0.014		0.05
Zn-65	< 0.018	< 0.009	< 0.052	< 0.035		0.10
Zr-Nb-95	< 0.008	< 0.009	< 0.019	< 0.023		0.10
I-131	< 0.016	< 0.031	< 0.044	< 0.035		0.06 ^a
Cs-134	< 0.013	< 0.006	< 0.017	< 0.020		0.08
Cs-137	< 0.015	< 0.011	< 0.023	< 0.019		0.08

Location		J. Sarno Farm			
Lab Code	PAVE-4863	PAVE-4864	PAVE-4865		Req. LLD
Date Collected	7/7/99	7/7/99	7/7/99		
Sample Type	Peaches	Cherries	Blueberries		
Gross Beta	2.12 ± 0.08	1.63 ± 0.05	0.87 ± 0.03		1.00
Mn-54	< 0.019	< 0.013	< 0.014		0.08
Fe-59	< 0.020	< 0.018	< 0.022		0.10
Co-58	< 0.005	< 0.017	< 0.009		0.08
Co-60	< 0.023	< 0.016	< 0.022		0.05
Zn-65	< 0.036	< 0.015	< 0.038		0.10
Zr-Nb-95	< 0.012	< 0.018	< 0.018		0.10
I-131	< 0.030	< 0.036	< 0.028		0.06 ^a
Cs-134	< 0.023	< 0.008	< 0.023		0.08
Cs-137	< 0.015	< 0.009	< 0.012		0.08

^a Required for broadleaf vegetation only.

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Table 11. Food Crops, analyses for gross beta and gamma-emitting isotopes.
 Collection: Semiannually, at the time of harvest.
 Units: pCi/g wet

J. Sarno Farm					
Location					
Lab Code	PAVE-6787	PAVE-6788	PAVE-6789	PAVE-6790	
Date Collected	9/15/99	9/15/99	9/15/99	9/15/99	Req. LLD
Sample Type	Plums	Peaches	Grapes	Grapes	
Gross Beta	2.13 ± 0.07	1.64 ± 0.05	2.60 ± 0.09	2.61 ± 0.08	1.00
Mn-54	< 0.010	< 0.006	< 0.026	< 0.016	0.08
Fe-59	< 0.033	< 0.038	< 0.060	< 0.046	0.10
Co-58	< 0.012	< 0.010	< 0.012	< 0.011	0.08
Co-60	< 0.015	< 0.014	< 0.027	< 0.017	0.05
Zn-65	< 0.020	< 0.017	< 0.051	< 0.008	0.10
Zr-Nb-95	< 0.006	< 0.012	< 0.018	< 0.018	0.10
I-131	< 0.008	< 0.020	< 0.039	< 0.014	0.06 ^a
Cs-134	< 0.011	< 0.008	< 0.014	< 0.009	0.08
Cs-137	< 0.008	< 0.009	< 0.026	< 0.013	0.08

J. Sarno Farm					
Location					
Lab Code	PAVE-6791	PAVE-6792	PAVE-6793, 4		
Date Collected	9/15/99	9/15/99	9/15/99		Req. LLD
Sample Type	Pears	Apples	Apples		
Gross Beta	1.19 ± 0.04	0.94 ± 0.03	1.13 ± 0.03		1.00
Mn-54	< 0.011	< 0.008	< 0.011		0.08
Fe-59	< 0.024	< 0.019	< 0.014		0.10
Co-58	< 0.005	< 0.013	< 0.012		0.08
Co-60	< 0.007	< 0.006	< 0.012		0.05
Zn-65	< 0.022	< 0.010	< 0.037		0.10
Zr-Nb-95	< 0.006	< 0.009	< 0.014		0.10
I-131	< 0.014	< 0.012	< 0.028		0.06 ^a
Cs-134	< 0.009	< 0.004	< 0.018		0.08
Cs-137	< 0.010	< 0.011	< 0.015		0.08

^a Required for broadleaf vegetation only.

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Table 12. Fish, analyses for gross beta and gamma-emitting isotopes.
 Collection: Semiannually
 Units: pCi/g wet

Location	Discharge			
Lab Code	PAF-3004	PAF-3005	PAF-3006	
Date Collected	5/4/99	5/4/99	5/4/99	Req. LLD
Sample Type	Alewife	Steelhead	Carp	
Gross Beta	1.19 ± 0.10	2.41 ± 0.11	1.78 ± 0.07	1.00
Mn-54	< 0.016	< 0.015	< 0.010	0.13
Fe-59	< 0.065	< 0.024	< 0.019	0.26
Co-58	< 0.010	< 0.013	< 0.026	0.13
Co-60	< 0.030	< 0.007	< 0.021	0.13
Zn-65	< 0.017	< 0.030	< 0.019	0.26
Zr-Nb-95	< 0.021	< 0.036	< 0.023	0.10
Cs-134	< 0.018	< 0.014	< 0.010	0.13
Cs-137	< 0.022	0.033 ± 0.014	< 0.016	0.15
Lab Code	PAF-8069	PAF-8070	PAF-8071	
Date Collected	10/12/99	10/12/99	10/19/99	Req. LLD
Sample Type	Gizzard Shad	Chinook Salmon	Lake Trout	
Gross Beta	1.44 ± 0.06	1.88 ± 0.10	2.35 ± 0.11	1.00
Mn-54	< 0.020	< 0.011	< 0.007	0.13
Fe-59	< 0.052	< 0.026	< 0.034	0.26
Co-58	< 0.019	< 0.015	< 0.020	0.13
Co-60	< 0.015	< 0.008	< 0.014	0.13
Zn-65	< 0.037	< 0.043	< 0.039	0.26
Zr-Nb-95	< 0.025	< 0.013	< 0.042	0.10
Cs-134	< 0.019	< 0.012	< 0.009	0.13
Cs-137	< 0.021	< 0.014	< 0.024	0.15

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Table 12. Fish, analyses for gross beta and gamma-emitting isotopes.
 Collection: Semiannually
 Units: pCi/g wet

Location	Ludington Pumped Storage Plant (Control)			
Lab Code	PAF-7955	PAF-7956	PAF-7957	
Date Collected	10/7/99	10/7/99	10/7/99	Req. LLD
Sample Type	Lakle Trout	Gizzard Shad	Chinook Salmon	
Gross Beta	1.66 ± 0.06	1.41 ± 0.07	1.70 ± 0.10	1.00
Mn-54	< 0.017	< 0.011	< 0.012	0.13
Fe-59	< 0.046	< 0.033	< 0.024	0.26
Co-58	< 0.022	< 0.010	< 0.011	0.13
Co-60	< 0.027	< 0.014	< 0.010	0.13
Zn-65	< 0.028	< 0.018	< 0.058	0.26
Zr-Nb-95	< 0.015	< 0.015	< 0.020	0.10
Cs-134	< 0.014	< 0.010	< 0.012	0.13
Cs-137	< 0.024	< 0.015	< 0.016	0.15

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Table 13. Algae, analyses for gross beta and gamma-emitting isotopes.
Collection: Semiannually
Units: pCi/g wet

Location		Palisades Discharge	
Lab Code	PASL-3007		
Date Collected	5/4/99		Req. LLD
Gross Beta	2.82 ± 0.54		1.00
Mn-54	< 0.012		0.08
Fe-59	< 0.047		0.10
Co-58	< 0.017		0.08
Co-60	< 0.013		0.05
Zn-65	< 0.015		0.10
Zr-Nb-95	< 0.030		0.10
Cs-134	< 0.012		0.15
Cs-137	0.035 ± 0.015		0.18

Location		Ludington (Control)	
Lab Code			
Date Collected			Req. LLD
Gross Beta			1.00
Mn-54			0.08
Fe-59			0.10
Co-58			0.08
Co-60			0.05
Zn-65			0.10
Zr-Nb-95			0.10
Cs-134			0.15
Cs-137			0.18

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Table 14. Bottom sediment, analyses for gross beta and gamma-emitting isotopes.
 Collection: Semiannually
 Units: pCi/g dry

Location	South Haven (8.9 km North)		Ludington (Control)		
Lab Code	PABS-3095	PABS-7827	PABS-6272	PABS-633	
Date Collected	4/20/99	10/5/99	8/4/99	1/12/00	Req. LLD
Gross Beta	11.09 ± 1.53	9.09 ± 1.43	12.73 ± 2.32	5.40 ± 1.41	1.00
Mn-54	< 0.018	< 0.020	< 0.007	< 0.005	0.08
Fe-59	< 0.085	< 0.061	< 0.031	< 0.043	0.10
Co-58	< 0.030	< 0.012	< 0.010	< 0.009	0.08
Co-60	< 0.014	< 0.024	< 0.010	< 0.008	0.05
Zn-65	< 0.069	< 0.091	< 0.032	< 0.027	0.10
Zr-Nb-95	< 0.040	< 0.015	< 0.017	< 0.026	0.10
Cs-134	< 0.020	< 0.026	< 0.014	< 0.012	0.15
Cs-137	< 0.017	< 0.023	0.017 ± 0.006	0.033 ± 0.010	0.18

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Table 14. Bottom sediment, analyses for gross beta and gamma-emitting isotopes.
 Collection: Semiannually
 Units: pCi/g dry

Location	Palisades Discharge			
Lab Code	PABS-3093,4	PABS-7830		
Date Collected	4/20/99	10/5/99		Req. LLD
Gross Beta	5.57 ± 0.96	6.67 ± 1.33		1.00
Mn-54	< 0.012	< 0.018		0.08
Fe-59	< 0.036	< 0.028		0.10
Co-58	< 0.023	< 0.017		0.08
Co-60	< 0.005	< 0.027		0.05
Zn-65	< 0.058	< 0.074		0.10
Zr-Nb-95	< 0.017	< 0.029		0.10
Cs-134	< 0.021	< 0.017		0.15
Cs-137	< 0.016	< 0.020		0.18

Location	North Property (0.8 mi.)		South Property (0.8 mi.)		
Lab Code	PABS-3096	PABS-7828	PABS-3097	PABS-7829	
Date Collected	4/20/99	10/5/99	4/20/99	10/5/99	Req. LLD
Gross Beta	8.04 ± 1.46	7.58 ± 1.44	4.75 ± 1.25	5.66 ± 1.39	1.00
Mn-54	< 0.018	< 0.022	< 0.015	< 0.009	0.08
Fe-59	< 0.055	< 0.062	< 0.029	< 0.023	0.10
Co-58	< 0.027	< 0.034	< 0.027	< 0.014	0.08
Co-60	< 0.013	< 0.022	< 0.016	< 0.011	0.05
Zn-65	< 0.071	< 0.087	< 0.065	< 0.079	0.10
Zr-Nb-95	< 0.035	< 0.036	< 0.039	< 0.019	0.10
Cs-134	< 0.017	< 0.025	< 0.019	< 0.024	0.15
Cs-137	< 0.019	< 0.024	< 0.018	< 0.016	0.18

PALISADES

Table 15.1. Liquid Radwaste, analyses for gross alpha, tritium, strontium-89, strontium-90, plutonium-239 and gamma emitting isotopes.

Collection: Monthly

Units: uCi/ml

Lab Code	Required LLD	PARW-656	NS ^a	NS ^a
Date Collected	-	01-31-99	02-28-99	03-31-99
Gross Alpha	1.0 E-07	< 1.8 E-09	-	-
H-3	1.0 E-05	2.67 ± 0.01 E-01	-	-
Sr-89	5.0 E-08	< 3.0 E-09	-	-
Sr-90	5.0 E-08	1.8 ± 0.2 E-08	-	-
Pu-239	5.0 E-08	< 5.9 E-11	-	-
Cr-51	5.0 E-07	< 1.01 E-07	-	-
Mn-54	5.0 E-07	< 4.65 E-09	-	-
Fe-59	5.0 E-07	< 8.25 E-09	-	-
Co-58	5.0 E-07	9.06 ± 0.67 E-08	-	-
Co-60	5.0 E-07	1.10 ± 0.47 E-07	-	-
Zn-65	5.0 E-07	< 1.46 E-08	-	-
Zr-95	5.0 E-07	< 8.79 E-09	-	-
Nb-95	5.0 E-07	< 7.62 E-09	-	-
Ag-110m	5.0 E-07	< 5.06 E-08	-	-
Sb-124	5.0 E-07	3.60 ± 1.86 E-08	-	-
Cs-134	5.0 E-07	5.37 ± 0.08 E-07	-	-
Cs-137	5.0 E-07	2.99 ± 0.02 E-06	-	-
Ba-140	5.0 E-07	< 9.52 E-08	-	-
La-140	5.0 E-07	< 1.02 E-08	-	-
Ce-141	5.0 E-07	< 1.81 E-08	-	-
Ce-144	5.0 E-07	< 8.73 E-08	-	-

^a NS=No sample; sample not received.

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Table 15.1. Liquid Radwaste, analyses for gross alpha, tritium, strontium-89, strontium-90, plutonium-239 and gamma emitting isotopes.

Collection: Monthly
Units: uCi/ml

Lab Code	Required LLD	NS ^a	NS ^a	PARW-5052
Date Collected	-	04-30-99	05-31-99	06-30-99
Gross Alpha	1.0 E-07	-	-	< 1.3 E-09
H-3	1.0 E-05	-	-	3.04 ± 0.01 E-01
Sr-89	5.0 E-08	-	-	< 3.5 E-09
Sr-90	5.0 E-08	-	-	2.9 ± 1.1 E-09
Pu-239	5.0 E-08	-	-	< 1.3 E-10
Cr-51	5.0 E-07	-	-	< 1.33 E-07
Mn-54	5.0 E-07	-	-	< 3.74 E-09
Fe-59	5.0 E-07	-	-	< 8.11 E-09
Co-58	5.0 E-07	-	-	1.52 ± 0.08 E-07
Co-60	5.0 E-07	-	-	9.81 ± 0.42 E-08
Zn-65	5.0 E-07	-	-	< 1.43 E-08
Zr-95	5.0 E-07	-	-	< 7.77 E-09
Nb-95	5.0 E-07	-	-	< 8.15 E-09
Ag-110m	5.0 E-07	-	-	1.24 ± 0.66 E-08
Sb-124	5.0 E-07	-	-	< 3.28 E-08
Cs-134	5.0 E-07	-	-	4.82 ± 0.08 E-07
Cs-137	5.0 E-07	-	-	2.73 ± 0.02 E-06
Ba-140	5.0 E-07	-	-	< 1.79 E-07
La-140	5.0 E-07	-	-	< 2.02 E-08
Ce-141	5.0 E-07	-	-	< 2.23 E-08
Ce-144	5.0 E-07	-	-	< 8.83 E-08

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Table 15.1. Liquid Radwaste, analyses for gross alpha, tritium, strontium-89, strontium-90, plutonium-239 and gamma emitting isotopes.

Collection: Monthly
Units: uCi/ml

Lab Code	Required LLD	NS ^a	NS ^a	NS ^a
Date Collected	-	07-31-99	08-31-99	09-30-99
Gross Alpha	1.0 E-07	-	-	-
H-3	1.0 E-05	-	-	-
Sr-89	5.0 E-08	-	-	-
Sr-90	5.0 E-08	-	-	-
Pu-239	5.0 E-08	-	-	-
Cr-51	5.0 E-07	-	-	-
Mn-54	5.0 E-07	-	-	-
Fe-59	5.0 E-07	-	-	-
Co-58	5.0 E-07	-	-	-
Co-60	5.0 E-07	-	-	-
Zn-65	5.0 E-07	-	-	-
Zr-95	5.0 E-07	-	-	-
Nb-95	5.0 E-07	-	-	-
Ag-110m	5.0 E-07	-	-	-
Sb-124	5.0 E-07	-	-	-
Cs-134	5.0 E-07	-	-	-
Cs-137	5.0 E-07	-	-	-
Ba-140	5.0 E-07	-	-	-
La-140	5.0 E-07	-	-	-
Ce-141	5.0 E-07	-	-	-
Ce-144	5.0 E-07	-	-	-

^a NS=No sample; sample not received.

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Table 15.1. Liquid Radwaste, analyses for gross alpha, tritium, strontium-89, strontium-90, plutonium-239 and gamma emitting isotopes.

Collection: Monthly
Units: uCi/ml

Lab Code	Required LLD	PARW-8905	NS ^a	NS ^a
Date Collected	-	10-04-99	11-30-99	12-31-99
Gross Alpha	1.0 E-07	< 1.4 E-09	-	-
H-3	1.0 E-05	2.19 ± 0.01 E-01	-	-
Sr-89	5.0 E-08	< 4.5 E-09	-	-
Sr-90	5.0 E-08	1.4 ± 0.2 E-08	-	-
Pu-239	5.0 E-08	< 1.1 E-10	-	-
Cr-51	5.0 E-07	< 1.95 E-07	-	-
Mn-54	5.0 E-07	4.05 ± 2.31 E-09	-	-
Fe-59	5.0 E-07	< 1.11 E-08	-	-
Co-58	5.0 E-07	1.60 ± 0.01 E-07	-	-
Co-60	5.0 E-07	1.43 ± 0.01 E-07	-	-
Zn-65	5.0 E-07	< 1.14 E-08	-	-
Zr-95	5.0 E-07	< 7.86 E-09	-	-
Nb-95	5.0 E-07	< 9.99 E-09	-	-
Ag-110m	5.0 E-07	< 3.86 E-08	-	-
Sb-124	5.0 E-07	1.06 ± 0.18 E-07	-	-
Cs-134	5.0 E-07	3.22 ± 0.18 E-07	-	-
Cs-137	5.0 E-07	2.79 ± 0.02 E-06	-	-
Ba-140	5.0 E-07	< 4.42 E-07	-	-
La-140	5.0 E-07	< 3.34 E-08	-	-
Ce-141	5.0 E-07	< 2.30 E-08	-	-
Ce-144	5.0 E-07	< 5.49 E-08	-	-

^a NS=No sample; sample not received.

PALISADES

Table 15.2. Stack Filters, analyses for gross alpha, plutonium-239, strontium-89 and strontium-90.

Collection: Continuous, monthly exchange.

Units: pCi/filter

Location		Palisades			
Date Collected	Lab Code	Gross Alpha	Sr-89	Sr-90	Pu-239
<u>Required LLD</u>		<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
01-31-99	PASP -657	< 0.9	< 4.8	< 3.6	< 0.1
02-28-99	-1420	< 0.8	< 3.8	< 3.1	< 0.1
03-31-99	-2398	< 0.6	< 4.2	< 2.8	< 0.2
04-30-99	-3142	< 0.6	< 7.0	< 3.4	< 0.2
05-31-99	-3944	< 0.5	< 5.1	< 2.3	< 0.2
06-30-99	-5053	< 0.6	< 6.4	< 3.1	< 0.3
07-31-99	-6011	< 0.6	< 5.7	< 2.8	< 0.3
08-31-99	-6712	< 0.8	< 4.1	< 3.0	< 0.2
09-30-99	-7647	1.0 ± 0.5	< 4.2	3.1 ± 1.7	< 0.2
10-27-99	-8904	< 0.6	< 6.6	< 3.0	< 0.2
11-24-99	-9360	< 0.6	< 5.6	< 3.4	< 0.1
12-30-99	-10119	1.0 ± 0.4	< 4.5	< 2.8	< 0.1

ENCLOSURE E

**CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255**

**PALISADES NUCLEAR PLANT
1999 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT
EPA INTERLABORATORY COMPARISON PROGRAM RESULTS**

25 Pages

APPENDIX A
INTERLABORATORY COMPARISON PROGRAM RESULTS

NOTE: Teledyne Brown Engineering - Environmental Services, Midwest Laboratory participates in intercomparison studies administered by Environmental Resources Associates, and serves as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada. Results are reported in Appendix A. TLD Intercomparison results, in-house spikes, blanks, duplicates and mixed analyte performance evaluation program results are also reported. Appendix A is updated four times a year; the complete Appendix is included in March, June, September and December monthly progress reports only.

January, 1999 through December, 1999

Appendix A

Interlaboratory Comparison Program Results

Teledyne Brown Engineering Environmental Services Midwest Laboratory has participated in interlaboratory comparison (crosscheck) programs since the formulation of its quality control program in December 1971. These programs are operated by agencies which supply environmental type samples (e.g., milk or water) containing concentrations of radionuclides known to the issuing agency but not to participant laboratories. The purpose of such a program is to provide an independent check on the laboratory's analytical procedures and to alert it to any possible problems.

Participant laboratories measure the concentration of specified radionuclides and report them to the issuing agency. Several months later, the agency reports the known values to the participant laboratories and specifies control limits. Results consistently higher or lower than the known values or outside the control limits indicate a need to check the instruments or procedures used.

The results in Table A-1 were obtained through participation in the environmental sample crosscheck program for milk, water and air filters during the past twelve months. Data for previous years is available upon request.

This program was conducted by Environmental Resources Associates and serves to replace studies conducted by the U.S. Environmental Protection Agency.

The results in Table A-2 were obtained for Thermoluminescent Dosimeters (TLDs), via various International Intercomparisons of Environmental Dosimeters under the sponsorships listed in Table A-2. Also Teledyne testing results are listed.

Table A-3 lists results of the analyses on in-house "spiked" samples for the past twelve months. All samples are prepared using NIST traceable sources. Data for previous years available upon request.

Table A-4 lists results of the analyses on in-house "blank" samples for the past twelve months. Data for previous years available upon request.

Table A-5 list results of the in-house "duplicate" program for the past twelve months. Acceptance is based on the difference of the results being less than the sum of the errors. Data for previous years available upon request.

The results in Table A-6 were obtained through participation in the Mixed Analyte Performance Evaluation Program.

The results in Table A-7 were obtained through participation in the Environmental Measurement Laboratory Quality Assessment Program.

Attachment A lists acceptance criteria for "spiked" samples.

Out-of-limit results are explained directly below the result.

12-31-99

ATTACHMENT A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

LABORATORY PRECISION: ONE STANDARD DEVIATION VALUES FOR VARIOUS ANALYSES^a

Analysis	Level	One Standard Deviation for single determinations
Gamma Emitters	5 to 100 pCi/liter or kg >100 pCi/liter or kg	5.0 pCi/liter 5% of known value
Strontium-89 ^b	5 to 50 pCi/liter or kg >50 pCi/liter or kg	5.0 pCi/liter 10% of known value
Strontium-90 ^b	2 to 30 pCi/liter or kg >30 pCi/liter or kg	5.0 pCi/liter 10% of known value
Potassium-40	>0.1 g/liter or kg	5% of known value
Gross alpha	≤20 pCi/liter >20 pCi/liter	5.0 pCi/liter 25% of known value
Gross beta	≤100 pCi/liter >100 pCi/liter	5.0 pCi/liter 5% of known value
Tritium	≤4,000 pCi/liter >4,000 pCi/liter	1s = (pCi/liter) = 169.85 x (known) ^{0.0933} 10% of known value
Radium-226,-228	<0.1 pCi/liter	15% of known value
Plutonium	0.1 pCi/liter, gram, or sample	10% of known value
Iodine-131, Iodine-129 ^b	≤55 pCi/liter >55 pCi/liter	6.0 pCi/liter 10% of known value
Uranium-238, Nickel-63 ^b Technetium-99 ^b	≤35 pCi/liter >35 pCi/liter	6.0 pCi/liter 15% of known value
Iron-55 ^b	50 to 100 pCi/liter >100 pCi/liter	10 pCi/liter 10% of known value
Others ^b	--	20% of known value

^a From EPA publication, "Environmental Radioactivity Laboratory Intercomparison Studies Program, Fiscal Year, 1981-1982, EPA-600/4-81-004.

^b Teledyne limit.

Table A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA), comparison of ERA and Teledyne Midwest Laboratory results^a.

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				Teledyne Results ± 2 Sigma ^c	ERA Result ^d 1s, N=1	Control Limits
STW-861	WATER	Sep, 1999	Ra-226	15.6 \pm 0.3	16.5 \pm 1.7	12.2 - 20.8
STW-861	WATER	Sep, 1999	Ra-228	3.2 \pm 0.3	2.2 \pm 0.2	1.2 - 3.1
The activity reported is the average of three separate analyses. Individual results : 2.6, 2.9 and 4.0.						
STW-861	WATER	Sep, 1999	Uranium	39.4 \pm 1.2	45.4 \pm 4.5	37.7 - 53.1
STW-862	WATER	Nov, 1999	I-131	23.9 \pm 0.1	23.3 \pm 2.3	18.1 - 28.5

^a Results obtained by Teledyne Brown Engineering Environmental Services Midwest Laboratory as a participant in the environmental sample crosscheck program operated by Environmental Resource Associates(ERA).

^b All results are in pCi/L, except for elemental potassium (K) data in milk, which are in mg/L; air filter samples, which are in pCi/Filter.

^c Unless otherwise indicated, the TBESML results are given as the mean \pm 2 standard deviations for three determinations.

^d ERA results are presented as the known values and expected laboratory precision (1s, 1 determination) and control limits as defined by ERA.

Table A-2. Crosscheck program results; Thermoluminescent Dosimeters. (TLDs).

Lab Code	TLD Type	Date	Measurement	mR		
				Teledyne Results ± 2 Sigma	Known Value	Average ± 2 Sigma (All Participants)
<u>Teledyne Testing</u>						
98-1	LiF-100 Chips	May, 1998	Lab, 1	15.5 ± 1.3	16.7	-
98-1	LiF-100 Chips	May, 1998	Lab, 2	23.9 ± 0.9	32.4	-
98-1	LiF-100 Chips	May, 1998	Lab, 3	59.8 ± 1.9	60.2	-
98-1	CaSO ₄ : Dy Cards	May, 1998	Reader 1, #1	18.5 ± 0.8	16.7	-
98-1	CaSO ₄ : Dy Cards	May, 1998	Reader 1, #2	27.3 ± 1.7	32.4	-
98-1	CaSO ₄ : Dy Cards	May, 1998	Reader 1, #3	70.0 ± 4.7	60.2	-

Chips and Cards were irradiated by Teledyne Brown Engineering, Westwood, New Jersey, in May, 1998.

Teledyne Testing

99-1	LiF-100 Chips	Mar, 1999	Lab, 1	14.5 ± 0.5	15.4	-
99-1	LiF-100 Chips	Mar, 1999	Lab, 2	29.3 ± 1.0	31.8	-
99-1	LiF-100 Chips	Mar, 1999	Lab, 3	60.0 ± 0.2	59.1	-
99-1	CaSO ₄ : Dy Cards	Mar, 1999	Reader 1, #1	18.3 ± 0.5	15.4	-
99-1	CaSO ₄ : Dy Cards	Mar, 1999	Reader 1, #2	35.9 ± 1.3	31.8	-
99-1	CaSO ₄ : Dy Cards	Mar, 1999	Reader 1, #3	66.5 ± 4.4	59.1	-

Chips and Cards were irradiated by Teledyne Brown Engineering, Westwood, New Jersey, in March, 1999.

Table A-3. In-house "spike" samples.

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^a		
				Teledyne Results 2s, n=1 ^b	Known Activity	Control ^c Limits
SPW-140	WATER	Jan, 1999	Ra-226	14.51 ± 0.52	13.79	9.65 - 17.93
SPW-140	WATER	Jan, 1999	Ra-228	9.47 ± 1.49	8.28	5.80 - 10.76
SPW-142	WATER	Jan, 1999	Gr. Alpha	30.82 ± 2.49	33.97	16.99 - 50.96
SPW-142	WATER	Jan, 1999	Gr. Beta	30.87 ± 1.91	30.18	20.18 - 40.18
SPW-254	WATER	Jan, 1999	H-3	37752.00 ± 540.00	38559.00	30847.20 - 46270.80
SPAP-270	AIR FILTER	Jan, 1999	Cs-137	2.04 ± 0.02	1.82	1.09 - 2.55
SPAP-787	AIR FILTER	Jan, 1999	Gr. Beta	5.97 ± 0.02	5.38	0.00 - 15.38
SPW-789	WATER	Jan, 1999	Co-60	44.83 ± 7.11	40.46	30.46 - 50.46
SPW-789	WATER	Jan, 1999	Cs-137	45.17 ± 8.63	37.70	27.70 - 47.70
SPW-791	WATER	Feb, 1999	Ra-226	15.50 ± 0.60	13.80	9.66 - 17.94
SPW-791	WATER	Feb, 1999	Ra-228	6.36 ± 1.39	8.20	5.74 - 10.66
SPW-792	WATER	Feb, 1999	Gr. Alpha	24.36 ± 2.08	33.97	16.99 - 50.96
SPW-792	WATER	Feb, 1999	Gr. Beta	28.98 ± 1.79	30.13	20.13 - 40.13
SPU-1030	WATER	Feb, 1999	Ra-226,	38.81 ± 1.30	34.45	24.12 - 44.79
SPW-1460	WATER	Mar, 1999	Ra-226	13.26 ± 0.55	13.79	9.65 - 17.93
SPW-1460	WATER	Mar, 1999	Ra-228	12.53 ± 1.47	16.26	11.38 - 21.13
SPW-1466	WATER	Mar, 1999	Gr. Alpha	61.00 ± 3.08	49.44	24.72 - 74.15
SPW-1466	WATER	Mar, 1999	Gr. Beta	35.52 ± 1.86	30.07	20.07 - 40.07
SPMI-1677	MILK	Mar, 1999	Cs-137	17.17 ± 2.08	18.78	8.78 - 28.78
SPMI-1677	MILK	Mar, 1999	Sr-90	34.94 ± 1.53	31.85	25.48 - 38.22
SPW-1681	WATER	Mar, 1999	Sr-89	49.30 ± 3.85	59.20	47.36 - 71.04
SPW-1681	WATER	Mar, 1999	Sr-90	29.00 ± 1.65	31.85	25.48 - 38.22
SPW-2264	WATER	Apr, 1999	Ra-226	12.44 ± 0.14	13.80	9.66 - 17.94
SPW-2264	WATER	Apr, 1999	Ra-228	18.73 ± 1.92	16.08	11.26 - 20.90
SPAP-2395	AIR FILTER	Apr, 1999	Cs-137	1.86 ± 0.02	1.81	1.09 - 2.53
SPW-2265	WATER	Apr, 1999	Gr. Alpha	62.89 ± 5.90	49.40	24.70 - 74.10
SPW-2265	WATER	Apr, 1999	Gr. Beta	34.52 ± 3.24	30.00	20.00 - 40.00
SPW-2574	WATER	Apr, 1999	H-3	56548.00 ± 648.00	57517.00	46013.60 - 69020.40
SPMI-2686	MILK	Apr, 1999	Cs-134	23.56 ± 5.30	22.30	12.30 - 32.30
SPMI-2686	MILK	Apr, 1999	Cs-137	40.21 ± 7.19	37.50	27.50 - 47.50
SPW-2688	WATER	Apr, 1999	Co-60	20.79 ± 5.61	19.64	9.64 - 29.64
SPW-2688	WATER	Apr, 1999	Cs-134	23.16 ± 6.13	22.29	12.29 - 32.29
SPW-2688	WATER	Apr, 1999	Cs-137	37.49 ± 3.75	31.60	21.60 - 41.60
SPAP-2653	AIR FILTER	Apr, 1999	Gr. Beta	8.96 ± 0.05	8.19	0.00 - 18.19
SPVE-2977	VEGETATION	May, 1999	Cs-134	0.67 ± 0.04	0.68	0.41 - 0.95
SPVE-2977	VEGETATION	May, 1999	Cs-137	0.55 ± 0.05	0.58	0.35 - 0.81
SPW-3314	WATER	May, 1999	Ra-226	13.62 ± 0.35	13.79	9.65 - 17.93
SPW-3314	WATER	May, 1999	Ra-228	16.57 ± 1.73	15.93	11.15 - 20.71
SPSO-3317	SOIL	May, 1999	Cs-134	0.09 ± 0.01	0.07	0.04 - 0.10
SPSO-3317	SOIL	May, 1999	Cs-137	0.54 ± 0.05	0.42	0.25 - 0.59
SPSO-3318	SOIL	May, 1999	Cs-134	0.09 ± 0.02	0.07	0.04 - 0.10

Table A-3. In-house "spike" samples.

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^a		
				Teledyne Results 2s, n=1 ^b	Known Activity	Control ^c Limits
SPSO-3318	SOIL	May, 1999	Cs-137	0.54 ± 0.02	0.42	0.25 - 0.59
SPW-3315	WATER	May, 1999	Gr. Beta	32.57 ± 1.63	29.95	19.95 - 39.95
SPF-3777	FISH	May, 1999	Cs-134	0.43 ± 0.03	0.52	0.31 - 0.73
SPF-3777	FISH	May, 1999	Cs-137	0.57 ± 0.04	0.60	0.36 - 0.84
SPW-3721	WATER	Jun, 1999	Rn-222	553.52 ± 46.70	610.35	366.21 - 854.49
SPW-4005	WATER	Jun, 1999	Ra-226	13.85 ± 0.42	13.79	9.65 - 17.93
SPW-4005	WATER	Jun, 1999	Ra-228	16.42 ± 1.81	15.77	11.04 - 20.50
SPW-4006	WATER	Jun, 1999	Gr. Alpha	46.32 ± 2.80	49.41	24.71 - 74.12
SPW-4006	WATER	Jun, 1999	Gr. Beta	32.12 ± 1.83	29.90	19.90 - 39.90
SPW-4869	WATER	Jul, 1999	Ra-226	14.00 ± 0.47	13.79	9.65 - 17.93
SPW-4869	WATER	Jul, 1999	Ra-228	14.96 ± 1.53	15.62	10.93 - 20.31
SPW-4870	WATER	Jul, 1999	Gr. Alpha	70.07 ± 3.45	29.84	14.92 - 44.76
SPW-4870	WATER	Jul, 1999	Gr. Beta	84.01 ± 2.62	41.18	31.18 - 51.18
Results for gross alpha and beta appear to be approximately 2x the spike level. The sample volume or spike level is suspect.						
SPW-4964	WATER	Jul, 1999	H-3	60442.00 ± 679.00	56807.00	45445.60 - 68168.40
SPAP-5001	AIR FILTER	Jul, 1999	Cs-137	2.03 ± 0.02	1.79	1.07 - 2.51
SPAP-5003	AIR FILTER	Jul, 1999	Gr. Beta	7.48 ± 0.02	8.15	0.00 - 18.15
SPMI-5348	MILK	Jul, 1999	Sr-89	46.85 ± 4.96	55.53	44.42 - 66.64
SPMI-5348	MILK	Jul, 1999	Sr-90	31.47 ± 1.65	31.60	25.28 - 37.92
SPW-5502	WATER	Jul, 1999	Sr-89	43.27 ± 2.81	51.15	40.92 - 61.38
SPW-5502	WATER	Jul, 1999	Sr-90	31.80 ± 1.56	31.59	25.27 - 37.91
SPF-5676	FISH	Jul, 1999	Cs-134	0.67 ± 0.04	0.65	0.39 - 0.91
SPF-5676	FISH	Jul, 1999	Cs-137	0.63 ± 0.05	0.60	0.36 - 0.83
SPCH-5833	CHARCOAL CANISTER	Aug, 1999	I-131(g)	1.46 ± 0.06	1.40	0.84 - 1.96
SPVE-5826	VEGETATION	Aug, 1999	I-131(g)	1.43 ± 0.09	1.25	0.75 - 1.75
SPMI-5828	MILK	Aug, 1999	Cs-134	31.46 ± 5.05	30.23	20.23 - 40.23
SPMI-5828	MILK	Aug, 1999	Cs-137	39.22 ± 7.60	37.23	27.23 - 47.23
SPMI-5828	MILK	Aug, 1999	I-131	72.33 ± 1.06	79.17	63.34 - 95.00
SPMI-5828	MILK	Aug, 1999	I-131(g)	77.99 ± 8.12	79.17	47.50 - 89.17
SPW-5830	WATER	Aug, 1999	Ra-226	13.82 ± 0.34	13.79	9.65 - 17.93
SPW-5830	WATER	Aug, 1999	Ra-228	13.59 ± 1.80	15.46	10.82 - 20.10
SPW-5831	WATER	Aug, 1999	Gr. Alpha	46.05 ± 2.93	41.17	20.59 - 61.76
SPW-5831	WATER	Aug, 1999	Gr. Beta	35.66 ± 2.01	29.78	19.78 - 39.78
SPW-6076	WATER	Aug, 1999	I-131	83.72 ± 0.98	99.30	79.44 - 119.16
SPW-6076	WATER	Aug, 1999	I-131(g)	105.38 ± 18.30	99.30	59.58 - 109.30
SPW-6542	WATER	Sep, 1999	Ra-226	15.38 ± 0.52	13.79	9.65 - 17.93
SPW-6542	WATER	Sep, 1999	Ra-228	16.48 ± 2.25	15.46	10.82 - 20.10
SPW-6543	WATER	Sep, 1999	Gr. Alpha	47.77 ± 2.69	41.17	20.59 - 61.76
SPW-6543	WATER	Sep, 1999	Gr. Beta	35.25 ± 1.86	29.78	19.78 - 39.78
SPW-7468	WATER	Oct, 1999	Ra-226	14.36 ± 0.41	13.79	9.65 - 17.93

Table A-3. In-house "spike" samples.

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^a		
				Teledyne Results 2s, n=1 ^b	Known Activity	Control ^c Limits
SPW-7468	WATER	Oct, 1999	Ra-228	13.41 ± 1.45	15.16	10.61 - 19.71
SPW-7469	WATER	Oct, 1999	Gr. Beta	31.37 ± 3.16	29.68	19.68 - 39.68
SPW-7486	WATER	Oct, 1999	I-131	49.26 ± 0.89	48.82	36.82 - 60.82
SPMI-7488	MILK	Oct, 1999	I-131	49.54 ± 0.89	48.82	36.82 - 60.82
SPSO-7761	SOIL	Oct, 1999	Cs-134	0.06 ± 0.01	0.07	0.04 - 0.10
SPSO-7761	SOIL	Oct, 1999	Cs-137	0.53 ± 0.01	0.49	0.29 - 0.69
SPAP-7763	AIR FILTER	Oct, 1999	Cs-137	1.84 ± 0.02	1.79	1.07 - 2.51
SPW-7469	WATER	Oct, 1999	Gr. Alpha	43.55 ± 4.67	41.16	20.58 - 61.74
SPF-8545	FISH	Oct, 1999	Cs-134	0.60 ± 0.03	0.59	0.36 - 0.83
SPF-8545	FISH	Oct, 1999	Cs-137	0.60 ± 0.04	0.59	0.36 - 0.83
SPMI-9028	MILK	Oct, 1999	Cs-134	39.43 ± 6.37	37.43	27.43 - 47.43
SPMI-9028	MILK	Oct, 1999	Cs-137	40.93 ± 9.42	37.05	27.05 - 47.05
SPW-8773	WATER	Nov, 1999	Ra-226	11.30 ± 0.14	13.79	9.65 - 17.93
SPW-8773	WATER	Nov, 1999	Ra-228	15.18 ± 2.26	15.00	10.50 - 19.50
SPW-8774	WATER	Nov, 1999	Gr. Alpha	43.12 ± 3.09	41.15	20.58 - 61.73
SPW-8774	WATER	Nov, 1999	Gr. Beta	31.98 ± 2.06	29.62	19.62 - 39.62
SPW-9133	WATER	Nov, 1999	Co-60	30.70 ± 4.43	29.06	19.06 - 39.06
SPW-9133	WATER	Nov, 1999	Cs-134	40.56 ± 4.53	36.59	26.59 - 46.59
SPW-9133	WATER	Nov, 1999	Cs-137	38.20 ± 6.14	36.98	26.98 - 46.98
SPW-9720	WATER	Nov, 1999	H-3	57335.00 ± 657.00	58177.00	46541.60 - 69812.40
SPW-9717	WATER	Dec, 1999	Ra-228	18.88 ± 1.80	14.80	10.36 - 19.24
SPW-9719	WATER	Dec, 1999	Ra-226	14.91 ± 0.48	13.79	9.65 - 17.93
SPCH-9806	CHARCOAL CANISTER	Dec, 1999	I-131(g)	0.06 ± 0.01	0.06	0.04 - 0.09
SPW-9718	WATER	Dec, 1999	Gr. Alpha	44.82 ± 2.39	44.81	22.41 - 67.22
SPW-9718	WATER	Dec, 1999	Gr. Beta	33.93 ± 1.72	29.54	19.54 - 39.54
SPW-9718	WATER	Dec, 1999	Gr. Beta	33.93 ± 1.72	29.54	19.54 - 39.54

^a All results are in pCi/L, except for elemental potassium (K) in milk, which are in mg/L.; air filter samples, which are in pCi/Filter; and food products, which are in mg/kg.

^b All samples are the results of single determinations.

^c Control limits are based on Attachment A, page A2 of this report.

NOTE: For fish, Jello is used for the spike matrix. For vegetation, Sawdust is used for the spike matrix.

Table A-4. In-house "blank" samples.

Lab Code	Sample Type	Sample Date	Analysis	Concentration pCi/L ^a		
				Teledyne Results (4.66 Sigma)		Acceptance Criteria (4.66 Sigma)
				LLD	Activity ^b	
SPW-141	WATER	Jan 1999	Gr. Alpha	< 0.470	0.207 ± 0.320	< 1.00
SPW-141	WATER	Jan 1999	Gr. Beta	< 0.890	0.234 ± 0.591	< 3.20
SPW-141	WATER	Jan 1999	Ra-226	< 0.064	0.054 ± 0.030	< 1.00
SPW-141	WATER	Jan 1999	Ra-228	< 1.000	0.460 ± 0.530	< 1.00
SPW-255	WATER	Jan 1999	H-3	< 178.000	23.455 ± 94.510	< 200.00
SPW-790	WATER	Feb 1999	Gr. Alpha	< 0.440	-0.130 ± 0.250	< 1.00
SPW-790	WATER	Feb 1999	Gr. Beta	< 1.010	-0.250 ± 0.610	< 3.20
SPW-790	WATER	Feb 1999	Ra-226	< 0.036	0.026 ± 0.017	< 1.00
SPW-790	WATER	Feb 1999	Ra-228	< 0.850	0.355 ± 0.440	< 1.00
SPW-1461	WATER	Mar 1999	Gr. Alpha	< 0.800	0.060 ± 0.540	< 1.00
SPW-1461	WATER	Mar 1999	Gr. Beta	< 1.600	0.460 ± 1.080	< 3.20
SPW-1461	WATER	Mar 1999	Ra-226	< 0.044	0.071 ± 0.028	< 1.00
SPW-1461	WATER	Mar 1999	Ra-228	< 0.700	0.280 ± 0.350	< 1.00
SPMI-1678	MILK	Mar 1999	Sr-89	< 0.590	-0.190 ± 0.670	< 5.00
SPMI-1678	MILK	Mar 1999	Sr-90		1.020 ± 0.360	< 1.00
Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.						
SPW-1682	WATER	Mar 1999	Sr-89	< 0.530	-0.310 ± 0.450	< 5.00
SPW-1682	WATER	Mar 1999	Sr-90	< 0.590	0.256 ± 0.307	< 1.00
SPW-2263	WATER	Apr 1999	Gr. Alpha	< 0.380	-0.160 ± 0.240	< 1.00
SPW-2263	WATER	Apr 1999	Gr. Beta	< 0.880	0.320 ± 0.580	< 3.20
SPW-2263	WATER	Apr 1999	Ra-226	< 0.013	0.023 ± 0.009	< 1.00
SPW-2263	WATER	Apr 1999	Ra-228	< 0.680	0.310 ± 0.360	< 1.00
SPW-2575	WATER	Apr 1999	H-3	< 158.000	23.150 ± 79.380	< 200.00
SPAP-2652	AIR FILTER	Apr 1999	Gr. Beta	< 0.003	-0.000 ± 0.001	< 3.20
SPW-3316	WATER	May 1999	Ra-226	< 0.027	0.030 ± 0.014	< 1.00
SPW-3316	WATER	May 1999	Ra-228	< 0.800	0.192 ± 0.397	< 1.00
SPW-3316	WATER	May 1999	Gr. Alpha	< 0.830	0.310 ± 0.600	< 1.00
SPW-3316	WATER	May 1999	Gr. Beta	< 1.580	0.220 ± 1.110	< 3.20
SPW-4004	WATER	Jun 1999	Gr. Alpha	< 0.870	-0.030 ± 0.570	< 1.00
SPW-4004	WATER	Jun 1999	Gr. Beta	< 1.740	0.470 ± 1.150	< 3.20
SPW-4004	WATER	Jun 1999	Ra-226	< 0.023	0.036 ± 0.014	< 1.00
SPW-4004	WATER	Jun 1999	Ra-228	< 0.990	0.770 ± 0.551	< 1.00
SPW-4871	WATER	Jul 1999	Gr. Alpha	< 0.660	-0.420 ± 0.470	< 1.00
SPW-4871	WATER	Jul 1999	Gr. Beta	< 1.420	0.400 ± 1.060	< 3.20
SPW-4871	WATER	Jul 1999	Ra-226	< 0.019	0.021 ± 0.013	< 1.00
SPW-4871	WATER	Jul 1999	Ra-228	< 0.620	0.610 ± 0.360	< 1.00

Table A-4. In-house "blank" samples.

Lab Code	Sample Type	Sample Date	Analysis	Concentration pCi/L ^a		
				Teledyne Results (4.66 Sigma)		Acceptance Criteria (4.66 Sigma)
				LLD	Activity ^b	
SPW-4965	WATER	Jul 1999	H-3	< 176.000	8.100 ± 87.800	< 200.00
SPMI-5349	MILK	Jul 1999	Sr-89	< 0.410	-0.750 ± 0.540	< 5.00
SPMI-5349	MILK	Jul 1999	Sr-90		1.140 ± 0.360	< 1.00
Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.						
SPW-5501	WATER	Jul 1999	Sr-89	< 0.450	0.150 ± 0.450	< 5.00
SPW-5501	WATER	Jul 1999	Sr-90	< 0.580	0.280 ± 0.310	< 1.00
SPMI-5829	MILK	Aug 1999	I-131	< 0.240	0.140 ± 0.140	< 0.50
SPW-5832	WATER	Aug 1999	Gr. Alpha	< 0.890	0.570 ± 0.600	< 1.00
SPW-5832	WATER	Aug 1999	Gr. Beta	< 2.000	0.590 ± 1.230	< 3.20
SPW-5832	WATER	Aug 1999	Ra-226	< 0.020	0.090 ± 0.010	< 1.00
SPW-5832	WATER	Aug 1999	Ra-228	< 0.780	0.110 ± 0.370	< 1.00
SPW-6067	WATER	Aug 1999	I-131	< 0.250	0.017 ± 0.170	< 0.50
SPW-6541	WATER	Sep 1999	Gr. Alpha	< 0.770	0.360 ± 0.530	< 1.00
SPW-6541	WATER	Sep 1999	Gr. Beta	< 1.690	0.410 ± 1.130	< 3.20
SPW-6541	WATER	Sep 1999	Ra-226	< 0.020	0.160 ± 0.020	< 1.00
SPW-6541	WATER	Sep 1999	Ra-228	< 1.280	0.018 ± 0.594	< 1.00
SPW-7467	WATER	Oct 1999	Ra-226		0.069 ± 0.014	< 1.00
SPW-7467	WATER	Oct 1999	Ra-228	< 0.892	0.461 ± 0.467	< 1.00
SPW-7487	WATER	Oct 1999	I-131	< 0.260	0.080 ± 0.150	< 0.50
SPMI-7489	MILK	Oct 1999	I-131	< 0.250	0.140 ± 0.150	< 0.50
SPW-8775	WATER	Nov 1999	Ra-226		0.050 ± 0.012	< 1.00
SPW-8775	WATER	Nov 1999	Ra-228	< 0.989	0.380 ± 0.500	< 1.00
SPW-9721	WATER	Nov 1999	H-3	< 158.000	51.400 ± 80.600	< 200.00
SPW-9719	WATER	Dec 1999	Ra-226		0.031 ± 0.013	< 1.00

^a Liquid sample results are reported in pCi/Liter, air filter sample results are in pCi/filter, charcoal sample results are in pCi/charcoal, and solid sample results are in pCi/kilogram.

^b The activity reported is the net activity result.

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L ^a		
			First Result	Second Result	Averaged Result
E-47, 48	Jan, 1999	Gr. Beta	1.206 ± 0.056	1.265 ± 0.061	1.236 ± 0.041
E-47, 48	Jan, 1999	K-40	1.283 ± 0.136	1.394 ± 0.182	1.339 ± 0.114
SW-68, 69	Jan, 1999	K-40 (FP)	1.300 ± 0.130	1.300 ± 0.130	1.300 ± 0.092
LW-153, 154	Jan, 1999	Gr. Beta	1.509 ± 0.647	1.619 ± 0.646	1.564 ± 0.457
WW-373, 374	Jan, 1999	H-3	171.100 ± 83.600	131.700 ± 81.800	151.400 ± 58.481
SW-867, 868	Jan, 1999	H-3	1,149.300 ± 122.100	1,225.000 ± 124.400	1,187.150 ± 87.155
SWT-425, 426	Jan, 1999	Gr. Beta	2.572 ± 0.639	2.646 ± 0.598	2.609 ± 0.438
CW-450, 451	Jan, 1999	Gr. Beta	0.600 ± 1.100	0.700 ± 1.100	0.650 ± 0.778
SW-570, 571	Feb, 1999	K-40 (FP)	1.730 ± 0.173	1.644 ± 0.164	1.687 ± 0.119
LW-614, 615	Feb, 1999	Gr. Alpha	0.354 ± 0.369	0.666 ± 0.390	0.510 ± 0.268
LW-614, 615	Feb, 1999	Gr. Beta	2.213 ± 0.406	2.613 ± 0.442	2.413 ± 0.300
MI-682, 683	Feb, 1999	Co-60	0.200 ± 0.600	-0.400 ± 2.700	-0.100 ± 1.383
MI-682, 683	Feb, 1999	Cs-137	0.300 ± 3.700	0.600 ± 2.700	0.450 ± 2.290
MI-682, 683	Feb, 1999	I-131	0.200 ± 0.300	0.200 ± 0.300	0.200 ± 0.212
WW-968, 969	Feb, 1999	H-3	199.300 ± 89.600	80.900 ± 84.500	140.100 ± 61.580
CW-1042, 1043	Feb, 1999	Gr. Beta	3.200 ± 1.500	3.500 ± 1.530	3.350 ± 1.071
LW-1523, 1524	Feb, 1999	Gr. Beta	1.930 ± 0.567	2.197 ± 0.584	2.063 ± 0.407
MI-1627, 1628	Mar, 1999	K-40	1,340.200 ± 118.000	1,409.300 ± 112.000	1,374.750 ± 81.345
WW-1808, 1809	Mar, 1999	H-3	4.400 ± 83.400	47.400 ± 85.300	25.900 ± 59.648
LW-2937, 2938	Mar, 1999	Gr. Beta	3.044 ± 0.663	3.242 ± 0.660	3.143 ± 0.468
AP-2155, 2156	Mar, 1999	Be-7	0.078 ± 0.017	0.073 ± 0.015	0.075 ± 0.011
AP-2357, 2358	Mar, 1999	Be-7	0.081 ± 0.016	0.086 ± 0.020	0.084 ± 0.013
AP-1991, 1992	Mar, 1999	Be-7	0.218 ± 0.079	0.149 ± 0.062	0.184 ± 0.050
AP-1991, 1992	Mar, 1999	Be-7	0.083 ± 0.011	0.082 ± 0.015	0.083 ± 0.009
LW-2405, 2406	Mar, 1999	Gr. Beta	3.322 ± 0.473	2.292 ± 0.468	2.807 ± 0.333
LW-2474, 2475	Mar, 1999	Gr. Beta	2.003 ± 0.592	2.742 ± 0.648	2.372 ± 0.439
LW-2474, 2475	Mar, 1999	H-3	124.016 ± 84.129	151.507 ± 85.318	137.762 ± 59.910
MI-2019, 2020	Apr, 1999	K-40	1,277.300 ± 173.000	1,377.800 ± 107.000	1,327.550 ± 101.708
MI-2019, 2020	Apr, 1999	Sr-90	0.615 ± 0.366	1.126 ± 0.368	0.871 ± 0.260
WW-2040, 2041	Apr, 1999	Gr. Beta	1.424 ± 0.316	1.233 ± 0.329	1.329 ± 0.228
WW-2040, 2041	Apr, 1999	K-40 (FP)	1.100 ± 0.110	1.100 ± 0.110	1.100 ± 0.078
MI-2134, 2135	Apr, 1999	K-40	1,316.000 ± 147.000	1,485.100 ± 168.000	1,400.550 ± 111.617
AP-2658, 2659	Apr, 1999	Be-7	0.134 ± 0.067	0.175 ± 0.105	0.154 ± 0.062
MI-2019, 2020	Apr, 1999	Calcium	0.850 ± 0.085	0.880 ± 0.088	0.865 ± 0.061
MI-2251, 2252	Apr, 1999	K-40	1,261.900 ± 156.000	1,320.800 ± 141.000	1,291.350 ± 105.139

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L ^a		
			First Result	Second Result	Averaged Result
MI-2451, 2452	Apr, 1999	K-40	1,647.700 ± 201.000	1,706.300 ± 159.000	1,677.000 ± 128.142
SS-2528, 2529	Apr, 1999	Gr. Beta	7.724 ± 1.978	9.287 ± 1.970	8.505 ± 1.396
SS-2528, 2529	Apr, 1999	K-40	7.530 ± 0.520	8.073 ± 0.388	7.802 ± 0.324
SS-2758, 2759	Apr, 1999	Gr. Beta	6.540 ± 2.200	4.960 ± 2.190	5.750 ± 1.552
SS-2758, 2759	Apr, 1999	K-40	7.483 ± 0.416	7.357 ± 0.432	7.420 ± 0.300
SS-2758, 2759	Apr, 1999	Sr-90	0.006 ± 0.008	-0.005 ± 0.007	0.000 ± 0.005
BS-3093, 3094	Apr, 1999	Gr. Beta	5.180 ± 1.350	5.960 ± 1.370	5.570 ± 0.962
F-3072, 3073	Apr, 1999	K-40	2.991 ± 0.332	2.438 ± 0.347	2.714 ± 0.240
MI-3001, 3002	Apr, 1999	K-40	1,485.800 ± 142.000	1,564.900 ± 162.000	1,525.350 ± 107.713
LW-3149, 3150	Apr, 1999	Gr. Beta	1.982 ± 0.595	2.120 ± 0.612	2.051 ± 0.427
SW-3047, 3048	May, 1999	Gr. Beta	2.281 ± 0.585	2.194 ± 0.567	2.238 ± 0.407
SW-3047, 3048	May, 1999	K-40 (FP)	1.300 ± 0.130	1.400 ± 0.140	1.350 ± 0.096
F-3238, 3239	May, 1999	Gr. Beta	3.329 ± 0.135	3.388 ± 0.144	3.358 ± 0.099
F-3238, 3239	May, 1999	K-40	2.866 ± 0.366	2.792 ± 0.337	2.829 ± 0.249
BS-3195, 3196	May, 1999	K-40	8.610 ± 0.620	9.320 ± 0.540	8.965 ± 0.411
AP-3769, 3770	May, 1999	Be-7	0.135 ± 0.075	0.188 ± 0.097	0.161 ± 0.061
MI-3259, 3260	May, 1999	K-40	1,444.800 ± 94.200	1,460.300 ± 166.000	1,452.550 ± 95.433
AP-3304, 3305	May, 1999	Be-7	0.104 ± 0.083	0.095 ± 0.068	0.099 ± 0.054
G-3461, 3462	May, 1999	Be-7	0.454 ± 0.210	0.350 ± 0.154	0.402 ± 0.130
G-3461, 3462	May, 1999	K-40	5.341 ± 0.492	4.837 ± 0.619	5.089 ± 0.395
SW-3217, 3218	May, 1999	Gr. Alpha	1.223 ± 1.323	2.490 ± 1.230	1.857 ± 0.903
SW-3217, 3218	May, 1999	Gr. Beta	4.956 ± 1.232	5.715 ± 1.221	5.336 ± 0.867
LW-2937, 2938	May, 1999	Gr. Beta	2.379 ± 0.626	2.864 ± 0.641	2.622 ± 0.448
SWU-2853, 2854	May, 1999	Gr. Beta	2.860 ± 0.539	3.065 ± 0.577	2.962 ± 0.395
DW-2878, 2879	May, 1999	Gr. Beta	0.706 ± 0.319	0.849 ± 0.335	0.777 ± 0.231
G-3461, 3462	May, 1999	Gr. Beta	5.205 ± 0.169	5.166 ± 0.110	5.186 ± 0.101
SO-3482, 3483	May, 1999	Cs-137	0.456 ± 0.059	0.467 ± 0.048	0.461 ± 0.038
SO-3482, 3483	May, 1999	Gr. Beta	24.880 ± 1.980	26.170 ± 2.150	25.525 ± 1.461
SO-3482, 3483	May, 1999	K-40	20.631 ± 1.240	20.077 ± 0.906	20.354 ± 0.768
SO-2832, 2833	May, 1999	Cs-137	0.390 ± 0.052	0.403 ± 0.031	0.397 ± 0.030
SO-2832, 2833	May, 1999	K-40	26.000 ± 0.660	24.673 ± 1.240	25.337 ± 0.702
SWT-3675, 3676	May, 1999	Gr. Beta	2.439 ± 0.598	2.530 ± 0.630	2.484 ± 0.434
LW-3699, 3700	May, 1999	Gr. Beta	2.488 ± 0.596	3.002 ± 0.654	2.745 ± 0.442
MI-3748, 3749	Jun, 1999	K-40	1,553.800 ± 178.000	1,408.600 ± 149.000	1,481.200 ± 116.066
SW-4107, 4108	Jun, 1999	Gr. Alpha	3.993 ± 0.919	3.606 ± 0.875	3.800 ± 0.635

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L ^a		
			First Result	Second Result	Averaged Result
SW-4107, 4108	Jun, 1999	Gr. Beta	6.271 ± 0.754	6.910 ± 0.807	6.591 ± 0.552
SS-4065, 4066	Jun, 1999	K-40	7.350 ± 0.400	7.945 ± 0.370	7.648 ± 0.272
AP-3986, 3987	Jun, 1999	Be-7	0.272 ± 0.147	0.182 ± 0.085	0.227 ± 0.085
G-4007, 4008	Jun, 1999	Be-7	0.830 ± 0.210	0.950 ± 0.200	0.890 ± 0.145
G-4007, 4008	Jun, 1999	K-40	5.790 ± 0.460	4.990 ± 0.400	5.390 ± 0.305
MI-4172, 4173	Jun, 1999	K-40	1,423.600 ± 115.000	1,481.300 ± 129.000	1,452.450 ± 86.409
MI-4293, 4294	Jun, 1999	K-40	1,397.200 ± 179.000	1,388.100 ± 130.000	1,392.650 ± 110.613
AP-4317, 4318	Jun, 1999	Be-7	0.201 ± 0.125	0.213 ± 0.088	0.207 ± 0.076
AP-4894, 4895	Jun, 1999	Be-7	0.092 ± 0.019	0.091 ± 0.014	0.092 ± 0.012
G-4426, 4427	Jun, 1999	Be-7	0.730 ± 0.210	0.630 ± 0.170	0.680 ± 0.135
G-4426, 4427	Jun, 1999	K-40	3.230 ± 0.350	3.400 ± 0.440	3.315 ± 0.281
AP-4454, 4455	Jun, 1999	Be-7	0.205 ± 0.120	0.238 ± 0.087	0.222 ± 0.074
SWU-4601, 4602	Jun, 1999	Gr. Beta	2.209 ± 0.568	1.980 ± 0.589	2.094 ± 0.409
SWU-4601, 4602	Jun, 1999	Gr. Beta	2.209 ± 0.568	1.980 ± 0.589	2.094 ± 0.409
SW-4622, 4623	Jun, 1999	Gr. Beta	2.130 ± 0.854	2.267 ± 0.803	2.198 ± 0.586
AP-4915, 4916	Jun, 1999	Be-7	0.089 ± 0.012	0.094 ± 0.015	0.091 ± 0.010
LW-4974, 4975	Jun, 1999	Gr. Beta	1.916 ± 0.578	2.617 ± 0.644	2.267 ± 0.433
LW-5039, 5040	Jun, 1999	Gr. Beta	2.170 ± 0.610	2.030 ± 0.580	2.100 ± 0.421
LW-5039, 5040	Jun, 1999	H-3	90.659 ± 81.800	162.800 ± 85.000	126.730 ± 58.984
G-4643, 4644	Jul, 1999	Be-7	1.326 ± 0.460	1.555 ± 0.390	1.441 ± 0.302
G-4643, 4644	Jul, 1999	Gr. Beta	5.870 ± 0.151	5.798 ± 0.150	5.834 ± 0.106
G-4643, 4644	Jul, 1999	K-40	5.738 ± 0.780	6.200 ± 0.733	5.969 ± 0.535
SW-4664, 4665	Jul, 1999	Gr. Beta	1.956 ± 0.415	1.836 ± 0.429	1.896 ± 0.298
SW-4664, 4665	Jul, 1999	K-40	1.120	1.120	1.120
WW-4690, 4691	Jul, 1999	Co-60	0.860 ± 1.840	0.374 ± 0.344	0.617 ± 0.936
WW-4690, 4691	Jul, 1999	Cs-137	-0.806 ± 3.130	-2.010 ± 2.610	-1.408 ± 2.038
WW-4690, 4691	Jul, 1999	H-3	399.519 ± 103.570	564.249 ± 109.428	481.884 ± 75.335
WW-4808, 4809	Jul, 1999	Co-60	-0.360 ± 1.910	1.420 ± 25.700	0.530 ± 12.885
WW-4808, 4809	Jul, 1999	Cs-137	0.446 ± 2.260	-1.060 ± 1.720	-0.307 ± 1.420
WW-4808, 4809	Jul, 1999	H-3	72.004 ± 90.621	94.545 ± 91.551	83.274 ± 64.409
MI-4742, 4743	Jul, 1999	K-40	1,344.000 ± 66.000	1,375.000 ± 112.000	1,359.500 ± 65.000
CW-5018, 5019	Jul, 1999	H-3	364.162 ± 92.219	430.163 ± 94.673	397.163 ± 66.082
VE-4873, 4874	Jul, 1999	Be-7	2.023 ± 0.294	1.882 ± 0.338	1.953 ± 0.224
VE-4873, 4874	Jul, 1999	K-40	7.894 ± 0.650	7.394 ± 0.655	7.644 ± 0.461
F-5124, 5125	Jul, 1999	K-40	2.394 ± 0.364	2.802 ± 0.360	2.598 ± 0.256

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L ^a		
			First Result	Second Result	Averaged Result
VE-5187, 5188	Jul, 1999	K-40	2.990 ± 0.422	3.265 ± 0.446	3.128 ± 0.307
VE-5187, 5188	Jul, 1999	Sr-90	0.005 ± 0.002	0.002 ± 0.002	0.004 ± 0.002
CW-5212, 5213	Jul, 1999	Gr. Beta	2.187 ± 1.449	2.452 ± 1.381	2.320 ± 1.001
CW-5212, 5213	Jul, 1999	Gr. Beta	-0.405 ± 1.220	-0.438 ± 1.196	-0.422 ± 0.854
MI-5260, 5261	Jul, 1999	K-40	1,367.000 ± 172.000	1,462.000 ± 161.000	1,414.500 ± 117.797
MI-5287, 5288	Jul, 1999	K-40	1,417.900 ± 89.000	1,280.700 ± 163.000	1,349.300 ± 92.857
PW-5237, 5238	Jul, 1999	H-3	189.773 ± 96.797	220.943 ± 97.971	205.358 ± 68.862
AP-5329, 5330	Jul, 1999	Be-7	0.168 ± 0.065	0.140 ± 0.122	0.154 ± 0.069
SWU-5379, 5380	Jul, 1999	Gr. Beta	2.571 ± 0.605	2.219 ± 0.611	2.395 ± 0.430
SWU-5379, 5380	Jul, 1999	H-3	484.749 ± 105.455	520.309 ± 106.709	502.529 ± 75.013
G-5354, 5355	Jul, 1999	Be-7	1.120 ± 0.270	1.030 ± 0.160	1.075 ± 0.157
G-5354, 5355	Jul, 1999	K-40	6.160 ± 0.450	5.990 ± 0.530	6.075 ± 0.348
MI-5520, 5521	Jul, 1999	Co-60	-1.180 ± 3.460	-2.330 ± 2.740	-1.755 ± 2.207
MI-5520, 5521	Jul, 1999	Cs-137	1.450 ± 2.200	3.160 ± 2.660	2.305 ± 1.726
MI-5520, 5521	Jul, 1999	I-131	0.184 ± 0.283	0.009 ± 0.285	0.096 ± 0.201
AP-5499, 5500	Jul, 1999	Be-7	0.181 ± 0.070	0.175 ± 0.066	0.178 ± 0.048
CW-5550, 5551	Jul, 1999	Gr. Beta	1.858 ± 1.362	1.361 ± 1.329	1.609 ± 0.952
CW-5550, 5551	Jul, 1999	Gr. Beta	1.208 ± 1.334	-0.174 ± 0.933	0.517 ± 0.814
WW-5575, 5576	Jul, 1999	H-3	224.412 ± 93.866	220.812 ± 93.728	222.612 ± 66.325
MI-5596, 5597	Jul, 1999	K-40	1,355.200 ± 157.000	1,370.900 ± 191.000	1,363.050 ± 123.622
MI-5644, 5645	Jul, 1999	Calcium	0.830 ± 0.083	0.840 ± 0.084	0.835 ± 0.059
MI-5644, 5645	Jul, 1999	K-40	1,327.000 ± 141.000	1,488.000 ± 169.000	1,407.500 ± 110.048
MI-5644, 5645	Jul, 1999	Sr-90	1.300 ± 0.350	1.070 ± 0.350	1.185 ± 0.247
MI-4742, 4743	Aug, 1999	Sr-90	0.502 ± 0.243	0.702 ± 0.303	0.602 ± 0.194
MI-5666, 5667	Aug, 1999	K-40	1,639.000 ± 161.000	1,724.800 ± 207.000	1,681.900 ± 131.120
WW-5756, 5757	Aug, 1999	Gr. Beta	1.704 ± 0.568	2.432 ± 0.567	2.068 ± 0.401
CW-5712, 5713	Aug, 1999	Gr. Beta	1.906 ± 1.360	1.608 ± 1.270	1.757 ± 0.930
CW-5712, 5713	Aug, 1999	Gr. Beta	-0.269 ± 1.174	-0.634 ± 1.076	-0.451 ± 0.796
G-5735, 5736	Aug, 1999	Be-7	2.961 ± 0.296	3.295 ± 0.492	3.128 ± 0.287
G-5735, 5736	Aug, 1999	K-40	6.731 ± 0.548	6.997 ± 0.492	6.864 ± 0.368
LW-8450, 8451	Aug, 1999	Sr-90	0.390 ± 0.310	0.570 ± 0.310	0.480 ± 0.219
SW-5841, 5842	Aug, 1999	Gr. Alpha	2.850 ± 1.675	2.500 ± 1.685	2.675 ± 1.188
SW-5841, 5842	Aug, 1999	Gr. Beta	9.343 ± 1.425	12.378 ± 1.634	10.860 ± 1.084
VE-5905, 5906	Aug, 1999	Co-60	0.013 ± 0.066	-0.000 ± 0.002	0.006 ± 0.033
VE-5905, 5906	Aug, 1999	Cs-137	0.006 ± 0.008	0.001 ± 0.009	0.004 ± 0.006

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L ^a		
			First Result	Second Result	Averaged Result
CW-6148, 6149	Aug, 1999	H-3	141.545 ± 89.443	74.402 ± 86.675	107.974 ± 62.275
PW-5968, 5969	Aug, 1999	H-3	1,625.921 ± 147.401	1,698.481 ± 149.269	1,662.201 ± 104.891
MI-6072, 6073	Aug, 1999	K-40	1,478.600 ± 163.000	1,675.400 ± 202.000	1,577.000 ± 129.782
G-6116, 6117	Aug, 1999	Be-7	4.178 ± 0.306	4.319 ± 0.378	4.248 ± 0.243
G-6116, 6117	Aug, 1999	K-40	5.525 ± 0.548	5.657 ± 0.486	5.591 ± 0.366
AP-6200, 6201	Aug, 1999	K-40	8.465 ± 0.356	8.822 ± 0.666	8.643 ± 0.378
DW-6121, 6122	Aug, 1999	Gr. Beta	1.229 ± 0.325	1.022 ± 0.332	1.126 ± 0.233
SWU-6345, 6346	Aug, 1999	Gr. Beta	2.417 ± 0.582	1.870 ± 0.587	2.144 ± 0.413
MI-6242, 6243	Aug, 1999	Co-60	-1.160 ± 3.210	-0.075 ± 0.105	-0.617 ± 1.606
MI-6242, 6243	Aug, 1999	Cs-137	-0.395 ± 2.610	0.534 ± 2.270	0.070 ± 1.730
MI-6242, 6243	Aug, 1999	I-131	-0.112 ± 0.226	0.119 ± 0.239	0.003 ± 0.164
VE-6263, 6264	Aug, 1999	Co-60	0.001 ± 0.002	0.009 ± 0.027	0.005 ± 0.013
VE-6263, 6264	Aug, 1999	Cs-137	0.010 ± 0.010	-0.004 ± 0.009	0.003 ± 0.007
SW-6389, 6390	Aug, 1999	K-40 (FP)	13.000 ± 1.300	12.000 ± 1.200	12.500 ± 0.885
SWU-6452, 6453	Aug, 1999	Gr. Beta	2.587 ± 0.598	2.053 ± 0.561	2.320 ± 0.410
WW-6604, 6605	Aug, 1999	Gr. Beta	2.199 ± 0.578	1.878 ± 0.594	2.039 ± 0.414
WW-6677, 6678	Aug, 1999	H-3	202.838 ± 101.400	122.240 ± 98.143	162.539 ± 70.559
WW-6506, 6507	Sep, 1999	Co-60	-0.789 ± 7.010	0.416 ± 1.310	-0.187 ± 3.566
WW-6506, 6507	Sep, 1999	Cs-137	0.568 ± 3.270	0.834 ± 3.180	0.701 ± 2.281
WW-6506, 6507	Sep, 1999	H-3	29,273.964 ± 494.519	30,525.051 ± 504.610	29,899.507 ± 353.264
MI-6410, 6411	Sep, 1999	K-40	1,128.500 ± 159.000	1,355.900 ± 174.000	1,242.200 ± 117.853
VE-6431, 6432	Sep, 1999	Gr. Beta	1.880 ± 0.053	1.917 ± 0.053	1.899 ± 0.037
VE-6431, 6432	Sep, 1999	K-40	1.697 ± 0.202	1.603 ± 0.192	1.650 ± 0.139
VE-6558, 6559	Sep, 1999	K-40	2.200 ± 0.204	2.222 ± 0.189	2.211 ± 0.139
AP-6704, 6705	Sep, 1999	Be-7	0.020 ± 0.055	0.018 ± 0.081	0.019 ± 0.049
VE-6649, 6650	Sep, 1999	Co-60	0.008 ± 0.015	-0.001 ± 0.004	0.004 ± 0.008
VE-6649, 6650	Sep, 1999	Cs-137	-0.001 ± 0.007	-0.001 ± 0.007	-0.001 ± 0.005
AP-6727, 6728	Sep, 1999	Be-7	0.109 ± 0.043	0.158 ± 0.089	0.134 ± 0.049
VE-6793, 6794	Sep, 1999	Gr. Beta	1.115 ± 0.037	1.139 ± 0.035	1.127 ± 0.025
SO-6937, 6938	Sep, 1999	Cs-137	0.225 ± 0.027	0.260 ± 0.040	0.243 ± 0.024
SO-6937, 6938	Sep, 1999	K-40	10.450 ± 0.520	10.428 ± 0.760	10.439 ± 0.460
SO-6937, 6938	Sep, 1999	Sr-90	0.041 ± 0.017	0.034 ± 0.014	0.038 ± 0.011
SWU-7045, 7046	Sep, 1999	Gr. Beta	2.623 ± 0.606	2.720 ± 0.593	2.672 ± 0.424
AP-7087, 7088	Sep, 1999	Be-7	0.091 ± 0.068	0.119 ± 0.054	0.105 ± 0.043
PW-7013, 7014	Sep, 1999	H-3	3,002.639 ± 183.527	3,038.815 ± 184.318	3,020.727 ± 130.053

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L ^a		
			First Result	Second Result	Averaged Result
SWT-7964, 7965	Sep, 1999	Sr-90	0.826 ± 0.411	0.501 ± 0.285	0.664 ± 0.250
W-7302, 7303	Sep, 1999	H-3	364.860 ± 109.550	221.740 ± 104.150	293.300 ± 75.578
SS-7432, 7433	Sep, 1999	K-40	8.619 ± 0.487	8.049 ± 0.508	8.334 ± 0.352
AP-7541, 7542	Sep, 1999	Be-7	0.086 ± 0.012	0.092 ± 0.014	0.089 ± 0.009
AP-7520, 7521	Sep, 1999	Be-7	0.087 ± 0.012	0.091 ± 0.011	0.089 ± 0.008
PW-7228, 7229	Oct, 1999	H-3	6,053.000 ± 243.000	6,177.000 ± 245.000	6,115.000 ± 172.536
SW-7252, 7253	Oct, 1999	H-3	544.000 ± 116.000	659.000 ± 120.000	601.500 ± 83.451
SO-7344, 7345	Oct, 1999	Cs-137	0.067 ± 0.020	0.066 ± 0.023	0.067 ± 0.015
SO-7344, 7345	Oct, 1999	Gr. Beta	27.800 ± 3.580	26.320 ± 3.550	27.060 ± 2.521
SO-7344, 7345	Oct, 1999	K-40	18.510 ± 0.690	19.680 ± 0.810	19.095 ± 0.532
SO-7344, 7345	Oct, 1999	Sr-90	0.020 ± 0.009	0.014 ± 0.008	0.017 ± 0.006
WW-7365, 7366	Oct, 1999	Gr. Beta	1.712 ± 0.500	1.341 ± 0.482	1.527 ± 0.347
WW-7365, 7366	Oct, 1999	K-40	1.200 ± 0.120	1.100 ± 0.110	1.150 ± 0.081
MI-7323, 7324	Oct, 1999	K-40	1,404.100 ± 111.000	1,374.200 ± 181.000	1,389.150 ± 106.163
F-7478, 7479	Oct, 1999	Co-60	0.010 ± 0.050	0.000 ± 0.010	0.005 ± 0.025
F-7478, 7479	Oct, 1999	Cs-137	0.000 ± 0.010	-0.010 ± 0.010	-0.005 ± 0.007
MI-7728, 7729	Oct, 1999	K-40	1,567.700 ± 170.000	1,471.900 ± 125.000	1,519.800 ± 105.505
MI-7587, 7588	Oct, 1999	K-40	1,263.200 ± 162.000	1,449.800 ± 122.000	1,356.500 ± 101.400
AP-7619, 7620	Oct, 1999	Be-7	0.166 ± 0.071	0.110 ± 0.090	0.138 ± 0.057
SL-7749, 7750	Oct, 1999	Gr. Beta	3.088 ± 0.278	3.320 ± 0.285	3.204 ± 0.199
SL-7749, 7750	Oct, 1999	K-40	1.190 ± 0.560	2.160 ± 0.500	1.675 ± 0.375
BS-7943, 7944	Oct, 1999	Gr. Beta	13.816 ± 2.943	14.263 ± 2.888	14.040 ± 2.062
BS-7943, 7944	Oct, 1999	K-40	11.681 ± 0.551	12.691 ± 0.754	12.186 ± 0.467
G-7898, 7899	Oct, 1999	Be-7	1.315 ± 0.188	1.342 ± 0.186	1.329 ± 0.132
G-7898, 7899	Oct, 1999	K-40	6.436 ± 0.449	6.292 ± 0.486	6.364 ± 0.331
CW-8058, 8059	Oct, 1999	Gr. Beta	2.520 ± 1.490	2.320 ± 1.490	2.420 ± 1.054
F-8379, 8380	Oct, 1999	K-40	2.980 ± 0.240	3.063 ± 0.262	3.021 ± 0.178
F-8171, 8172	Oct, 1999	Co-60	-0.010 ± 0.020	-0.010 ± 0.010	-0.010 ± 0.011
F-8171, 8172	Oct, 1999	Cs-137	-0.010 ± 0.010	0.000 ± 0.010	-0.005 ± 0.007
SWU-8316, 8317	Oct, 1999	Gr. Beta	2.310 ± 0.690	2.248 ± 0.691	2.279 ± 0.488
SWU-8316, 8317	Oct, 1999	H-3	187.623 ± 94.958	223.391 ± 96.366	205.507 ± 67.645
SP-8954, 8955	Oct, 1999	Gr. Beta	6.535 ± 1.721	4.745 ± 1.412	5.640 ± 1.113
CW-8425, 8426	Oct, 1999	Gr. Beta	1.720 ± 1.430	1.510 ± 1.410	1.615 ± 1.004
SS-8474, 8475	Oct, 1999	K-40	9.117 ± 0.719	9.634 ± 0.542	9.376 ± 0.450
LW-8747, 8748	Oct, 1999	Gr. Beta	1.984 ± 0.431	2.120 ± 0.476	2.052 ± 0.321

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L ^a		
			First Result	Second Result	Averaged Result
G-8572, 8573	Oct, 1999	Be-7	3.500 ± 0.338	3.410 ± 0.235	3.455 ± 0.206
G-8572, 8573	Oct, 1999	Gr. Beta	6.249 ± 0.167	6.679 ± 0.171	6.464 ± 0.120
G-8572, 8573	Oct, 1999	K-40	6.900 ± 0.518	6.961 ± 0.374	6.930 ± 0.319
SW-8506, 8507	Oct, 1999	H-3	5,114.000 ± 212.000	5,279.000 ± 215.000	5,196.500 ± 150.971
LW-8747, 8748	Oct, 1999	H-3	4,144.300 ± 194.900	4,392.700 ± 199.513	4,268.500 ± 139.456
SW-8614, 8615	Nov, 1999	Gr. Beta	3.884 ± 0.886	3.386 ± 0.836	3.635 ± 0.609
CW-8641, 8642	Nov, 1999	Gr. Beta	1.310 ± 1.400	2.250 ± 1.470	1.780 ± 1.015
AP-8688, 8689	Nov, 1999	Be-7	0.153 ± 0.083	0.144 ± 0.058	0.149 ± 0.051
SW-8975, 8976	Nov, 1999	H-3	-70.000 ± 85.000	-68.000 ± 85.000	-69.000 ± 60.104
MI-8928, 8929	Nov, 1999	K-40	1,328.300 ± 144.000	1,366.000 ± 163.000	1,347.150 ± 108.749
AP-9179, 9180	Nov, 1999	Be-7	0.145 ± 0.097	0.103 ± 0.055	0.124 ± 0.056
SW-9151, 9152	Nov, 1999	H-3	3,208.000 ± 174.000	3,517.000 ± 180.000	3,362.500 ± 125.176
SW-9227, 9228	Nov, 1999	Co-60	-1.320 ± 12.400	0.120 ± 0.330	-0.600 ± 6.202
SW-9227, 9228	Nov, 1999	Cs-137	0.060 ± 2.330	-0.530 ± 1.660	-0.235 ± 1.430
SW-9227, 9228	Nov, 1999	Gr. Beta	8.590 ± 1.880	9.810 ± 1.980	9.200 ± 1.365
SWU-9275, 9276	Nov, 1999	Gr. Beta	1.590 ± 0.586	1.404 ± 0.529	1.497 ± 0.395
CW-9307, 9308	Dec, 1999	Gr. Beta	0.700 ± 1.500	2.050 ± 1.630	1.375 ± 1.108
CW-9358, 9359	Dec, 1999	Gr. Beta	3.610 ± 0.460	4.210 ± 0.510	3.910 ± 0.343
CW-9358, 9359	Dec, 1999	H-3	14,646.000 ± 339.000	14,764.000 ± 340.000	14,705.000 ± 240.063
MI-9402, 9403	Dec, 1999	K-40	2,074.100 ± 174.000	1,967.700 ± 134.000	2,020.900 ± 109.809
CW-9423, 9424	Dec, 1999	Gr. Beta	1.870 ± 1.610	1.930 ± 1.610	1.900 ± 1.138
AP-9478, 9479	Dec, 1999	Be-7	0.156 ± 0.098	0.091 ± 0.058	0.123 ± 0.057
BS-9587, 9588	Dec, 1999	K-40	11.890 ± 0.550	11.624 ± 0.740	11.757 ± 0.461
LW-9525, 9526	Dec, 1999	Be-7	2.690 ± 0.630	2.340 ± 0.620	2.515 ± 0.442
AP-9767, 9768	Dec, 1999	Be-7	0.104 ± 0.072	0.144 ± 0.085	0.124 ± 0.056
SWU-9837, 9838	Dec, 1999	Gr. Beta	1.530 ± 0.530	2.504 ± 0.607	2.017 ± 0.403
CW-9870, 9871	Dec, 1999	H-3	1,221.000 ± 123.000	1,027.000 ± 117.000	1,124.000 ± 84.879
SW-9964, 9965	Dec, 1999	Co-60	-0.740 ± 2.710	0.950 ± 2.110	0.105 ± 1.717
SW-9964, 9965	Dec, 1999	Cs-137	-2.910 ± 3.140	1.830 ± 2.230	-0.540 ± 1.926
AP-10027, 10028	Dec, 1999	Be-7	0.059 ± 0.008	0.064 ± 0.011	0.062 ± 0.007
SW-9912, 9913	Dec, 1999	H-3	29.000 ± 87.000	113.000 ± 91.000	71.000 ± 62.948
WW-10069, 10070	Dec, 1999	Gr. Beta	2.539 ± 0.664	2.223 ± 0.591	2.381 ± 0.445

^a All concentrations are reported in pCi/liter, except solid samples, which are reported in pCi/gram.

^b Lab codes are comprised of the sample media and the sample numbers. Client codes have been eliminated to protect client anonymity.

Table A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP), comparison of MAPEP and Teledyne's Midwest Laboratory results for various sample media^a.

Lab Code	Sample Type	Date Collected	Analysis	Concentration ^b		
				Teledyne Result ^c	MAPEP Result ^d 1s, N=1	Control Limits
SPW-846	WATER	Jan, 1999	Co-57	337.60 ± 33.76	358.00	250.60 - 465.40
SPW-846	WATER	Jan, 1999	Cs-137	656.60 ± 65.66	637.00	445.90 - 828.10
SPW-846	WATER	Jan, 1999	Fe-55	724.50 ± 72.45	664.00	464.80 - 863.20
SPW-846	WATER	Jan, 1999	Mn-54	234.20 ± 23.42	229.00	160.30 - 297.70
SPW-846	WATER	Jan, 1999	Pu-238	1.10 ± 0.11	1.45	1.02 - 1.89
SPW-846	WATER	Jan, 1999	Pu-239/40	3.20 ± 0.32	4.04	2.83 - 5.25
SPW-846	WATER	Jan, 1999	Sr-90	40.90 ± 4.09	39.50	27.65 - 51.35
SPW-846	WATER	Jan, 1999	U-233/4	2.70 ± 0.27	2.67	1.87 - 3.47
SPW-846	WATER	Jan, 1999	U-238	20.80 ± 2.08	21.20	14.84 - 27.56
SPW-846	WATER	Jan, 1999	Zn-65	1,508.90 ± 150.90	1,560.00	1,092.00 - 2,028.00
STSO-854	SOIL	Jan, 1999	Am-241	6.16 ± 0.70	6.55	4.59 - 8.52
STSO-854	SOIL	Jan, 1999	Co-57	311.11 ± 3.60	360.00	252.00 - 468.00
STSO-854	SOIL	Jan, 1999	Co-60	134.57 ± 2.15	131.00	91.70 - 170.30
STSO-854	SOIL	Jan, 1999	Cs-134	682.35 ± 4.50	752.00	526.40 - 977.60
STSO-854	SOIL	Jan, 1999	Cs-137	319.50 ± 3.60	331.00	231.70 - 430.30
STSO-854	SOIL	Jan, 1999	K-40	667.04 ± 21.50	652.00	456.40 - 847.60
STSO-854	SOIL	Jan, 1999	Mn-54	349.01 ± 7.00	345.00	241.50 - 448.50
STSO-854	SOIL	Jan, 1999	Pu-238	25.28 ± 1.00	27.50	19.25 - 35.75
STSO-854	SOIL	Jan, 1999	Pu-239/40	45.66 ± 1.00	48.10	33.67 - 62.53
STSO-854	SOIL	Jan, 1999	U-233/4	139.56 ± 1.80	157.00	109.90 - 204.10
STSO-854	SOIL	Jan, 1999	U-238	23.47 ± 0.75	40.70	28.49 - 52.91
No errors were found in the calculations or the analytical process. The analysis is being repeated.						
STSO-854	SOIL	Jan, 1999	Zn-65	2,697.20 ± 25.00	2,840.00	1,988.00 - 3,692.00

^a Results obtained by Teledyne Brown Engineering Environmental Services Midwest Laboratory as a participant in the Department of Energy's Mixed Analyte Performance Evaluation Program, Idaho Operations office, Idaho Falls, Idaho.

^b All results are in Bq/kg or Bq/L as requested by the Department of Energy.

^c Unless otherwise indicated, the TBEE SML results are given as the mean ± 1 standard deviations for three determinations.

^d MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP.

Table A-7. Environmental Measurements Laboratory Quality Assessment Program (EML), comparison of EML and Teledyne's Midwest Laboratory results for various sample media^a.

Lab Code	Sample Type	Date Collected	Analysis	Concentration ^b		Control Limits ^e
				Teledyne Result ^c	EML Result ^d	
STAF-848	AIR FILTER	Mar, 1999	Gr. Alpha	1.24 ± 0.03	1.61 ± 0.16	0.60 - 1.64
STAF-848	AIR FILTER	Mar, 1999	Gr. Beta	1.98 ± 0.04	1.56 ± 0.16	0.60 - 1.64
STW-850	WATER	Mar, 1999	Am-241	1.22 ± 0.16	1.15 ± 0.05	0.50 - 1.50
STW-850	WATER	Mar, 1999	Co-60	54.40 ± 2.00	51.10 ± 3.00	0.92 - 1.18
STW-850	WATER	Mar, 1999	Cs-137	43.50 ± 2.00	39.38 ± 2.41	0.90 - 1.28
STW-850	WATER	Mar, 1999	Fe-55	81.50 ± 19.50	97.40 ± 1.65	0.31 - 1.54
STW-850	WATER	Mar, 1999	Gr. Alpha	1,169.00 ± 37.00	1,090.00 ± 20.00	0.50 - 1.29
STW-850	WATER	Mar, 1999	Gr. Beta	1,274.60 ± 33.30	1,100.00 ± 40.00	0.50 - 1.29
STW-850	WATER	Mar, 1999	H-3	90.30 ± 24.80	121.08 ± 6.78	0.65 - 1.91
STW-850	WATER	Mar, 1999	Ni-63	125.80 ± 6.30	114.00 ± 10.00	0.50 - 1.50
STW-850	WATER	Mar, 1999	Pu-238	0.80 ± 0.01	0.77 ± 0.04	0.78 - 1.42
STW-850	WATER	Mar, 1999	Pu-239/40	1.03 ± 0.07	1.01 ± 0.06	0.78 - 1.42
STW-850	WATER	Mar, 1999	Sr-90	3.63 ± 1.20	4.10 ± 0.05	0.50 - 1.50
STW-850	WATER	Mar, 1999	U-233/4	0.33 ± 0.08	0.27 ± 0.02	0.77 - 1.35
STW-850	WATER	Mar, 1999	U-238	0.33 ± 0.08	0.26 ± 0.02	0.77 - 1.35
STVE-851	VEGETATION	Mar, 1999	Am-241	3.35 ± 0.85	3.52 ± 0.59	0.68 - 2.78
STVE-851	VEGETATION	Mar, 1999	Cm-244	0.56 ± 0.41	1.67 ± 0.54	0.49 - 1.69
STVE-851	VEGETATION	Mar, 1999	Co-60	21.00 ± 1.90	21.45 ± 1.00	0.62 - 1.42
STVE-851	VEGETATION	Mar, 1999	Cs-137	453.90 ± 5.70	467.00 ± 20.00	0.81 - 1.45
STVE-851	VEGETATION	Mar, 1999	K-40	667.60 ± 33.70	656.50 ± 20.00	0.79 - 1.50
STVE-851	VEGETATION	Mar, 1999	Sr-90	704.80 ± 27.80	736.10 ± 7.70	0.48 - 1.29
STSO-852	SOIL	Mar, 1999	Ac-228	45.10 ± 7.40	47.15 ± 2.99	0.50 - 1.50
STSO-852	SOIL	Mar, 1999	Am-241	5.65 ± 2.41	4.89 ± 0.97	0.52 - 2.65
STSO-852	SOIL	Mar, 1999	Bi-214	67.30 ± 3.30	69.90 ± 5.66	0.50 - 1.50
STSO-852	SOIL	Mar, 1999	Cs-137	620.50 ± 5.90	659.50 ± 24.95	0.80 - 1.34
STSO-852	SOIL	Mar, 1999	K-40	355.70 ± 24.60	362.75 ± 20.16	0.73 - 1.67
STSO-852	SOIL	Mar, 1999	Pb-212	47.90 ± 3.00	47.93 ± 2.57	0.50 - 1.50
STSO-852	SOIL	Mar, 1999	Pb-214	70.10 ± 4.80	71.00 ± 7.04	0.50 - 1.50
STSO-852	SOIL	Mar, 1999	Pu-239/40	7.32 ± 1.32	8.11 ± 1.07	0.66 - 1.93
STSO-852	SOIL	Mar, 1999	Sr-90	28.30 ± 3.50	32.40 ± 0.53	0.46 - 2.84
STSO-852	SOIL	Mar, 1999	Th-234	227.40 ± 35.20	138.00 ± 4.08	0.50 - 2.00
STSO-852	SOIL	Mar, 1999	U-233/4	132.90 ± 6.90	140.67 ± 1.16	0.35 - 1.55
STSO-852	SOIL	Mar, 1999	U-238	139.40 ± 7.00	145.00 ± 1.73	0.35 - 1.55
STAF-853	AIR FILTER	Mar, 1999	Am-241	0.14 ± 0.02	0.13 ± 0.01	0.68 - 2.41
STAF-853	AIR FILTER	Mar, 1999	Co-57	3.32 ± 0.06	3.01 ± 0.14	0.62 - 1.22
STAF-853	AIR FILTER	Mar, 1999	Co-60	5.28 ± 0.15	4.96 ± 0.28	0.62 - 1.42
STAF-853	AIR FILTER	Mar, 1999	Cs-137	6.96 ± 0.15	6.05 ± 0.30	0.72 - 1.32
STAF-853	AIR FILTER	Mar, 1999	Pu-238	0.26 ± 0.02	0.27 ± 0.00	0.62 - 1.46

Table A-7. Environmental Measurements Laboratory Quality Assessment Program (EML), comparison of EML and Teledyne's Midwest Laboratory results for various sample media^a.

Lab Code	Sample Type	Date Collected	Analysis	Concentration ^b		Control Limits ^e
				Teledyne Result ^c	EML Result ^d	
STAF-853	AIR FILTER	Mar, 1999	Pu-239/40	0.12 ± 0.02	0.12 ± 0.00	0.62 - 1.46
STAF-853	AIR FILTER	Mar, 1999	Sb-125	4.35 ± 0.30	3.59 ± 0.31	0.62 - 1.39
STAF-853	AIR FILTER	Mar, 1999	Sr-90	0.65 ± 0.19	0.64 ± 0.01	0.66 - 2.65
STAF-853	AIR FILTER	Mar, 1999	U-233/4	0.07 ± 0.03	0.06 ± 0.00	0.78 - 3.00
STAF-853	AIR FILTER	Mar, 1999	U-238	0.07 ± 0.03	0.06 ± 0.00	0.78 - 3.00

^a The Environmental Measurements Laboratory provides the following nuclear species : Air Filters, Soil, Vegetation and Water.

^b Results are reported in Bq/L with the following exceptions: Air Filter results are reported in Bq/Filter, Soil results are reported in Bq/Kg, Vegetation results are reported in Bq/Kg.

^c Teledyne results are reported as the mean of three determinations ± standard deviation.

^d The EML result listed is the mean of replicate determinations for each nuclide ± the standard error of the mean.

^e The control limits are reported by EML as the ratio of Reported Value / EML value and are established from percentiles of historic data distributions (1982-1992). The evaluation of this historic data and the development of the control limits is presented in DOE report EML-564.

APPENDIX B

DATA REPORTING CONVENTIONS

Data Reporting Conventions

1.0. All activities, except gross alpha and gross beta, are decay corrected to collection time or the end of the collection period.

2.0. Single Measurements

Each single measurement is reported as follows: $x \pm s$

where: x = value of the measurement;

s = 2s counting uncertainty (corresponding to the 95% confidence level).

In cases where the activity is less than the lower limit of detection L , it is reported as: $<L$, where L = the lower limit of detection based on 4.66s uncertainty for a background sample.

3.0. Duplicate analyses

3.1 Individual results: For two analysis results; $x_1 \pm s_1$ and $x_2 \pm s_2$

Reported result: $x \pm s$; where $x = (1/2)(x_1 + x_2)$ and $s = (1/2)\sqrt{s_1^2 + s_2^2}$

3.2. Individual results: $<L_1, <L_2$ Reported result: $<L$, where L = lower of L_1 and L_2

3.3. Individual results: $x \pm s, <L$ Reported result: $x \pm s$ if $x \geq L$; $<L$ otherwise.

4.0. Computation of Averages and Standard Deviations

4.1 Averages and standard deviations listed in the tables are computed from all of the individual measurements over the period averaged; for example, an annual standard deviation would not be the average of quarterly standard deviations. The average \bar{x} and standard deviation s of a set of n numbers $x_1, x_2 \dots x_n$ are defined as follows:

$$\bar{x} = \frac{1}{n} \sum x \qquad s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

4.2 Values below the highest lower limit of detection are not included in the average.

4.3 If all values in the averaging group are less than the highest LLD, the highest LLD is reported.

4.4 If all but one of the values are less than the highest LLD, the single value x and associated two sigma error is reported.

4.5 In rounding off, the following rules are followed:

4.5.1. If the figure following those to be retained is less than 5, the figure is dropped, and the retained figures are kept unchanged. As an example, 11.443 is rounded off to 11.44.

4.5.2. If the figure following those to be retained is equal to or greater than 5, the figure is dropped and the last retained figure is raised by 1. As an example, 11.445 is rounded off to 11.45.

PALISADES

APPENDIX C

SPECIAL ANALYSES

PALISADES

Appendix C. Well Water, analysis for gamma emitting isotopes.

Collection: Monthly

Units: pCi/L

Lab Code	PAWW-266	PAWW-268	PAWW-542
Date Collected	01-15-99	01-15-99	02-01-99
K-40	< 74.0	< 54.1	< 56.4
Mn-54	< 3.4	< 2.8	< 2.0
Fe-59	< 12.6	< 12.5	< 4.4
Co-58	< 2.9	< 2.3	< 1.7
Co-60	< 2.2	< 1.3	< 2.0
Zn-65	< 6.8	< 3.8	< 3.8
Zr-Nb-95	< 9.1	< 7.3	< 4.8
Cs-134	< 4.1	< 2.1	< 3.1
Cs-137	< 3.3	< 2.2	< 3.2
Ce-141	< 11.7	< 14.0	< 7.3
Ce-144	< 21.5	< 17.8	< 21.2

Lab Code	PAWW-1582	PAWW-2213	PAWW-3159
Date Collected	03-11-99	04-06-99	05-04-99
K-40	< 47.5	< 67.4	< 54.3
Mn-54	< 1.9	< 1.7	< 2.2
Fe-59	< 6.8	< 5.8	< 8.5
Co-58	< 2.8	< 1.5	< 1.6
Co-60	< 2.3	< 1.4	< 1.5
Zn-65	< 3.0	< 2.5	< 4.1
Zr-Nb-95	< 1.8	< 3.7	< 4.5
Cs-134	< 2.4	< 2.8	< 2.1
Cs-137	< 2.0	< 3.0	< 2.7
Ce-141	< 4.5	< 10.9	< 10.2
Ce-144	< 19.6	< 17.6	< 27.8

PALISADES

Appendix C. Well Water, analysis for gamma emitting isotopes.

Collection: Monthly

Units: pCi/L

Lab Code	PAWW-6613	PAWW-7746	PAWW-9440
Date Collected	09-07-99	10-05-99	12-08-99
K-40	< 92.9	< 77.4	< 64.1
Mn-54	< 2.8	< 3.0	< 2.7
Fe-59	< 4.2	< 5.2	< 10.4
Co-58	< 4.3	< 2.1	< 2.9
Co-60	< 3.8	< 2.2	< 2.1
Zn-65	< 4.8	< 2.8	< 3.1
Zr-Nb-95	< 6.2	< 5.2	< 4.2
Cs-134	< 3.9	< 2.2	< 2.7
Cs-137	< 3.7	< 2.9	< 2.7
Ce-141	< 19.8	< 9.1	< 11.7
Ce-144	< 24.3	< 21.7	< 31.0

ENCLOSURE F

**CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255**

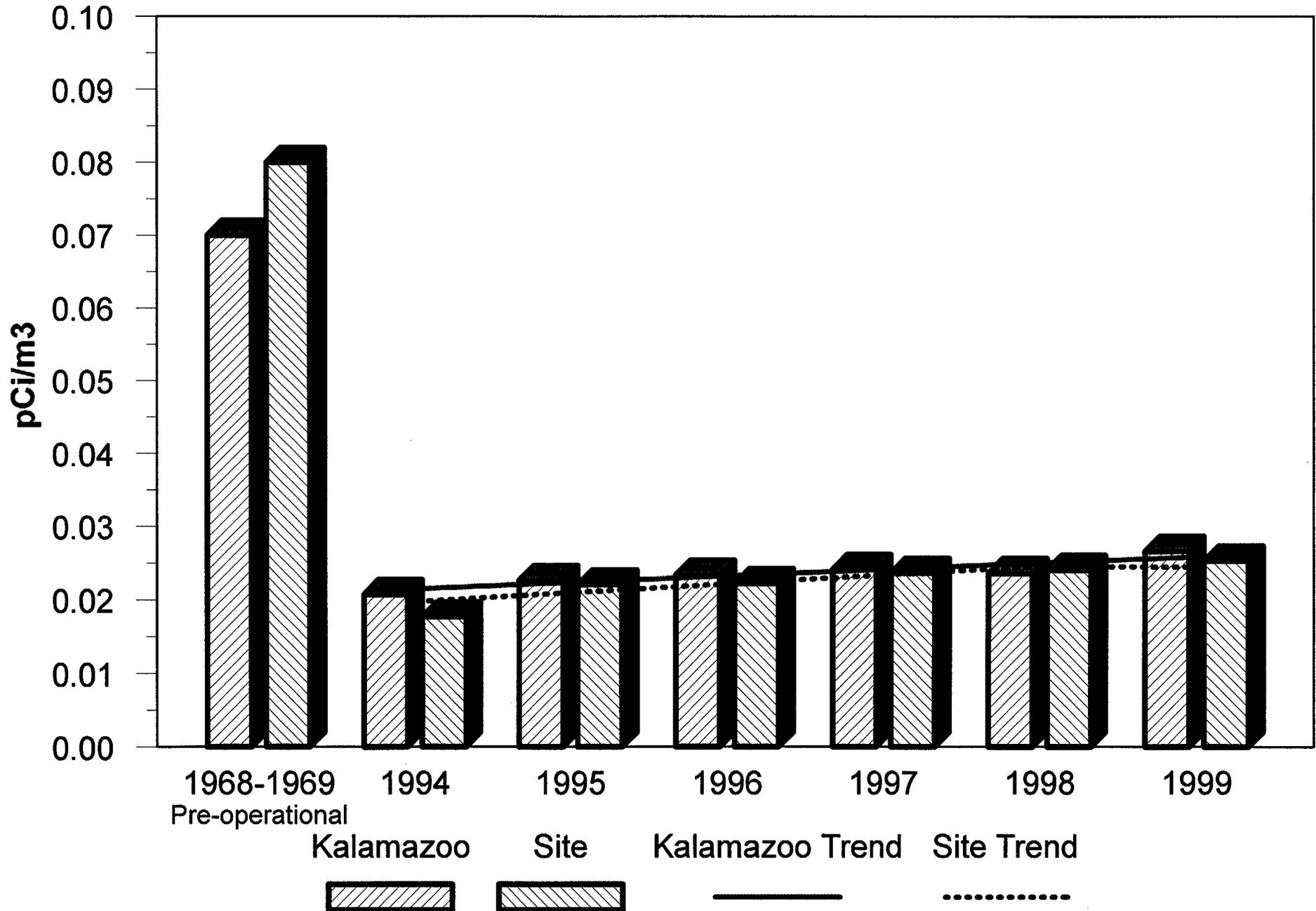
**PALISADES NUCLEAR PLANT
1999 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT
DATA GRAPHS**

25 Pages

Palisades Air Particulate

Gross Beta

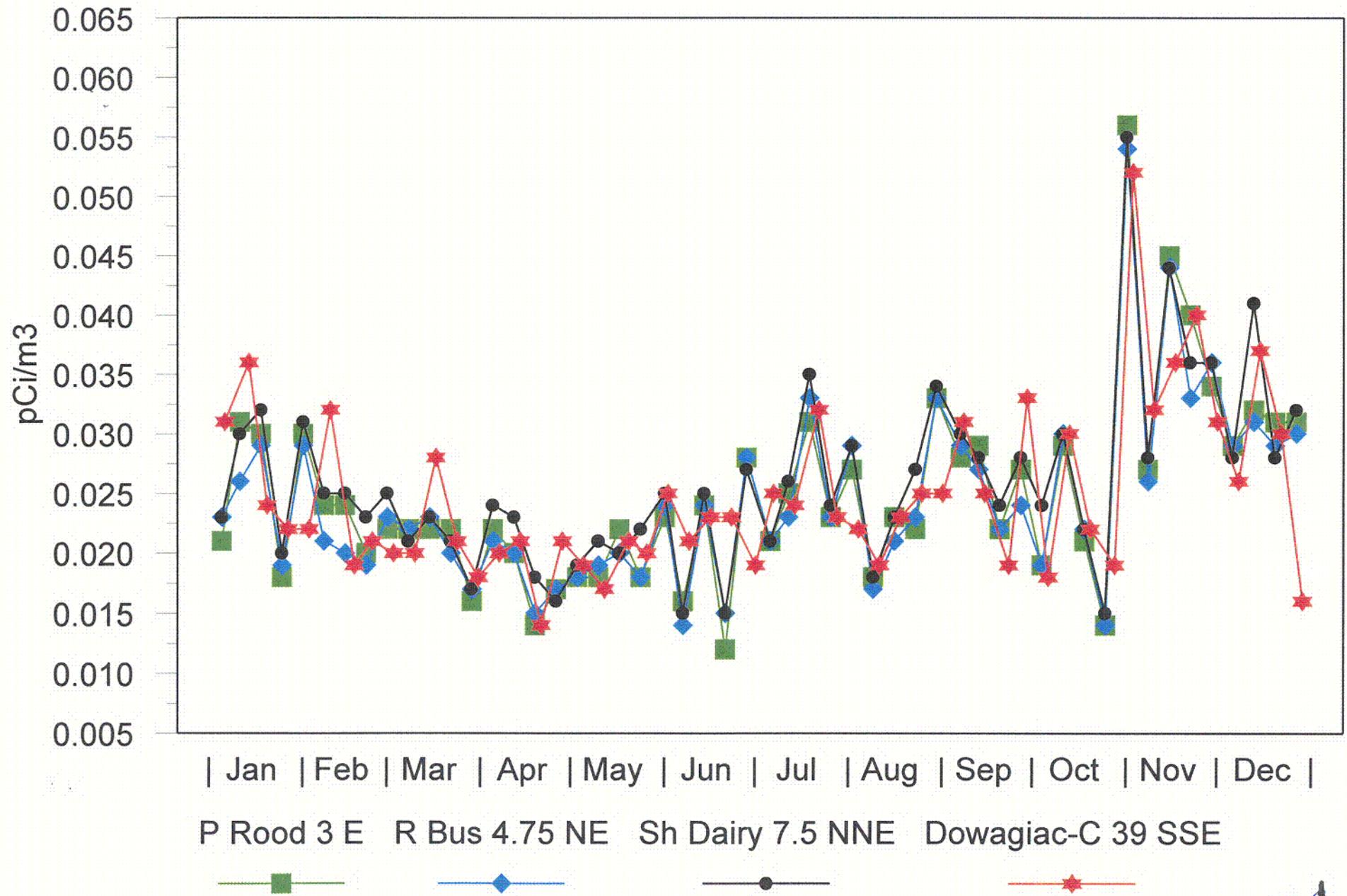
Pre-Operational vs. Operational



1999 PALISADES AIR PARTICULATE

Weekly Gross Beta

Dowagiac-Control vs Sherman Dairy, R Bus, P Rood

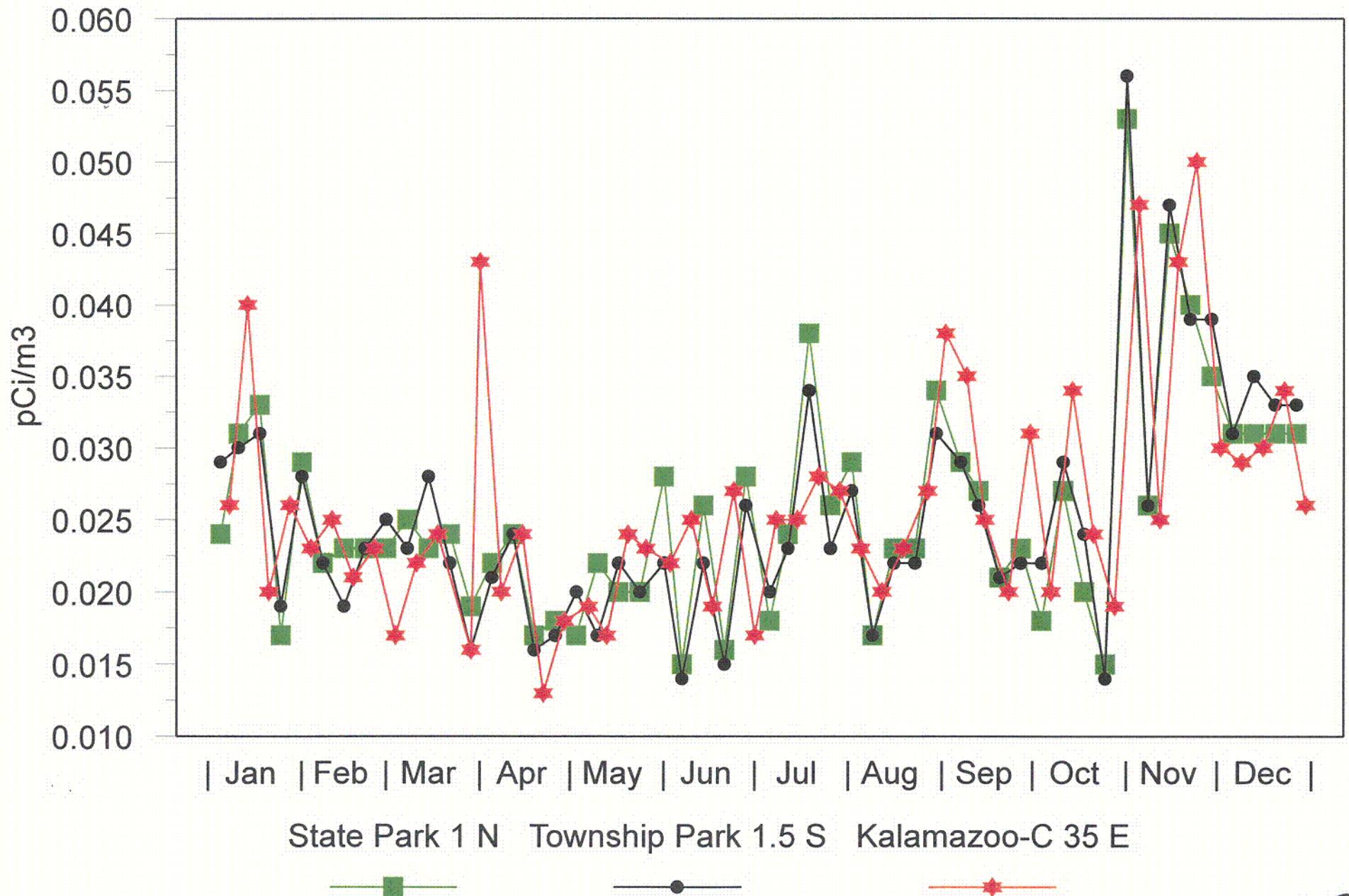


c.1

1999 PALISADES AIR PARTICULATE

Weekly Gross Beta

Kalamazoo-Control vs Township Park, State Park



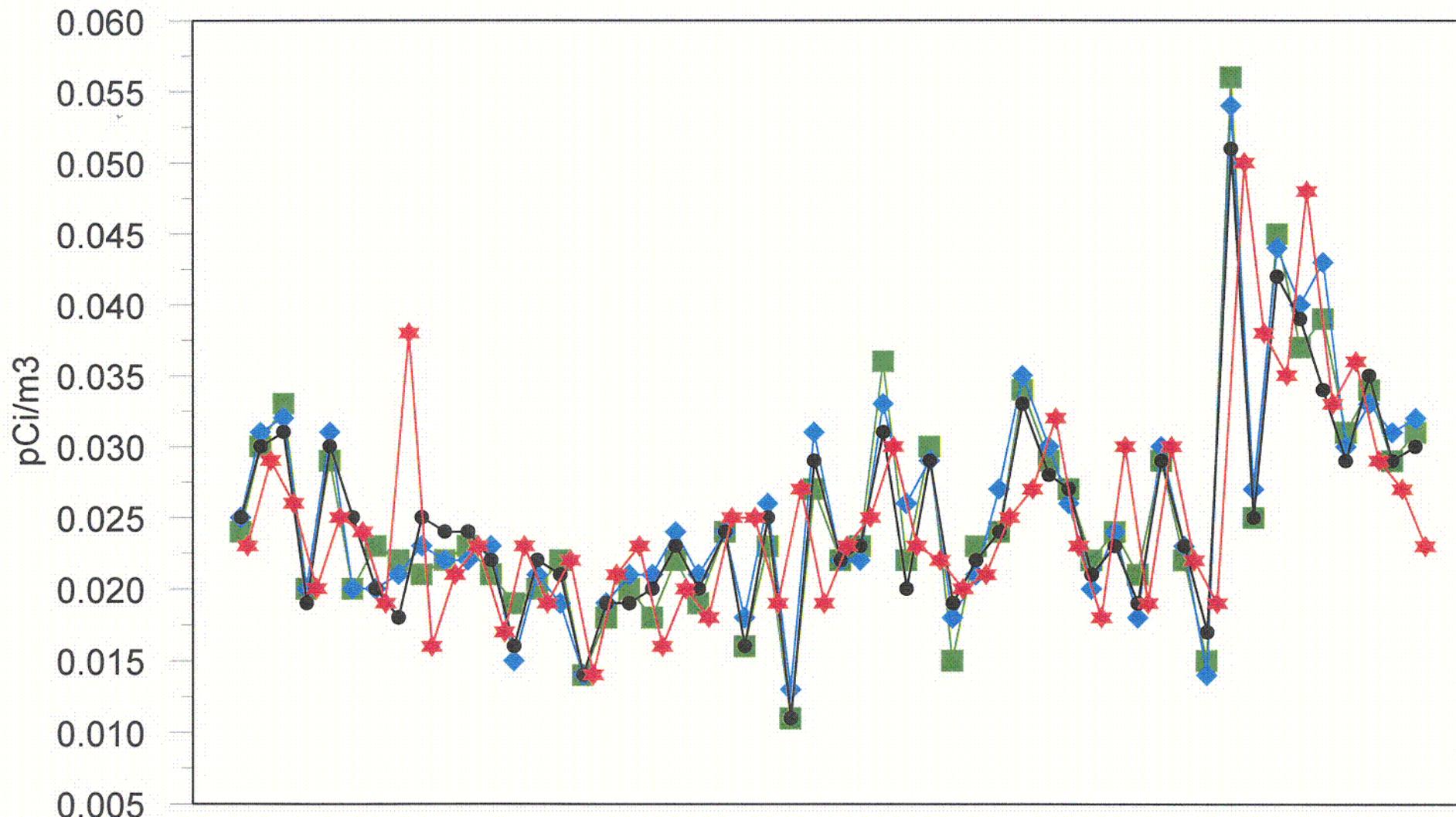
State Park 1 N Township Park 1.5 S Kalamazoo-C 35 E



1999 PALISADES AIR PARTICULATE

Weekly Gross Beta

Grand Rapids-Control vs Tower Hill, H Soderberg, J Sarno



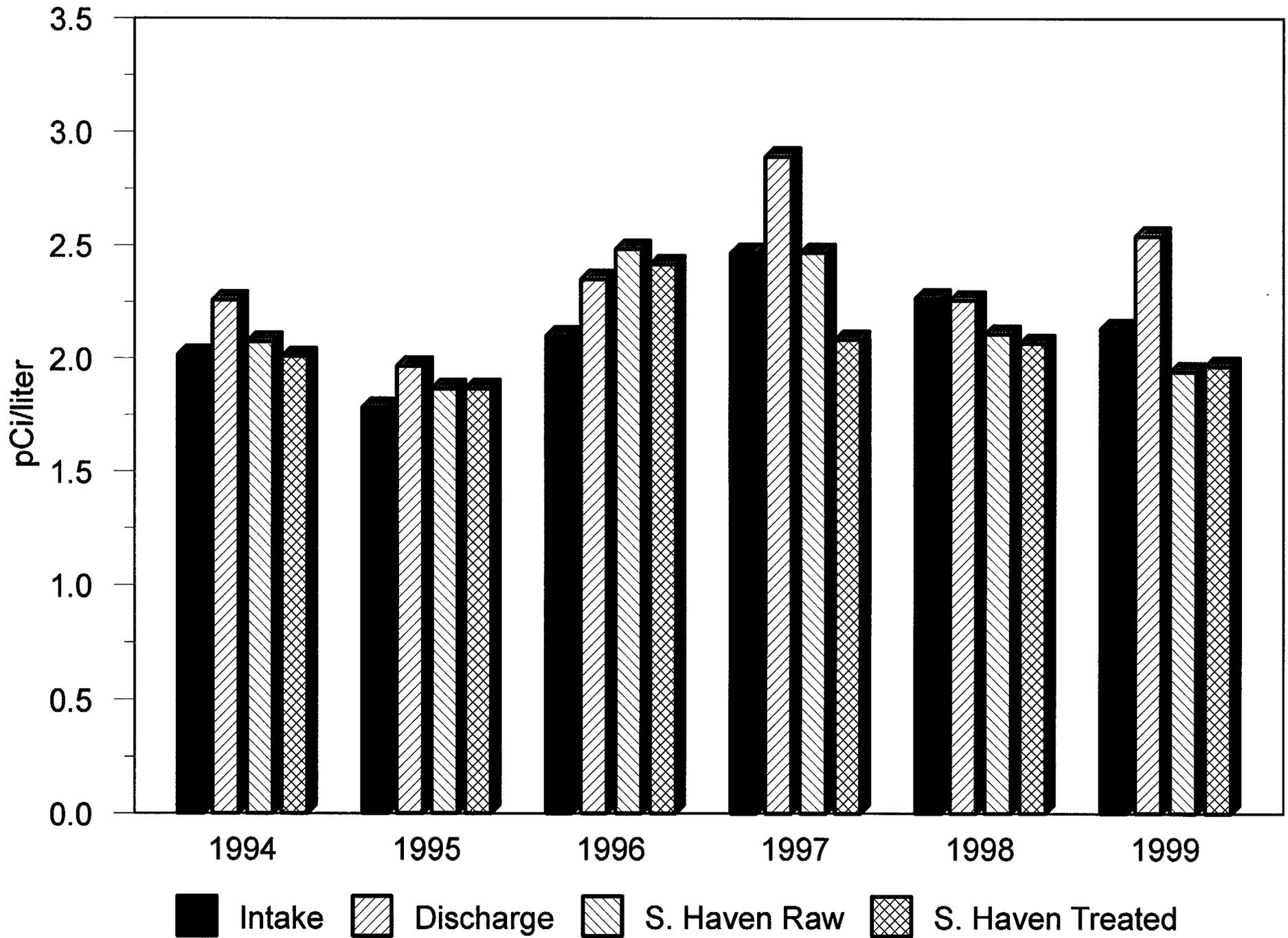
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |

Tower Hill 5 SSE H. Soderberg 5 SE J Sarno 3.5 ESE G.R.-C 55 NNE



Palisades Lake Water Gross Beta

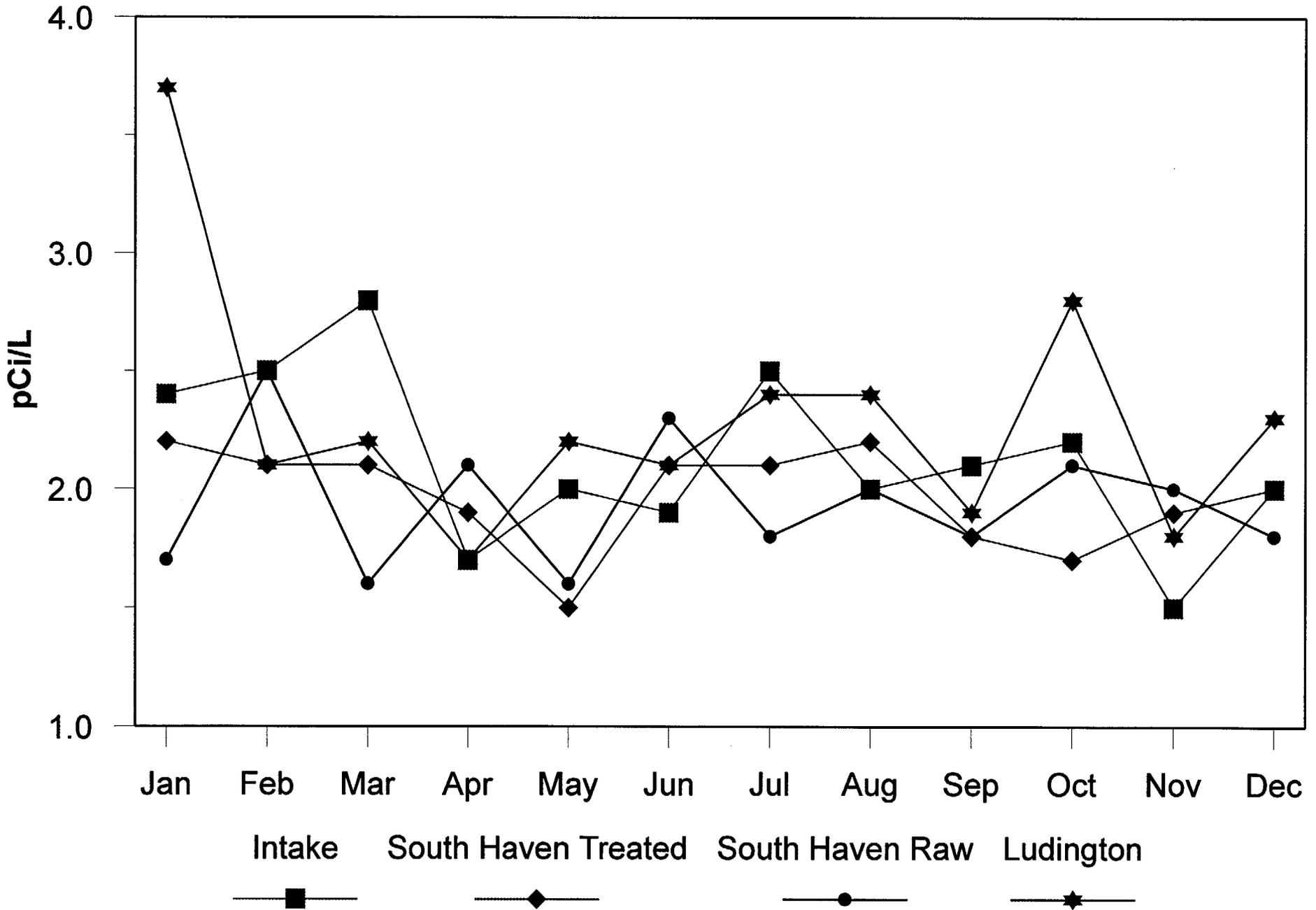
1994- 1999



1999 Palisades Lake Water Samples

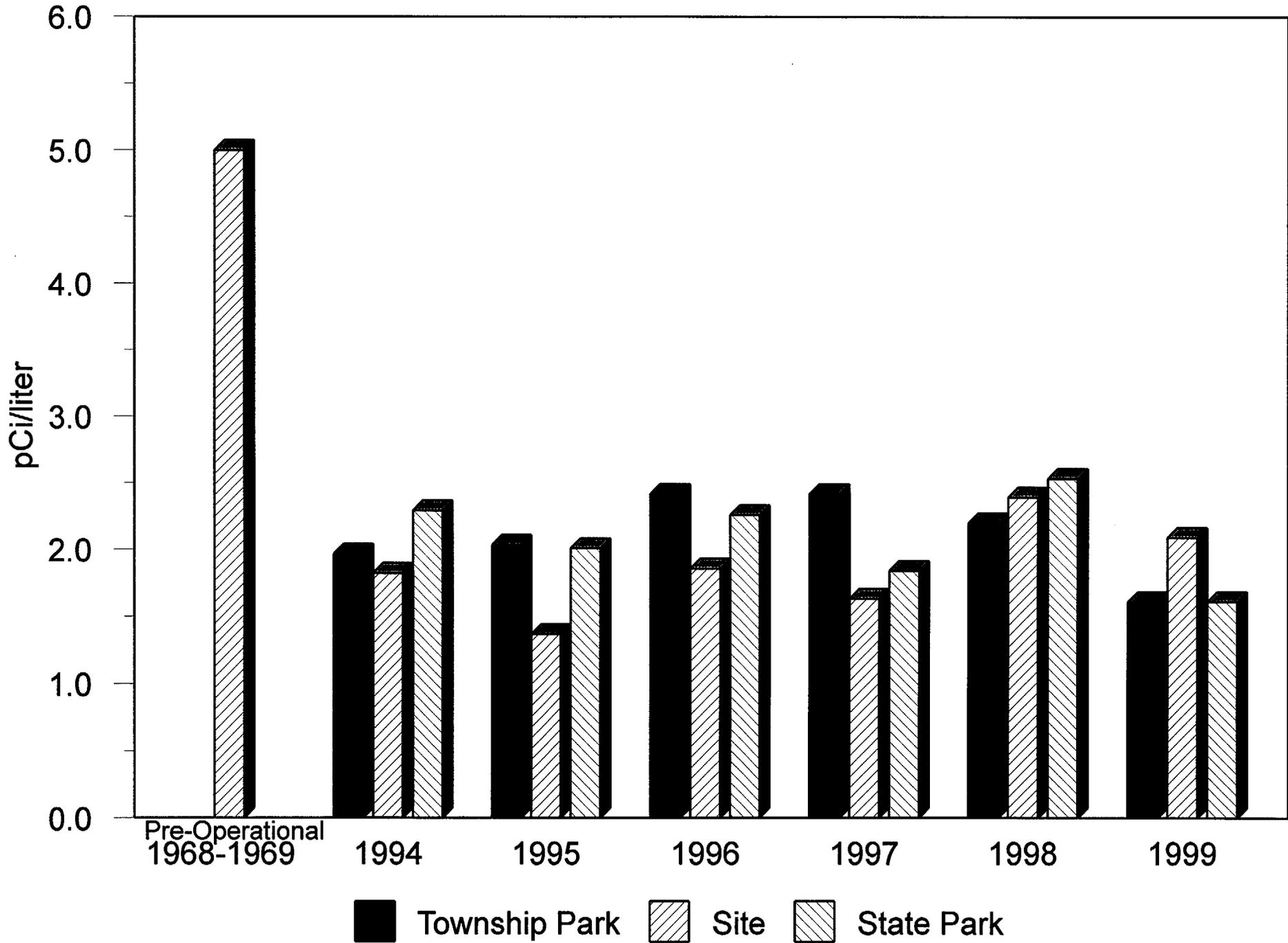
Gross Beta pCi/L

Ludington Control vs Intake, South Haven Treated & Raw



Palisades Well Water Gross Beta

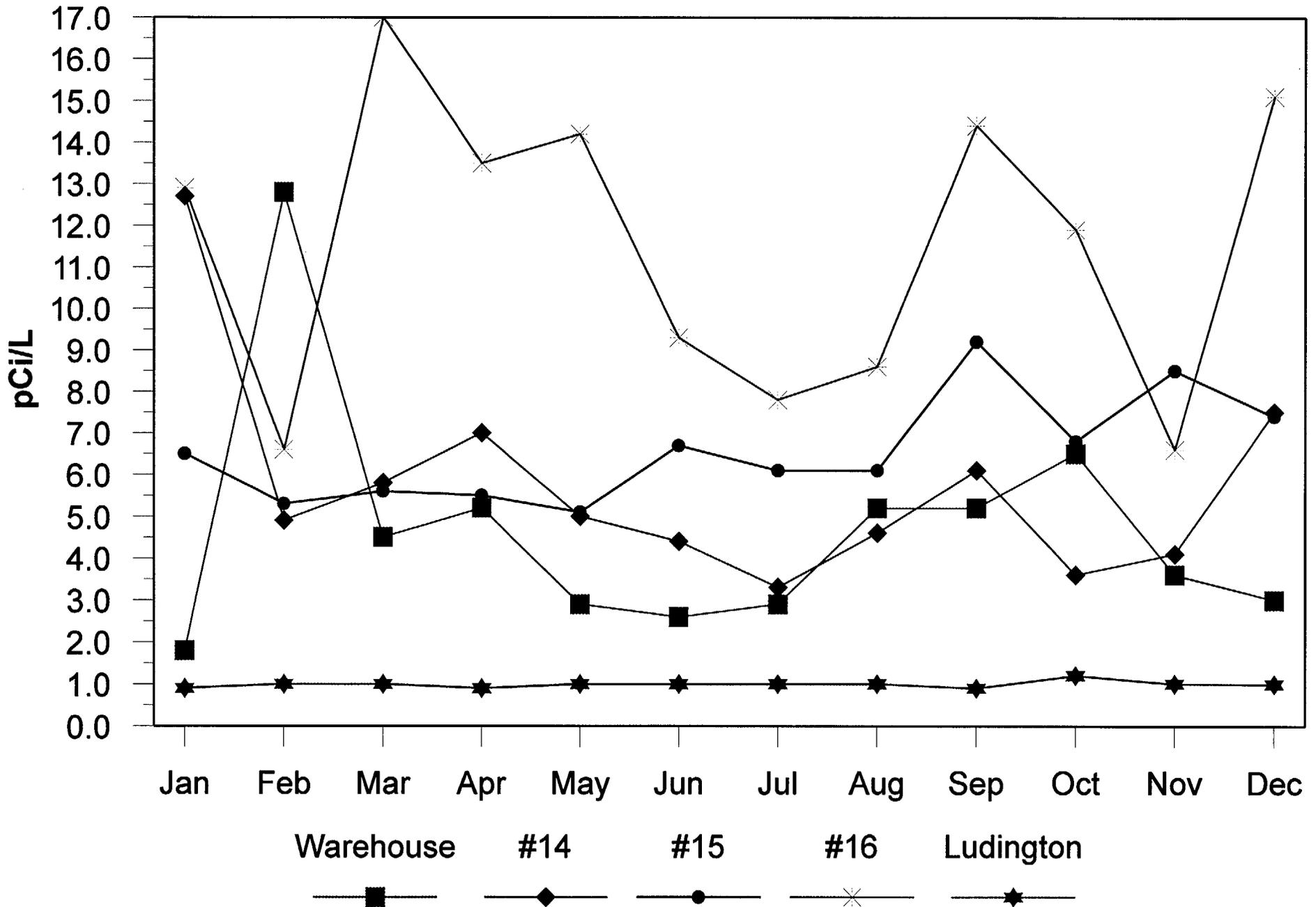
Pre-Operational vs. Operational



1999 Palisades Well Water Samples

Gross Beta pCi/L

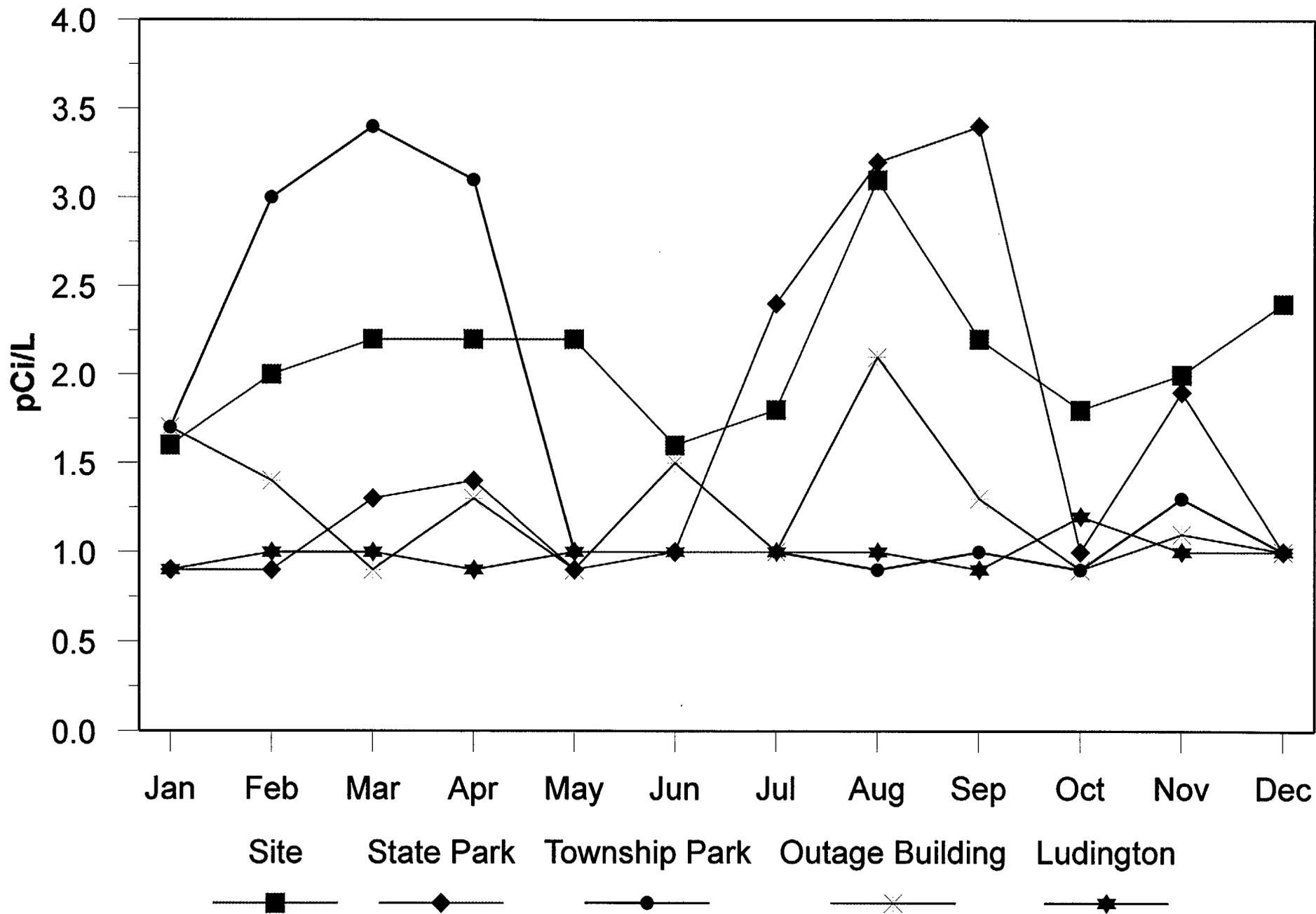
Ludington Control vs Warehouse, Well #14, Well#15 and Well #16



1999 Palisades Well Water Samples

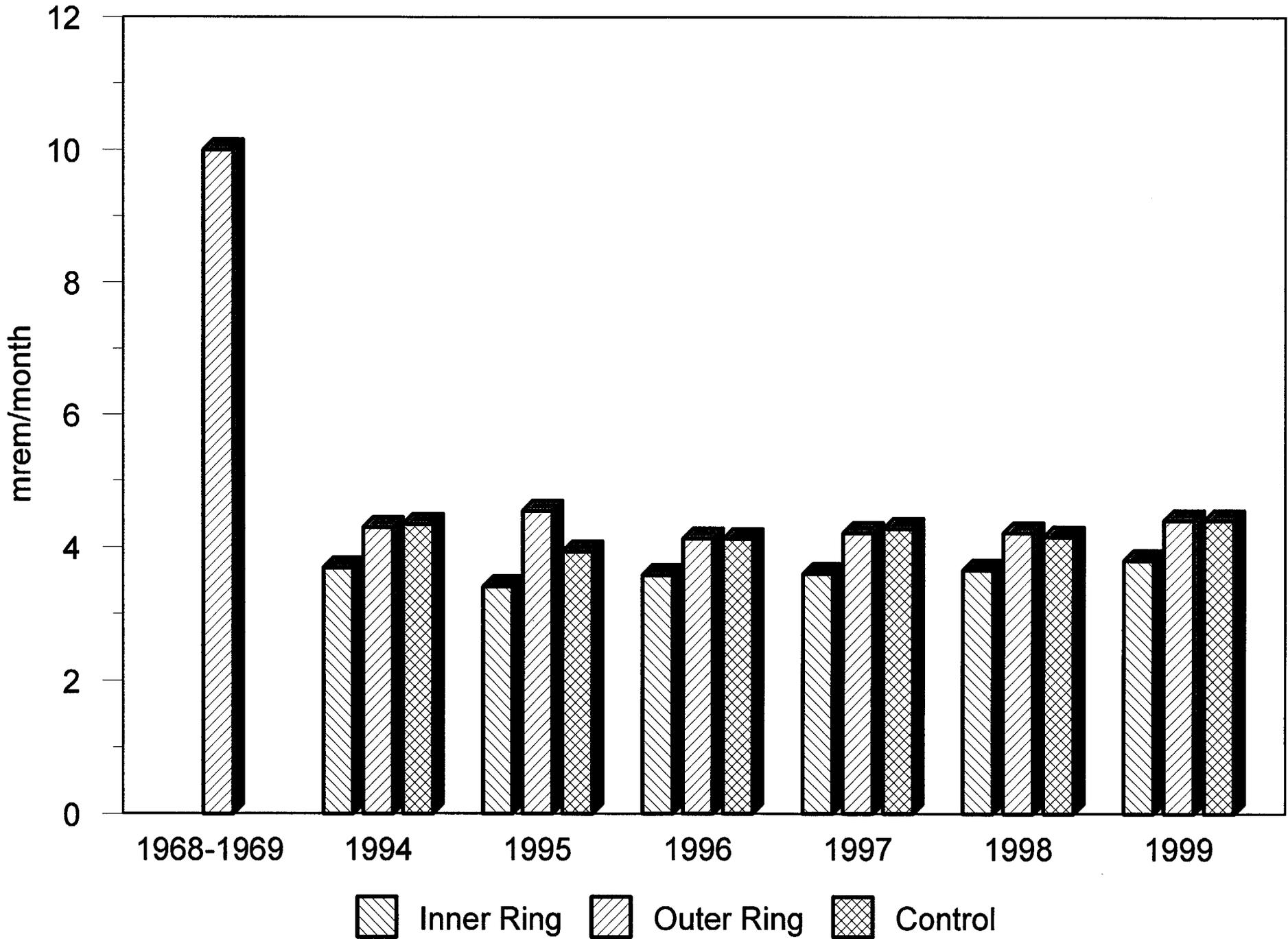
Gross Beta pCi/L

Ludington Control vs Site, Outage Building, State Park and Township Park

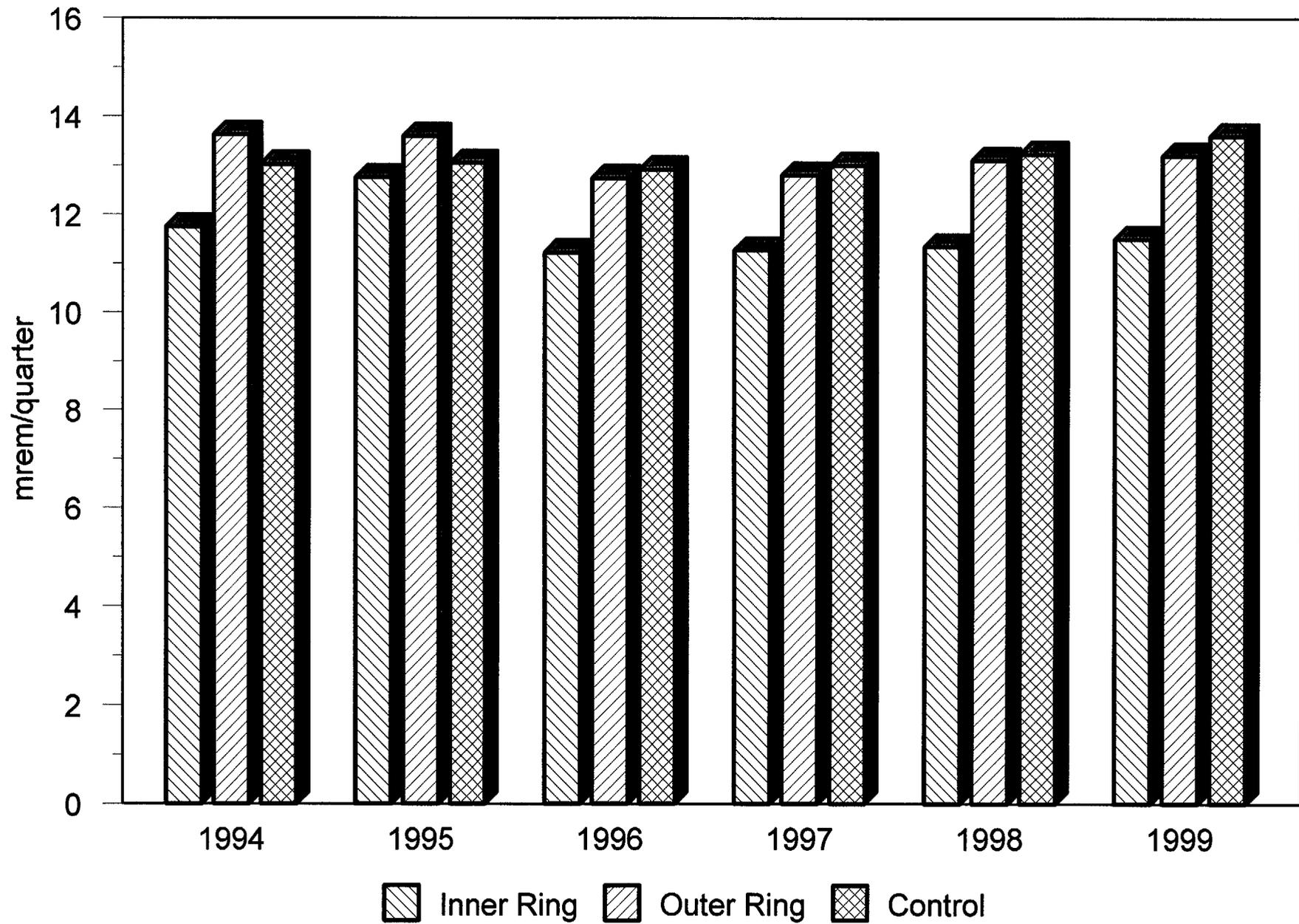


Palisades Monthly Thermoluminescent Dosimeters

Pre-Operational vs. Operational

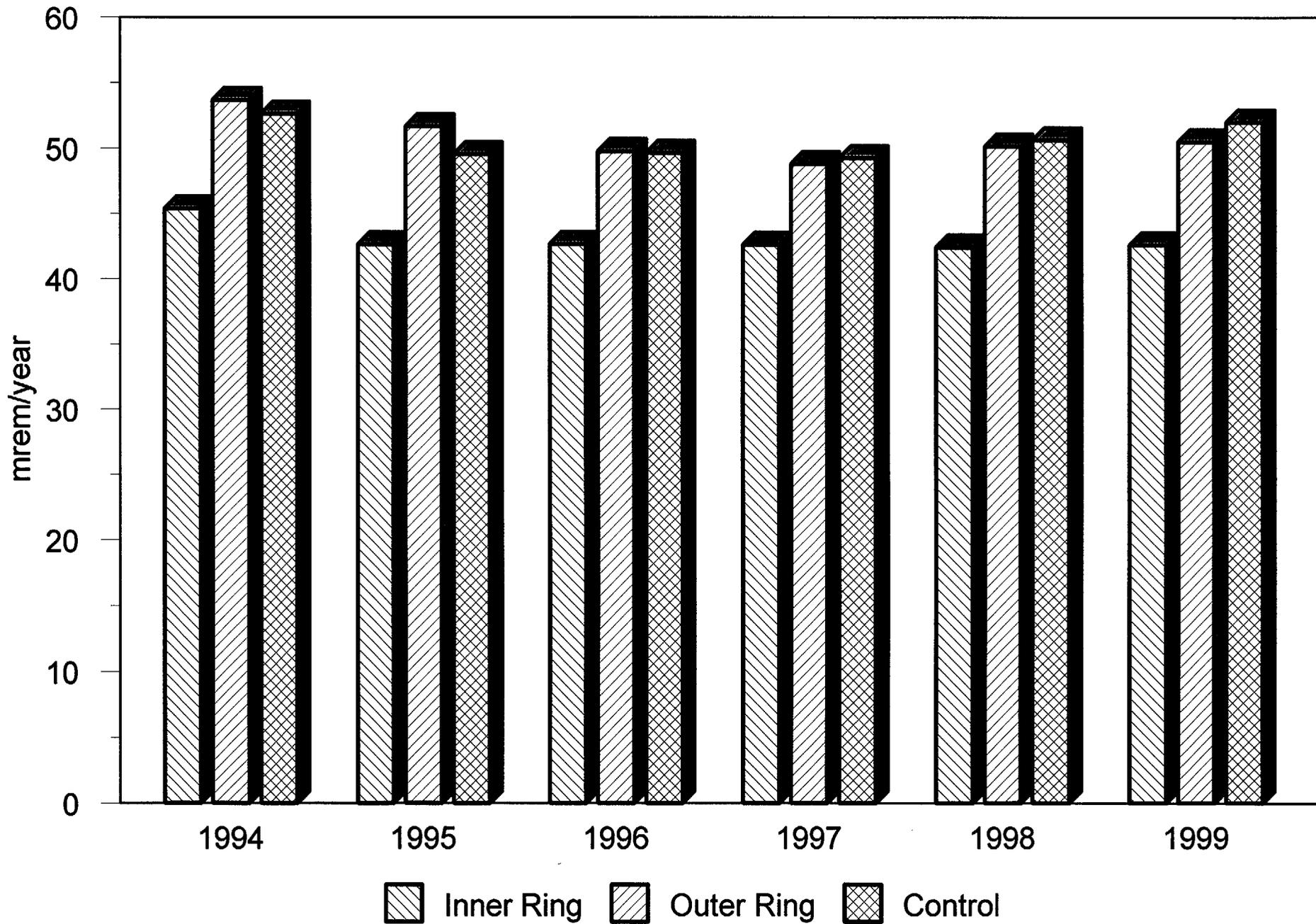


Palisades Quarterly Thermoluminescent Dosimeters 1994-1999



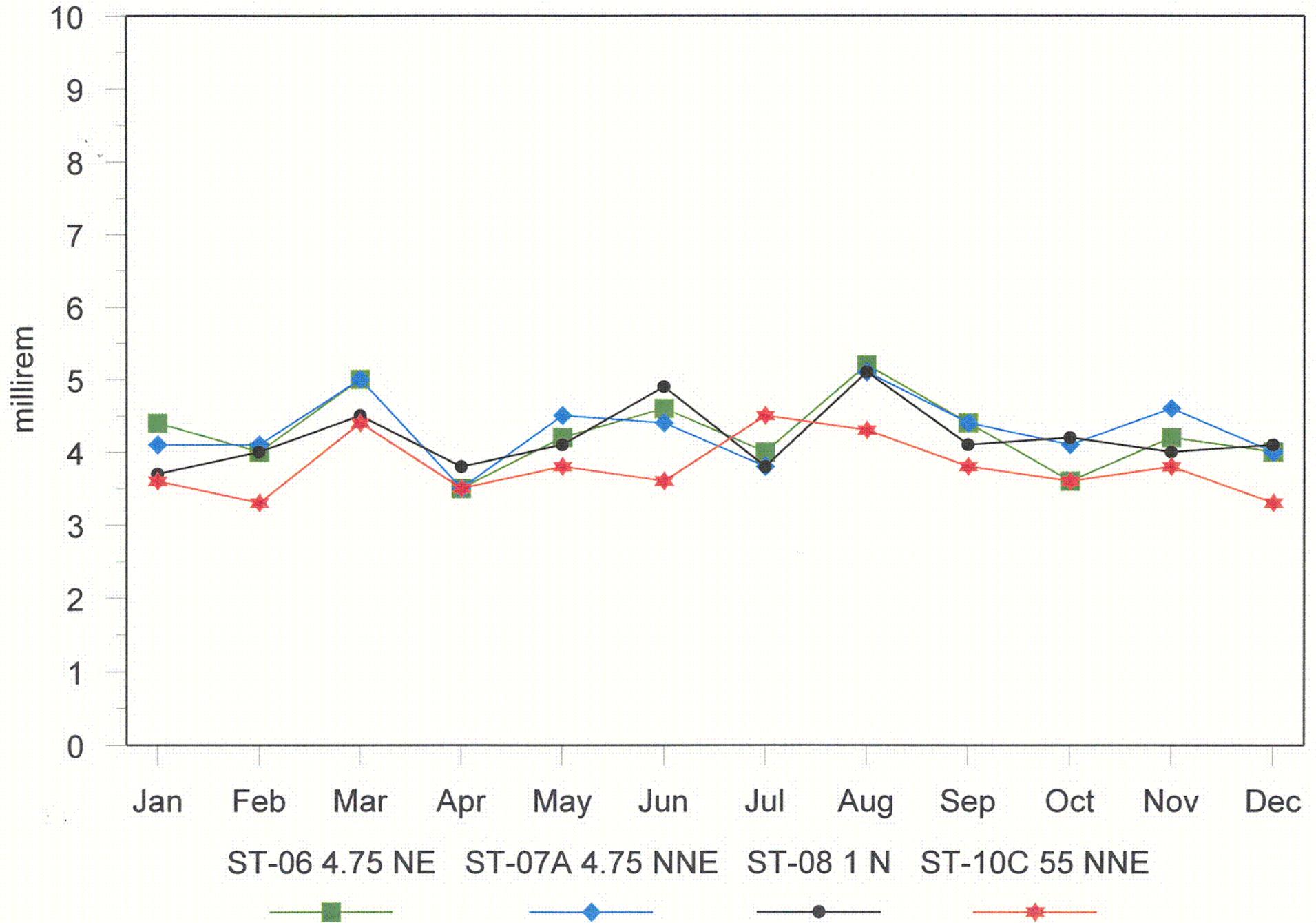
Palisades Annual Thermoluminescent Dosimeters

1994-1999



1999 Palisades TLDs

ST10 Control vs ST06, ST07A, ST08



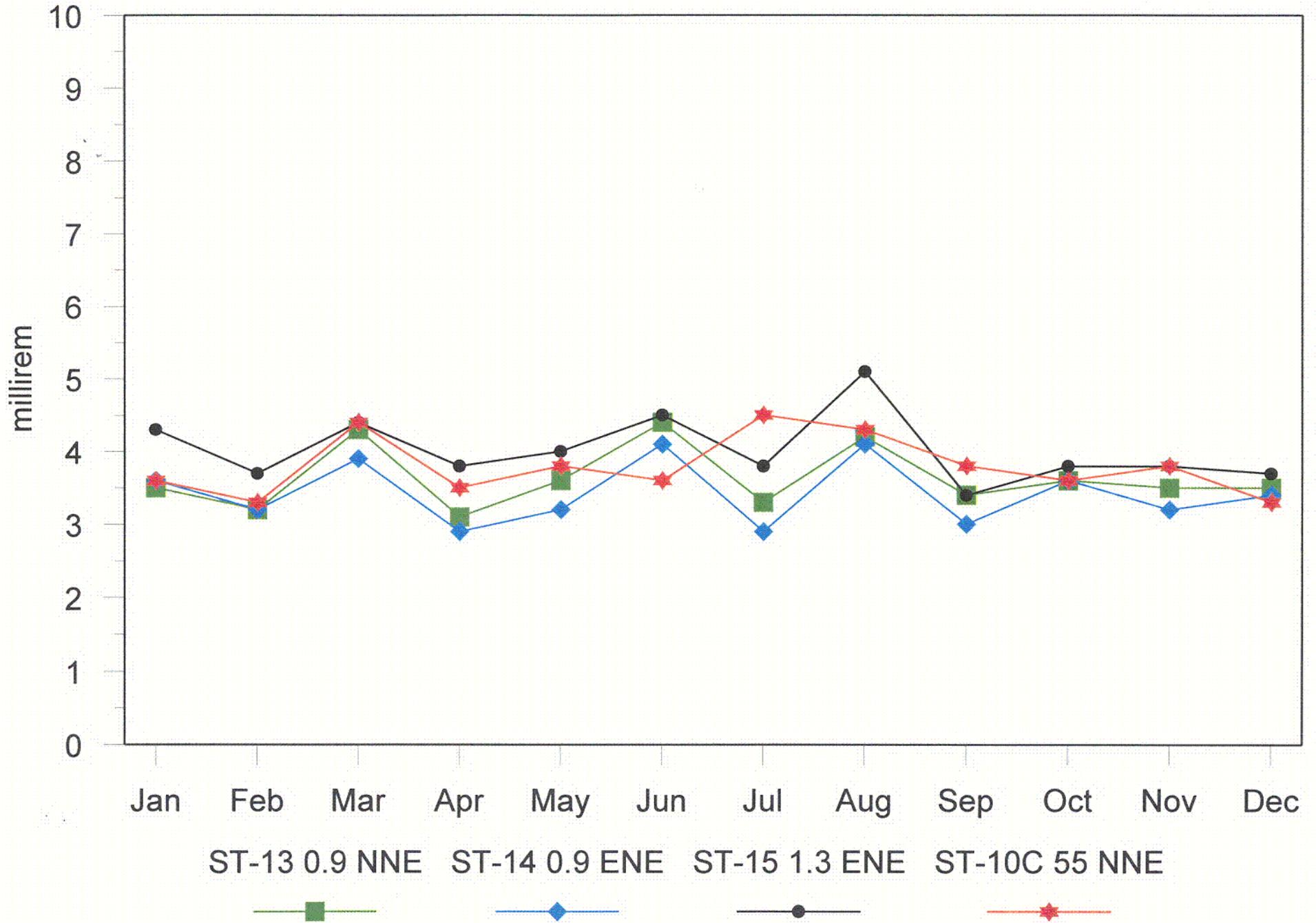
ST-06 4.75 NE ST-07A 4.75 NNE ST-08 1 N ST-10C 55 NNE



c-4

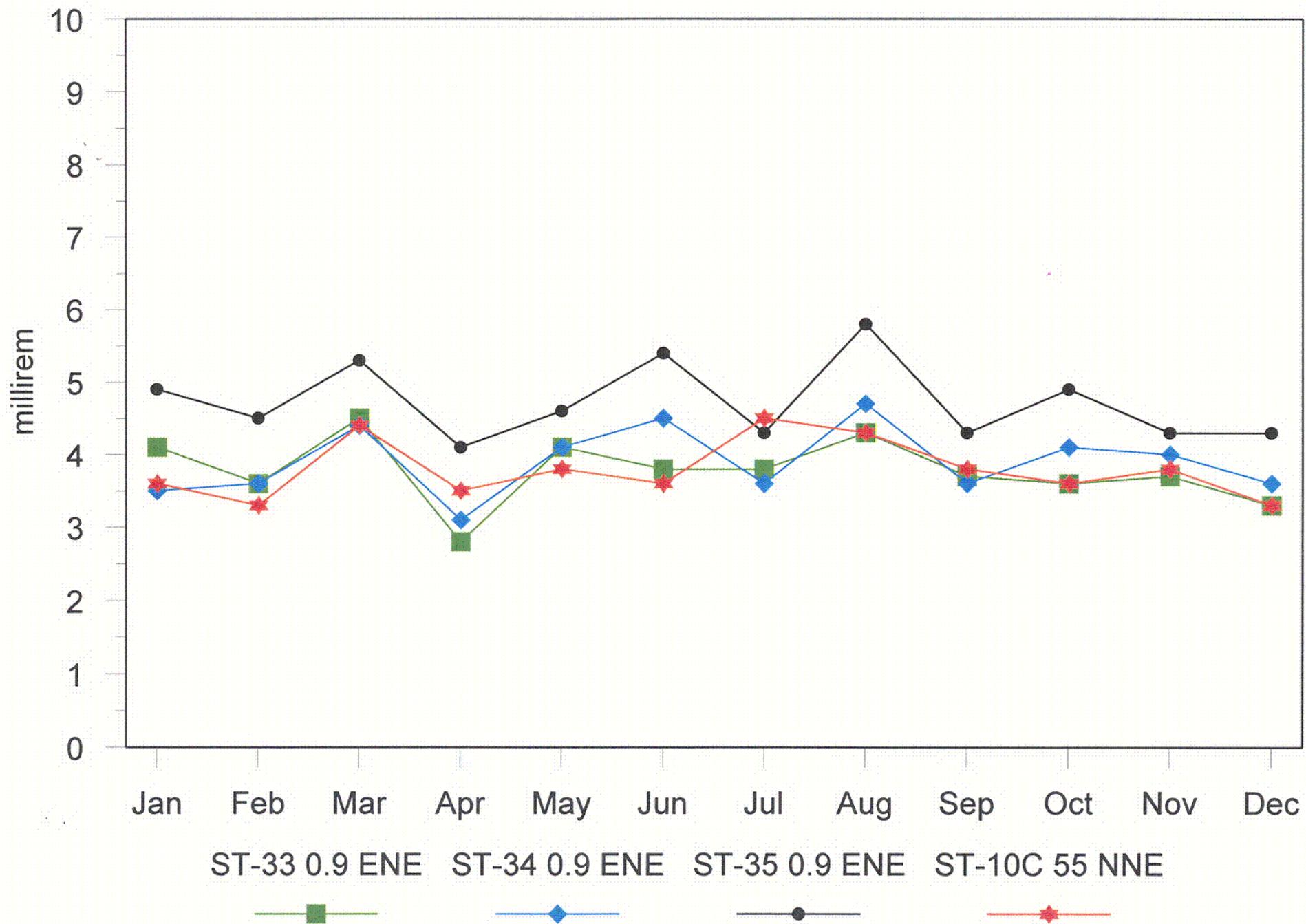
1999 Palisades TLDs

ST10 Control vs ST13, ST14, ST15



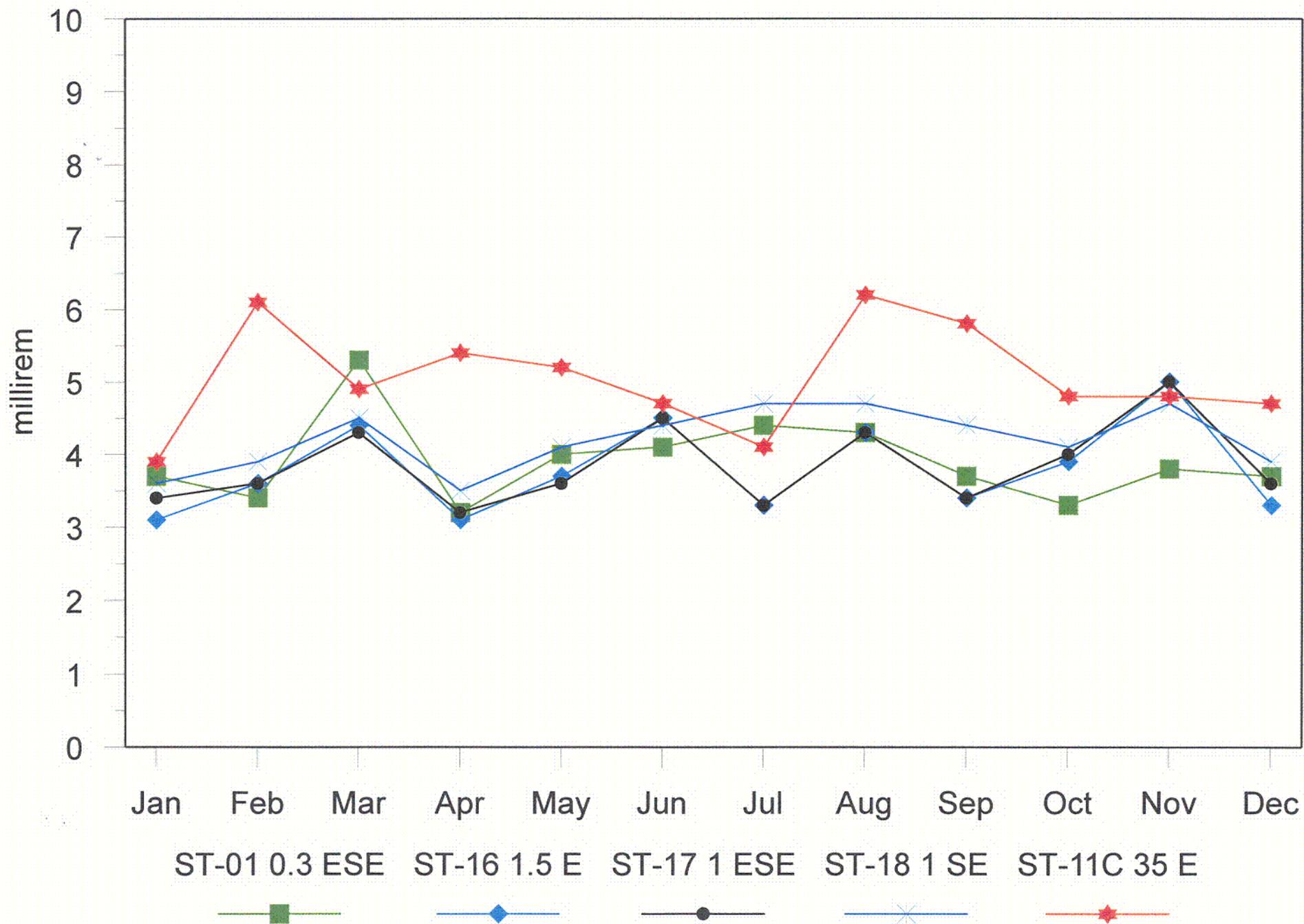
1999 Palisades TLDs

ST10 Control vs ST33, ST34, ST35



1999 Palisades TLDs

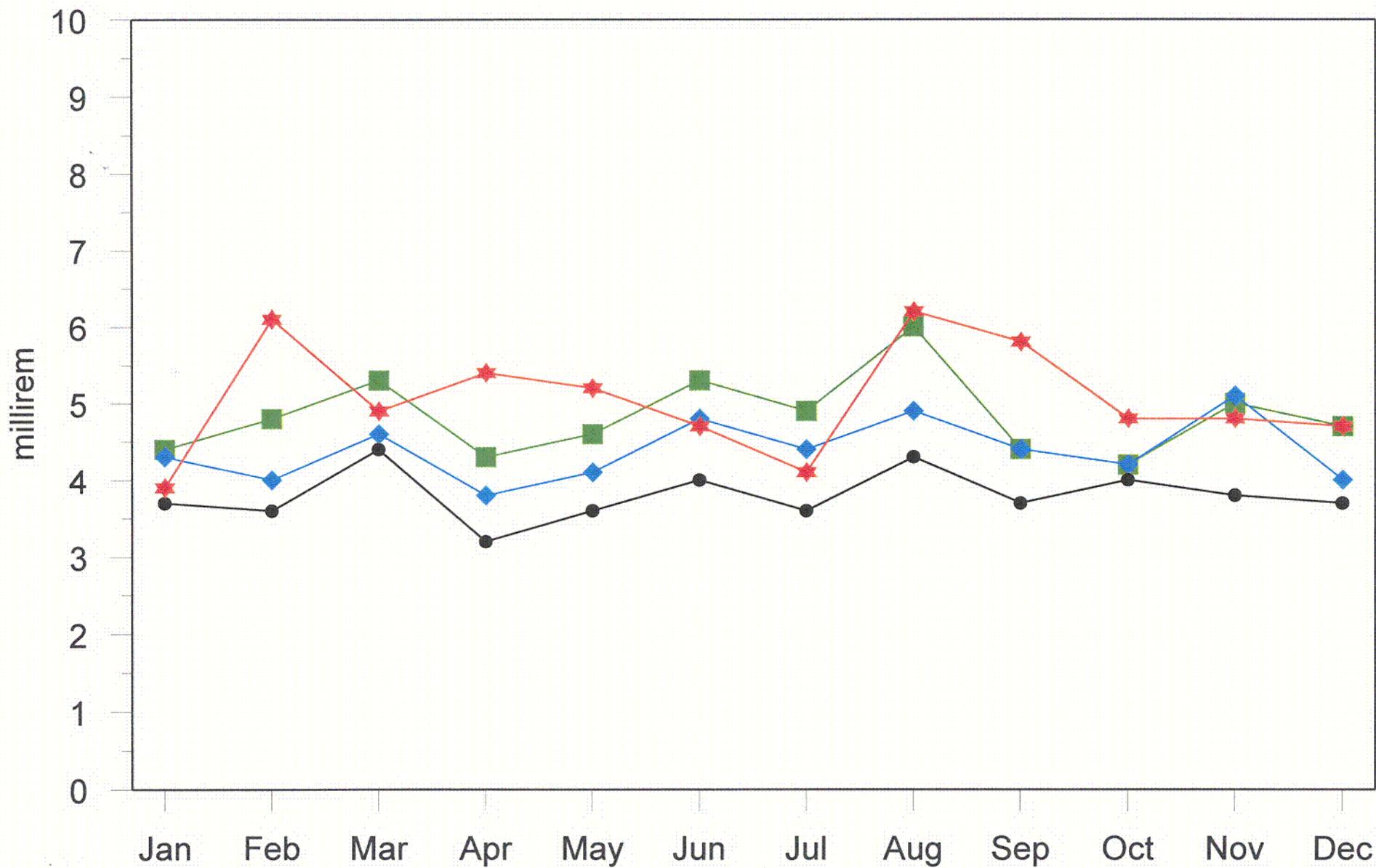
ST11 Control vs ST01, ST16, ST17, ST18



7
C-452

1999 Palisades TLDs

ST11 Control vs ST05, ST23, ST24



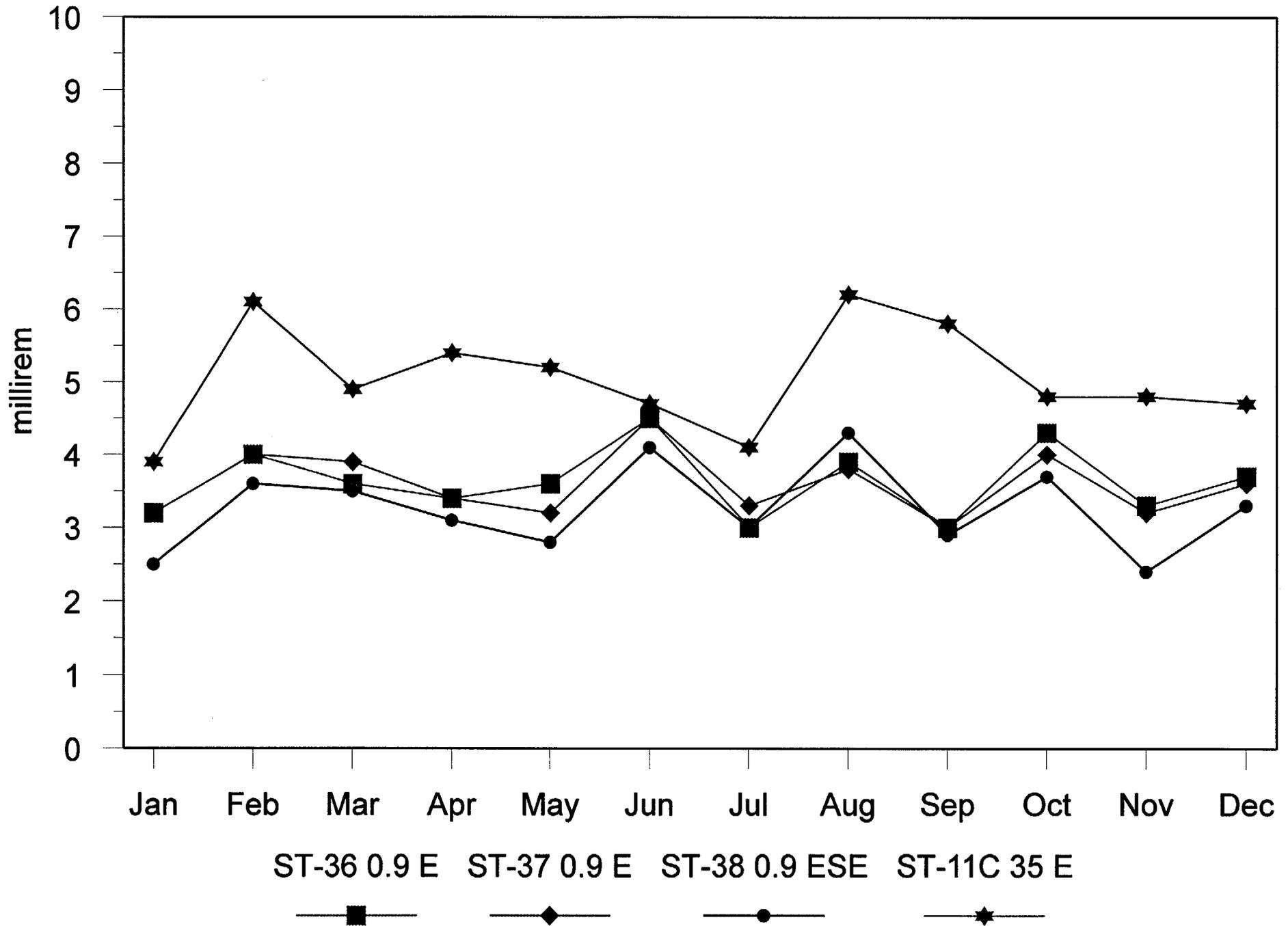
ST-05 3 E ST-23 3 ENE ST-24 4.5 E ST-11C 35 E



8
C-121

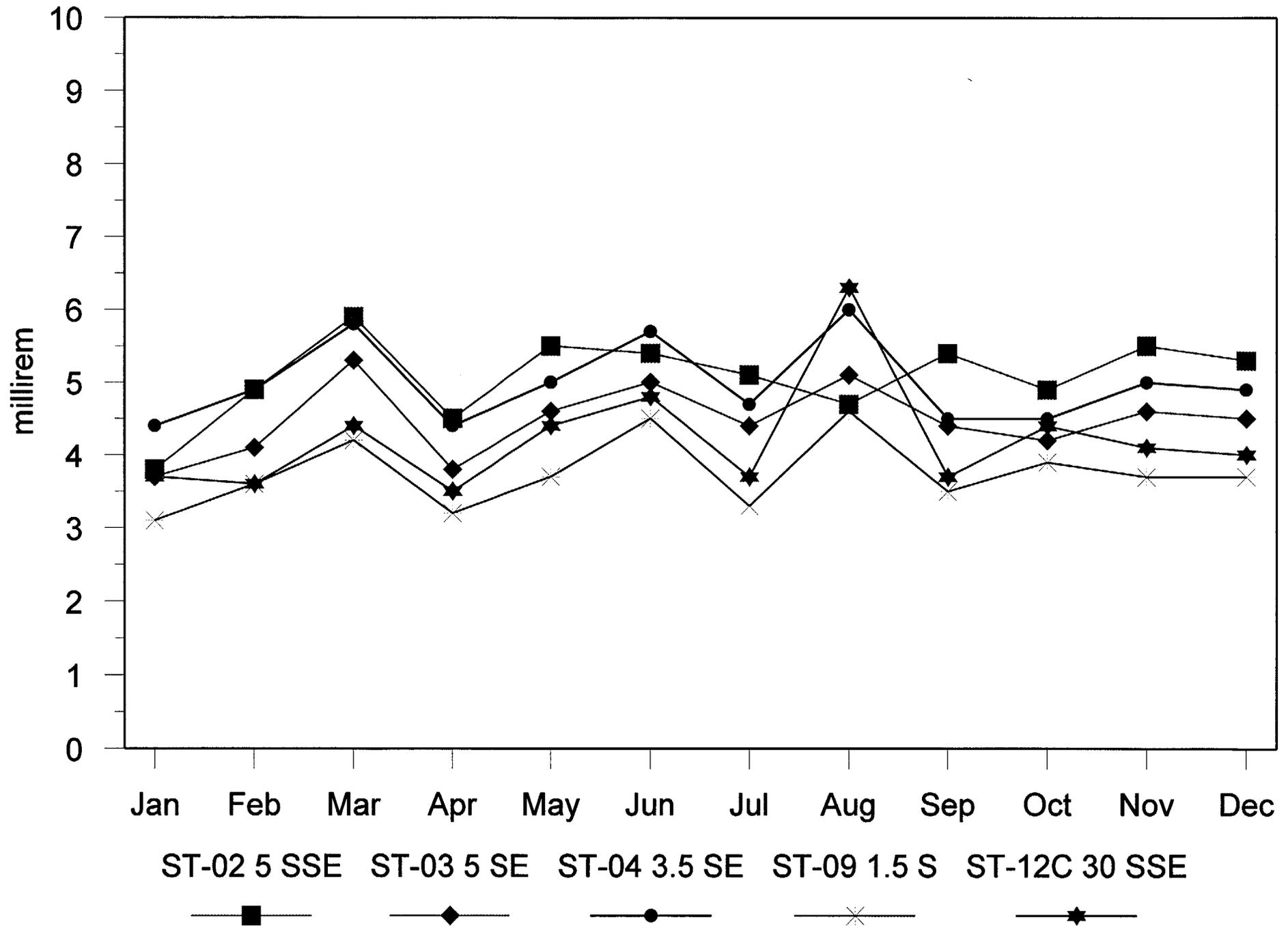
1999 Palisades TLDs

ST11 Control vs ST36, ST37, ST38



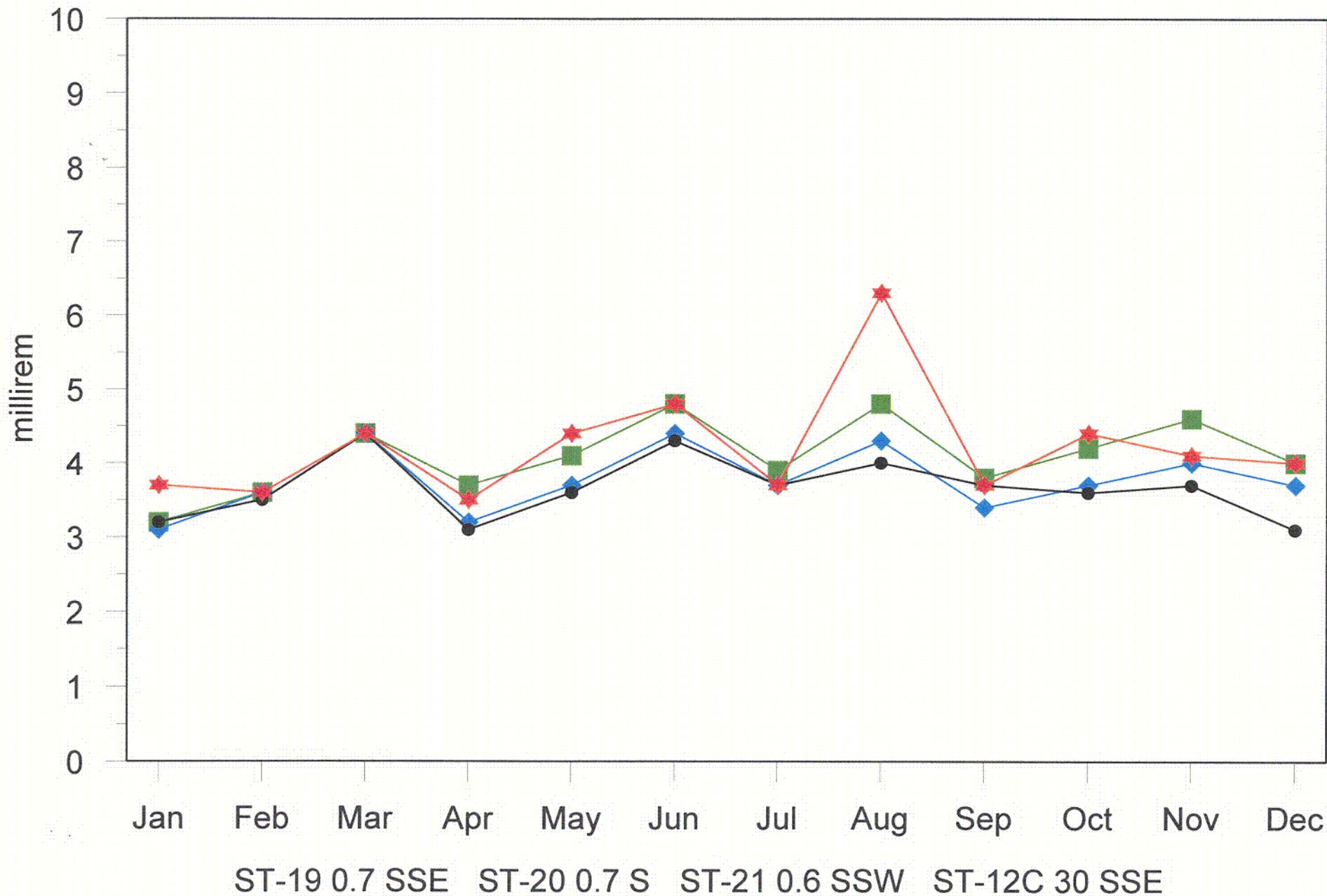
1999 Palisades TLDs

ST12 Control vs ST02, ST03, ST04, ST09



1999 Palisades TLDs

ST12 Control vs ST19, ST20, ST21

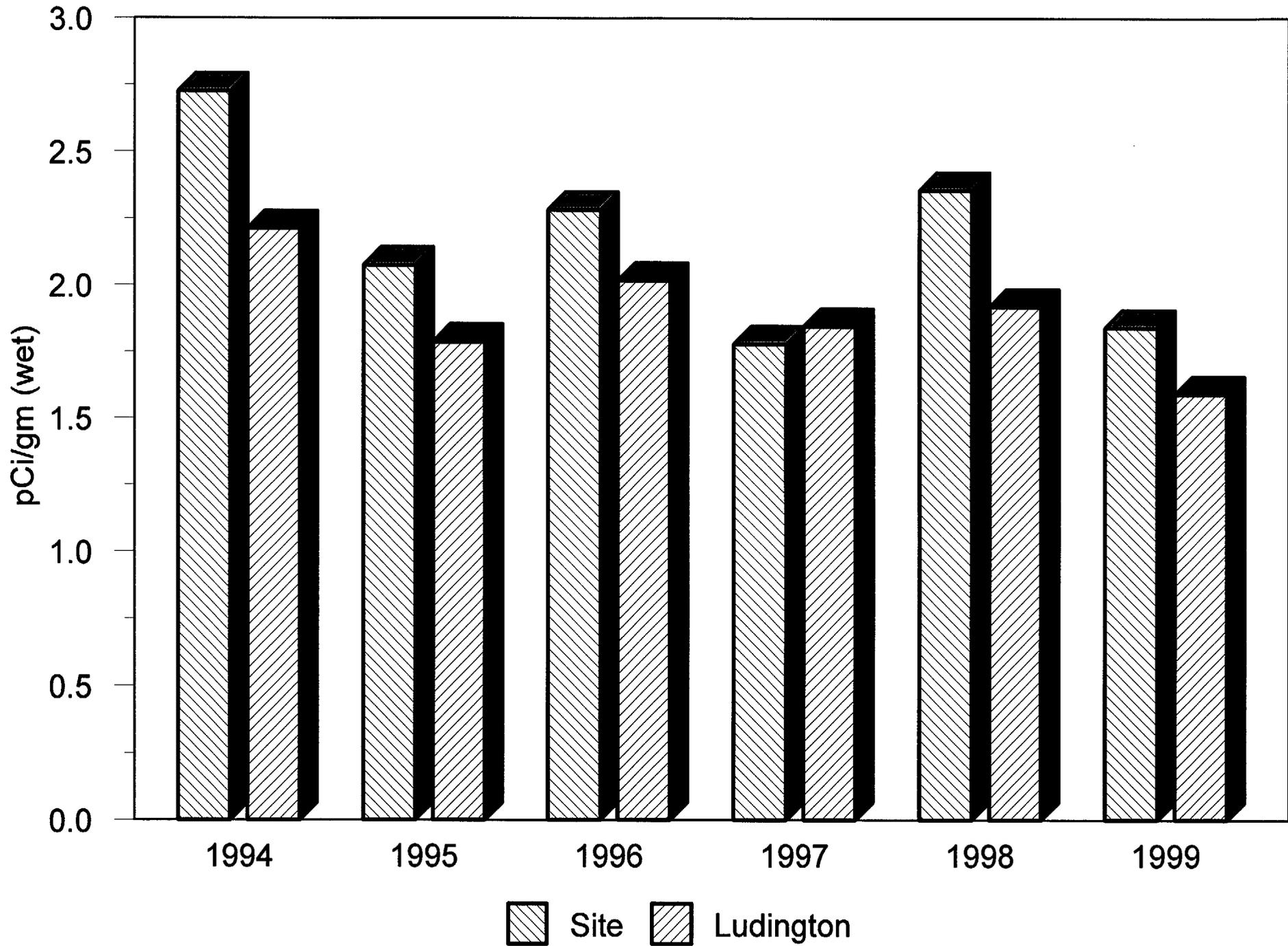


ST-19 0.7 SSE ST-20 0.7 S ST-21 0.6 SSW ST-12C 30 SSE



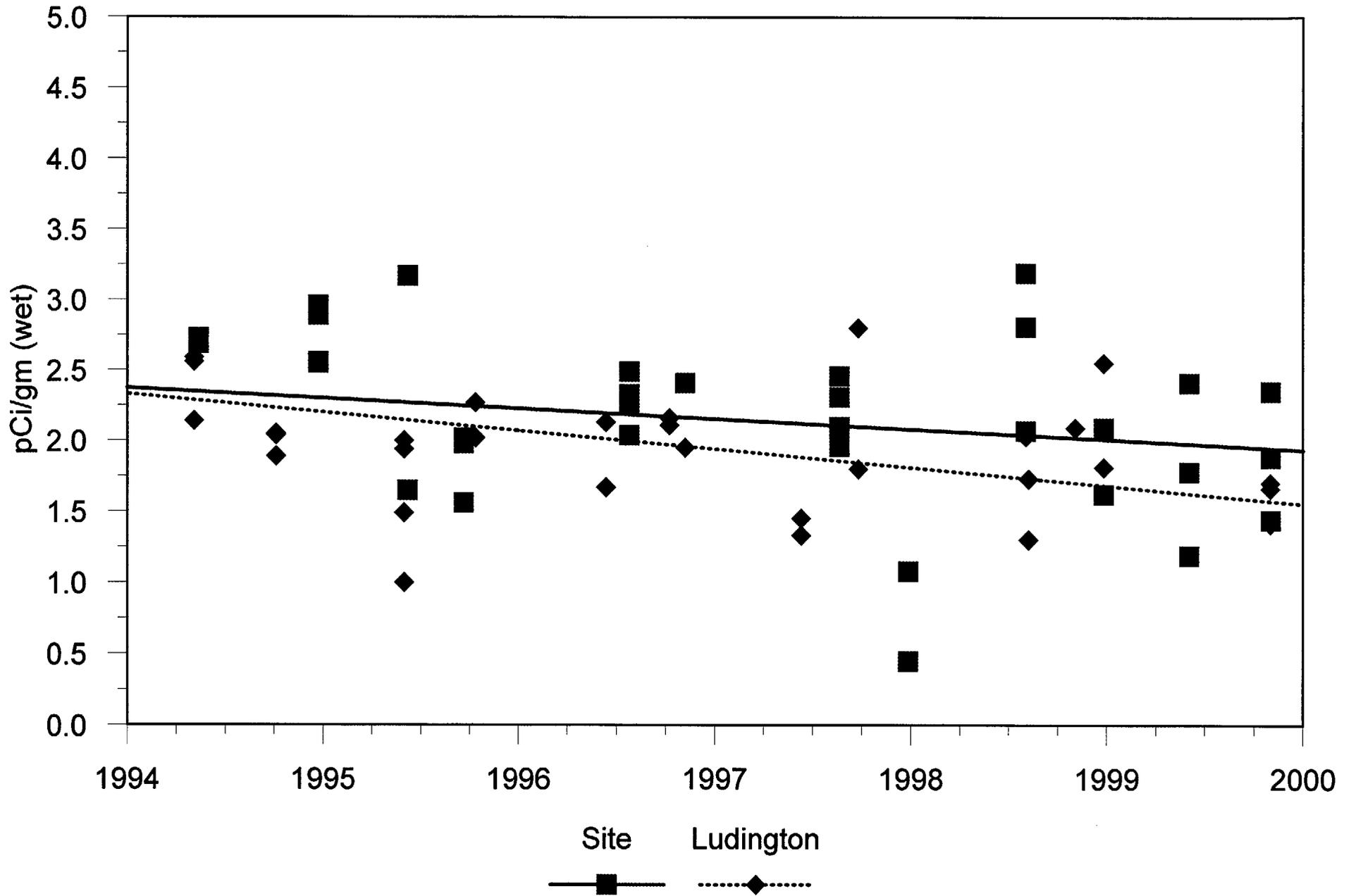
Palisades Fish Gross Beta

1994-1999



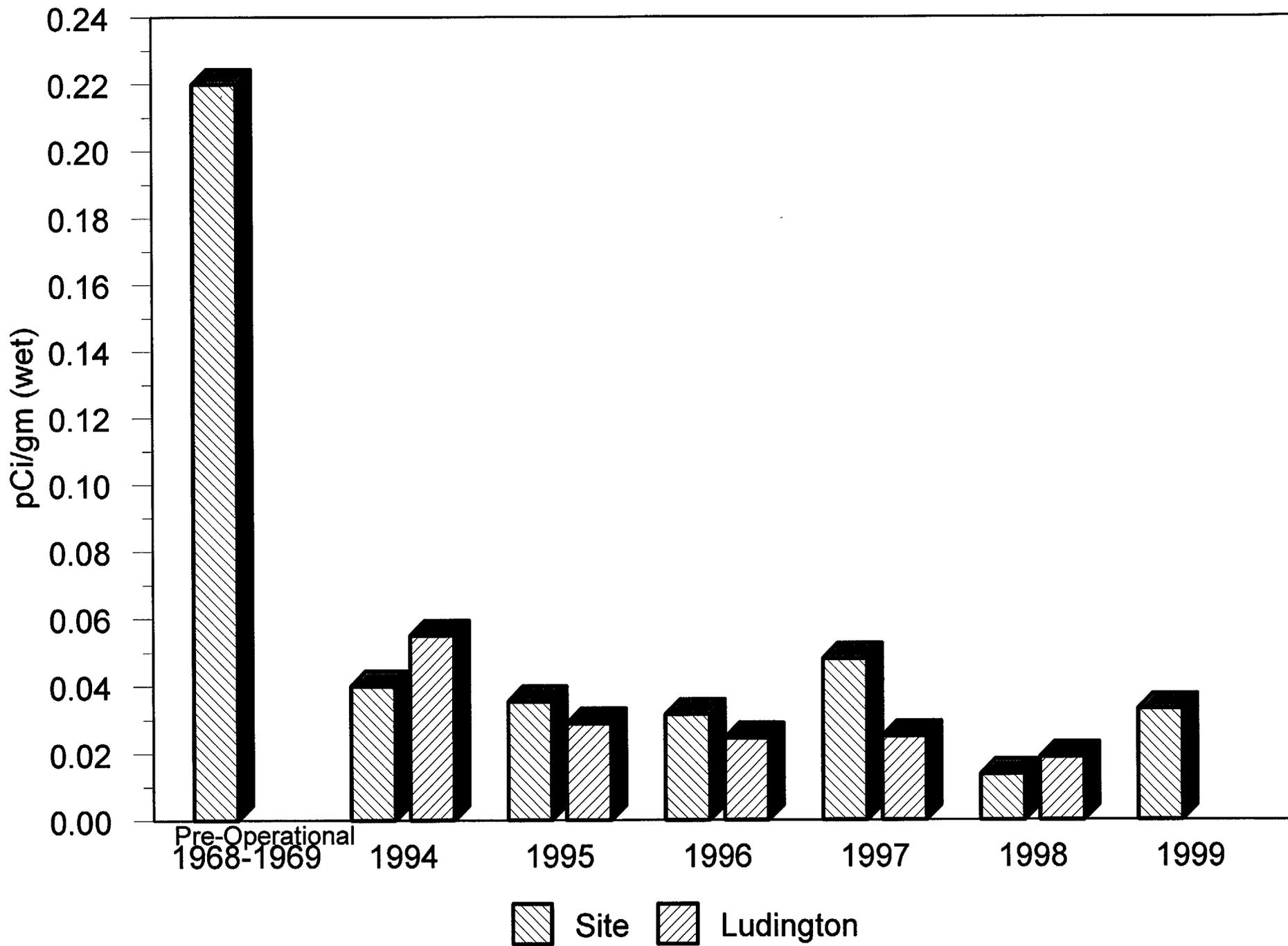
Palisades Fish Gross Beta

1994-1999



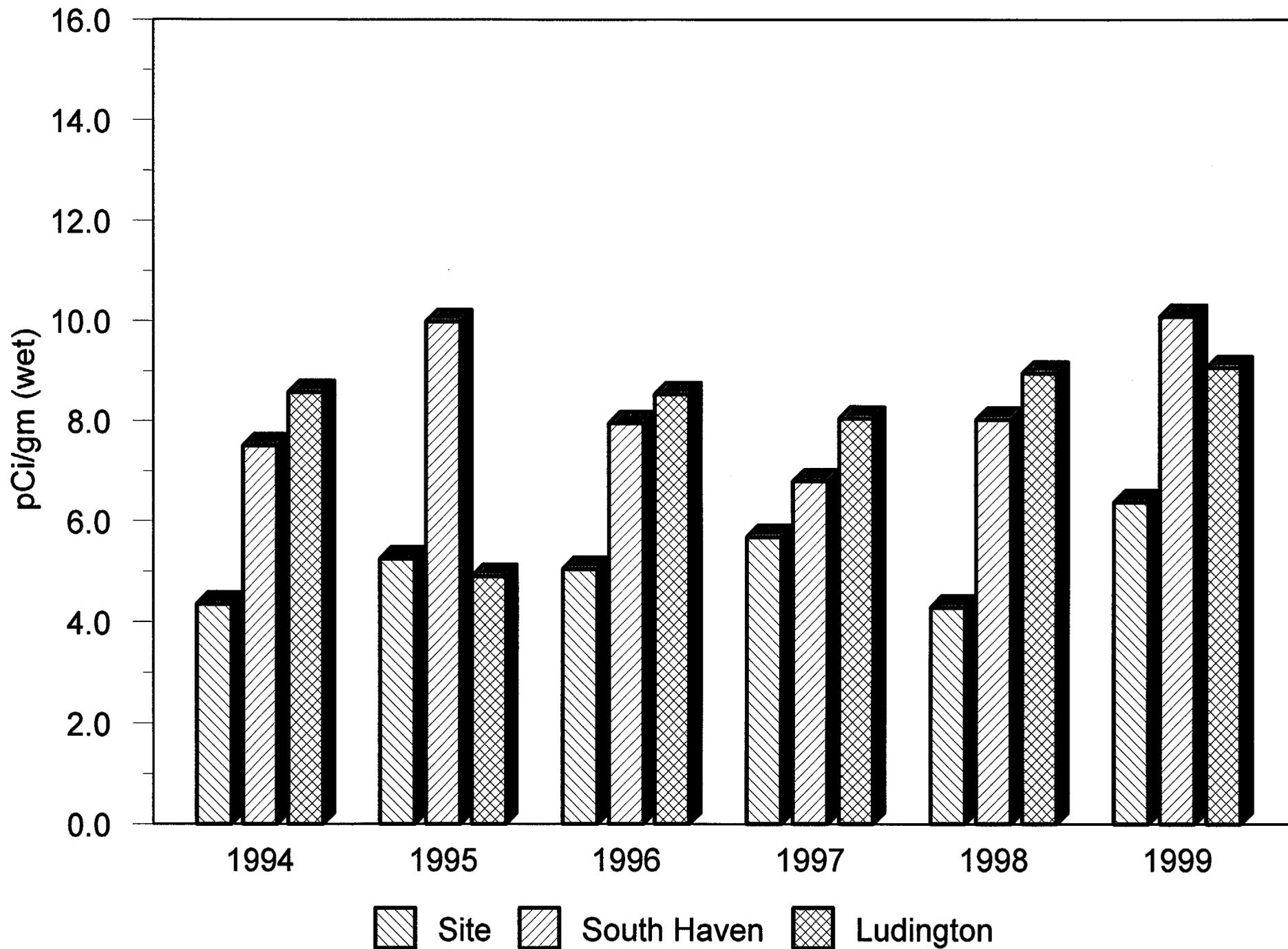
Palisades Fish Cs-137

Pre-Operational vs. Operational



Palisades Sediment Gross Beta

1994-1999



Palisades Sediment Gross Beta 1994-1999

